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COVID-19: Risk communication and blame

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COVID-19: Risk communication and blame

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Editorial: COVID-19: risk communication and blame

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COVID-19, health communication (MESH), blame, risk communication, media analysis, minority group, Aboriginal people in Australia, immigrants

Editorial on the Research Topic
COVID-19: risk communication and blame

In mid-2020, when we launched this Research Topic, we noted a wide variety of responses to COVID-19, and how critical health information was communicated. We noticed that the way health information was communicated to people often had a negative slant to it. Not only that, but we also noticed that the way health information was understood by people seemed to be filtered through a socio-cognitive lens. As discussed by Bouguettaya et al. opposing political parties, minorities, and the structurally vulnerable populations (Team and Manderson, 2020) often were blamed for spreading COVID-19 with dangerous consequences. The authors (Bouguettaya et al.) drew on empirical psychological research and well-established psychological theories and models of blame to explain what constitutes blame (allocation responsibility/foresight), and who is blamed (from a social identity approach). They provided historical evidence, showing that blaming at the time of pandemics was not helpful; and that we needed to understand why, when, and how blame affected COVID-19 responses. With this in mind, we put out a call for research on blame, the elements that make up blaming behavior at the time of COVID-19 pandemic.

Now, in 2023, after experiences of several outbreaks, lessons learned from mishandling this pandemic, and having COVID-19 vaccines developed, we can look back on the *in-situ* research in our Research Topic. We had a wide array of manuscripts submitted from health communication, public health and health psychology disciplines across countries, in which the authors have used various research methods to investigate the concept of blame in health communication of COVID-19 and its consequences. The authors of the articles included in our Research Topic demonstrated that if governments acted early to make high-quality resources available, blame based conspiracy theories were less likely to spread (Chan et al.; Su et al.), with Benski et al. and Pengpeng et al. proposing how these resources could be developed and communicated. Korin et al., Putois and Helms, Antwi-Berko et al., and Okuno et al. discussed how context matters in crafting messages that avoid blame like characteristics with positive outcomes in controlling COVID-19. Pisl et al. revealed how vaccine hesitancy in Czech students was less about morality and blame than individual beliefs and characteristics. They demonstrated that allocating responsibility based on morality is flawed. Bostwick et al. and Xiao and Yu discussed how social distancing is affected by person and context. Lu et al. examined how rumors spread on social network sites and contribute to COVID-19 blame.

Viola's study used critical discourse analysis theory as the applied theory for the analysis of the COVID-19 crisis narratives by experts, politicians, and other social actors from Spain, France, the Netherlands, and the UK when presenting their domestic measures in relation to Italy's response to coronavirus. She found that attribution of blame and blameworthiness were found to be a common pattern in these narratives that Italy was to blame for having taken inappropriate measures. This narrative was found in all the four countries.

Historically, immigrants were frequently blamed in the transmission of pathogens and their deviant beliefs and practices contributing this transmission, including vaccine resistance and hesitancy (Bouguettaya et al.). Acharya et al.'s article presented a survey of immigrants' attitudes toward COVID-19 vaccination in South Korea. In their study, a larger proportion of South Korean immigrants were vaccinated, and the remaining participants were rather concerned about the safety of the existing vaccines, which was similar to the general population. Study investigating minority ethnic groups in Amsterdam, the Netherlands, conducted by Antwi-Berko et al. also found that the main reasons for vaccine hesitancy were concerns about the vaccine efficacy and safety; and many people in these communities expressed their willingness to receive a vaccine once these concerns were addressed.

The role of community involvement in COVID-19 communication and community unity were repeatedly highlighted in the included works. Benski et al. provided two community case studies on the development of health education materials on COVID-19 for pregnant women in Madagascar and elementary school children in Japan. In both countries, communication materials were developed in collaboration with the key local communicators and the target audiences. In their community case study, Glennie et al. shared lessons learned from a novel, highly participatory pandemic prevention communication campaign that engaged individuals in remote Aboriginal communities of the Northern Territory of Australia directly in prevention messaging via crowdsourcing, and distributed videos to remote area post codes via targeted Facebook advertising.

Thompson et al. presented findings of content analysis of songs being used to create awareness about COVID-19 in Ghana. One of the emerging themes in their content analysis was a call for unity and collective efforts in contrast to blame in the lyrics. In the song lyrics, it was stated that coronavirus does not discriminate individuals or groups on the basis of skin tone *"this disease is not afraid of the blacks, not afraid of whites, not afraid of Indians*," socio-economic status *"coronavirus does not leave out the rich or the poor*," age *"does not leave out the child or the elderly*," and body image "*It is not afraid of the fat person or afraid slim person It is not afraid of a tall person or afraid of … It doesn't matter whether you are beautiful or ugly"* (Thompson et al. p. 7).

Blame of health professionals in transmitting coronavirus and mishandling the pandemic and its impact on health professionals' mental health received special attention. Gao et al.'s article presented findings on mental health of nursing students amid COVID-19 pandemic in China. Chen et al. investigated the relationships between public health literacy and public trust in physicians' control of COVID-19 in China. Their findings demonstrated significant positive relationships between health literacy and public trust in physicians.

Findings of the research studies featured in this Research Topic have applications beyond COVID-19. Many contributors to our Research Topic (Antwi-Berko et al.; Glennie et al.; Tretter) pointed out that considering the audience in creating health promotion messages is crucial as certain groups will interpret similar health messages in unintended ways. We encourage researchers in health to consider how health promoting messages on other health issues with a contagion element (substance abuse, alcoholism, obesity) could adapt their approaches to reduce blame and improve their reach.

Overall, our Research Topic revealed that careful consideration of how we communicate responsibility, social norms, intent, and capacity is crucial in emergency situations. Through these research articles, we hope future policy makers will consider how to create better health information materials, communication strategies, and better reach people who may be more hesitant to listen through social media. Being context aware is key to ensuring people have the tools to live healthy lives.

Author contributions

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Developing Health Communication Materials During a Pandemic

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As the COVID-19 virus spread rapidly around the world, information related to the pandemic also spread quickly and in massive amounts. Uncertainty and unknowns about the pandemic together with the explosion of information created confusion and fear among many populations. A major challenge for public health practitioners is to provide clear and consistent messages that can be understood by different types of audiences, including vulnerable populations such as pregnant women and children who are often forgotten in this process. We compared and analyzed the development processes of health communication products for pregnant women in Madagascar and for elementary school children in Japan during the COVID-19 pandemic. This study compared these two field experiences in different socioeconomic settings to identify common strategies for the development of communication materials in a health crisis. The two cases both developed communication materials developed in collaboration with key local communicators and the target audiences. Both products used a simple and clear structure and included do's and don'ts. Messages were tailored toward the lifestyles of the target audience and phrased to fit with cultural and linguistic contexts. Both developer teams paid attention to easy-to-understand words and culturally accepted design and colors. The final products were distributed swiftly and widely through multiple channels with the local community. These two field experiences demonstrate common strategies for developing health communication materials that are culturally-tailored and visually-appealing in a timely manner and can be disseminated through existing channels in a health crisis. Our experiences emphasize that collaborative and iterative efforts based on an existing trust relationship with the target community can provide the foundation for a rapid communication response in a health crisis.

Keywords: health communication, COVID-19, pandemic, health crisis, development process

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HIGHLIGHTS

- The COVID-19 pandemic produced a massive amount of information all around the world.
- A major public health challenge is to deliver health communication products with clear and simple messages during a health crisis and to reach all audiences, especially vulnerable populations.
- In this study, we compared and analyzed the development processes of two health communication products, one for pregnant women in Madagascar and one for elementary school children in Japan, during the COVID-19 pandemic.

- We identified several common strategies for developing health communication materials in a crisis, despite very different country settings: the importance of developing and disseminating culturally-tailored and visually-appealing materials developed through collaborative and iterative processes with the target community.

INTRODUCTION

Health communication is a key factor that affects people's decision making to protect and promote health during a health crisis (Rudd et al., 2003; Goto, 2020). Developing appropriate communication materials can facilitate the behavior changes needed for each type of health crisis (e.g., evacuation after a nuclear accident, handwashing in a pandemic). This point is particularly important in the COVID-19 pandemic.

The COVID-19 pandemic has produced a global explosion of viral cases but also a massive and varied global explosion of information (Finset et al., 2020). People are overwhelmed by the volume and the viewpoints in COVID-19 information, through newspapers, social media platforms, and other new channels, making it difficult to distinguish which information is reliable and helpful and which is false and harmful. People feel confused about what to do and how to act, and may feel anxious and lost (Chater, 2020; Finset et al., 2020), which can lead to a secondary information disaster. The COVID-19 pandemic has heightened public uncertainty over many questions, in part due to our limited experience and knowledge about this novel virus (Chater, 2020). Addressing this uncertainty is a major challenge for health communicators involved with the COVID-19 virus.

In confronting this uncertainty, health communication materials need to create a space for interpreting and incorporating new scientific findings through multiple updates. This is a long and public learning process. Health communication does not end when materials are distributed to the target audience. Instead, communicators need to create a continuous learning process and use updates to solidify trust with the target audience. In these circumstances, public health institutions have a duty to contribute to the dissemination of concise and valid information in different contexts, to promote population well-being, and to give clear and consistent messages to people (Rudd et al., 2003). This learning process is especially important for vulnerable populations such as children and pregnant women, who are often forgotten in health communication (Dalton et al., 2020).

Yet little is written about how to develop communication materials during a health crisis. Tailored health educational materials are more effective than non-tailored ones (Sudo, 2011). But during a health crisis, when time and resources are extremely limited, we need additional strategies (Rudd and Baur, 2020). This commentary compares two health communication products about COVID-19 prevention in two very different socioeconomic settings—Madagascar and Japan—but with similar development approaches. Below, we first compare the development processes (from conceptualization to dissemination) for the two efforts. Then we examine how key messages were framed and adapted to meet the country-specific needs and contexts. Through this analysis, we identify three common strategies for developing health communication materials in a timely manner during a health crisis.

TABLE 1 | Comparison of the two cases.

	Case from Madagascar	Case from Japan
Country setting*	Low-income setting - GNI (PPP international $): 1,350 - Probability of dying under five (per 1,000 live births): 54 - Maternal mortality rate (per 100,000 live births): 363	High-income setting - GNI (PPP international $): 37,630 - Probability of dying under five (per 1,000 live births): 2 - Maternal mortality rate (per 100,000 live births): 5
Target population	Pregnant women	Elementary school students (10–12 years old)
Literacy level	Low level or illiterate	Elementary school level
Language	French and Malgache (and translated into multiple languages for a wide diffusion in Africa)	Japanese and English
Material types and aims	Two posters - One for general information on individual protection and measures - One to inform women about "what to know" if they are pregnant regarding COVID-19	Two leaflets - One for general information on individual protection and measures - One to inform children about how to enjoy life during the stay-home period

Source: World Health Organization, https://www.who.int/countries/en/.

DEVELOPMENT PROCESS: CONCEPTUALIZATION AND DISSEMINATION

As shown in **Table 1**, the case settings in the two countries (Madagascar and Japan) are strikingly different in socioeconomic and health levels. But both cases involved health communication efforts focused on maternal and child health and targeted populations (mothers and children) with limited literacy. The health communication teams of the two countries worked independently, but through sharing experiences we found a number of commonalities. Such comparative case studies may enable us to replicate findings across different settings as well as to explore differences between the cases (Baxter and Jack, 2008).

In both conceptualization and dissemination, the development processes in these two efforts had various points in common (**Table 2**). First, plans to develop the communication materials were based on local needs identified through existing networks between professionals and communities. To accelerate development, the core content was drafted by health professionals utilizing materials that were already in use and well-accepted. Revisions of these drafts were repeated in collaboration with key local communicators and the target audiences, and

TABLE 2 | Common development processes in two countries: from conceptualization to dissemination.

Planning	- Local information needs were collected through existing networks between the professionals and community - Need for timely, accurate, and culturally appropriate health communication for the vulnerable groups was identified - Challenges existed in the mode of information distribution (printing and distribution difficulties in both local communities in Africa and schools in Japan)
Drafting	- Information materials collected by health professionals - Utilized existing materials already tested or well-accepted - Focused not only on physical health, but also mental and social health - Included a designer in the team
Reviewing	- Reviewed by local partners and the target audience - Review and revisions were done multiple times by both health professionals team and community partners
Distribution	- Distributed in print and electronically at local institutes (health centers, hospitals, and schools) and public places - Used existing professional networks and digital channels (e-mails, webpages and SNS)
Revision	- Kept revising the materials based on comments received while distributing - Clarified the date of updates as part of an ongoing process

these iterative processes led to communication concepts shared by both professional and community perspectives.

Second, communication materials were distributed widely through multiple channels within the local community. Dissemination channels depended on the local context. In Madagascar, the posters were displayed on walls in health centers and in the main squares of the villages. In Japan, the leaflets were distributed to students on days that schools were open for a short time and posted on walls and webpages of the relevant schools. In order to facilitate distribution, the Japanese team collaborated with the municipal office and the board of education, which resulted in distribution at all schools in the region. Both developer teams also distributed an electronic version to health providers at local hospitals and municipalities for patients and community members.

COMPARISON OF THE FINAL PRODUCTS: FRAMING AND ADAPTATION

Both communication products used a simple and clear structure with 4–5 sections (**Figure 1** and **Table 3**). Messages were tailored toward the lifestyles of the target audience and their life environments. In both cases, the content focused on making clear messages including do's and don'ts and used one section to give information about additional resources. For Madagascar, the team used as few words as possible to make the product understandable by illiterate people. In Japan, the team focused on giving valid alternatives to children about how to spend time at home and in outside places instead of emphasizing the idea of social distancing which can be difficult for children to accept. This was an important discussion point during the development process, and we decided to list as many alternatives as possible even though it made the materials text-heavy. Both used reliable sources to give scientific legitimacy to the material (World Health Organization and Ministry of Health's recommendations for Madagascar; and Ministry of Health, Welfare and Labor and academic organizations for Japan). When facing a crisis, we are required to perform a quick search of generally reliable sources like the ones we used, including government and international, and professional organizations.

In both cases in **Figure 1**, there is a limited use of numbers. As shown in **Table 3**, both teams included a graphic designer and paid attention to easy-to-understand words and culturally accepted designs and colors, with many illustrations. Illustrations in Madagascar included women in their traditional clothing, and the Japanese materials included kanji (or characters) that children were used to reading. For Madagascar the posters used yellow and orange, while the Japanese material used traditional soft colors like blue and green. The messages were phrased to fit with cultural and linguistic contexts. For Madagascar "*don't messages*" were expressed clearly and related to the specific context: the material showed not to spit and stressed the avoidance of social gatherings through the image of a "taxi brousse." The Japanese material discretely mentioned the need to avoid stigmatizing patients, and showed how to sneeze into an elbow, which was a new practice for students.

STRATEGIES FOR DEVELOPING COMMUNICATION MATERIALS IN A HEALTH CRISIS

This comparison of communication products and processes in a health crisis led us to identify three common communication strategies.

Strategy 1: Focus on Culturally-Adapted and Visually-Appealing Materials

Public health communication interventions must capture the public's attention and convey messages in ways that are reliable and appropriate across languages, ages, cultural affiliations, and education levels for the target audience (Dowse et al., 2014; Adam et al., 2020). As shown in **Tables 2**, **3**, the two health communication products described in this commentary had substantial differences, but both of them sought to make the materials culturally acceptable. The Madagascar materials used vivid colors and *don't messages* were stated explicitly, while the Japanese material used traditional soft colors and the *don't messages* were phrased implicitly. The Madagascar material showed not to spit, which was a common practice to avoid, whereas the Japanese material showed how to sneeze into an elbow, which was a new practice to apply. These adaptations of the general infection prevention measures were decided on through collaboration between the developer teams and the local communities in a process that continued throughout development and distribution.

These culturally tailored messages were shown visually with carefully selected images. Visual aids play a significant role in the front-line rapid responses to a health crisis, making these public health messages accessible to all in a timely manner. Past examples of images used in public health messages are the bold

FIGURE 1 | Poster for pregnant women and Leaflet for children.

graphics used to raise awareness of HIV/AIDS in the 1980s and the health communication campaigns by non-governmental organizations during the 2014 and 2015 Ebola outbreaks[1,2] (Kaaphen, 2020), as well as many other historical examples.[3,4,5]

Strategy 2: Deliver Communication Products Quickly

Both cases confronted challenges in deciding on the dissemination channels. Women in Madagascar, for example, had limited decision-making power to seek health information and even more restricted access to digital information. In Madagascar, communicating public health guidelines to the community is challenging, as 90% of people do not use the internet, 60% do not have a radio, 61% do not have a mobile phone, and 25% of the adult population is illiterate[6,7]. In Japan, schools were closed during the early months of the pandemic in 2020, and teachers had limited opportunities to communicate with students and limited resources for printing and internet connection. Especially in Fukushima prefecture (where the Japanese project was based), only about 10% of the schools had a computerized education management system (the lowest in Japan according to a 2018 survey).[8]

Both cases confronted uncertainties in scientific knowledge but still decided to deliver public health communication products quickly, to provide the best-available information to the target audiences. Community members identified their needs, and

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TABLE 3 | Health information materials from the two cases: framing general protections measures in a country-specific context.

	Poster for Madagascar Women	**Poster for Japanese Children**
Structure	4 areas - Prevention do's - Wash hands in detail - Prevention don'ts - Important phone numbers	5 areas - Prevention do's - Stigma-related don'ts - How to spend time at home - Resources for parents - Resources for teachers
Content	- Clear messages and avoided too much text - 7 messages (maximum 8 messages were accepted) - Included all prevention measures to protect women and their communities following WHO recommendations and adapted to the context - Used numbers to list the measures - Included travels in "taxi brousse" rather than social gatherings in general and local habits like spitting	- Clear messages targeting children - Balanced physical and mental health - Included ways children can keep in touch with their peers rather than stressing social distancing - Limited the number of messages but showed many ways about how to spend time at home - Used and introduced reliable sources rather than creating new ones
Words	- Simple words and as few words as possible	- Used words understandable to 4th graders - Limit use of numbers - Add how to read Kanji characters
Design	- Designed by a graphic artist - Used illustrations of women with African physiognomy wearing clothes (green tissues typical from traditional Madagascar) - Adapted material already used by others for reproductive and maternal health projects in Madagascar	- Designed by a team member specialized in anthropology and experienced in designing health information - Followed Japanese schools' general style of handouts - Designed for both print and digital distribution
Illustrations	- Included many illustrations to help illiterate women understand the messages	- Used simple animated illustrations
Colors	- Made it colorful by using yellow, green, pink (representing women), red (for don't), and blue	- Checked previous studies on colors that Japanese children prefer (blue and red) - Avoided yellow and used green instead for children with autism spectrum disorder
Referral	- Included the emergency numbers to call if needed	- Included messages for parents and teachers who support children on a daily basis in order to work together against the infection
Cultural adaptations to context	- Showed a "taxi brousse" (for African context) representing travel conditions and crowded places - Included "Do not spit" to avoid the commonly observed behavior	- Added an illustration of sneezing into an elbow, which was a new practice recommended in Japan after the COVID-19 pandemic

the health professionals selected the best available information. Cultural adaptation of the information was then done in an iterative manner involving both groups to decide on the final messages, images, and materials. In Madagascar dissemination started at the end of March 2020 and in Japan in April 2020. Based on past trust and collaboration, the community and the professional groups worked together to accelerate the development process to produce and disseminate the communication materials.

Strategy 3: Use Existing Relationships of Collaboration and Trust

Both cases decided to pre-test the information materials to assess audience perception, understanding, and socio-cultural acceptability, by using drafts with health workers and educators. Past studies show that once appropriate information is rolled out in communities, a shift in acceptance can occur regarding the prevalence of the infection and the adoption of positive behaviors[1] (Lucy Bray, 2016). Several recent reports examine collaborative information development in a clinical setting. As for the emergency settings, experiences from the Fukushima nuclear accident highlighted the importance of such collaboration from the acute phase onwards to minimize miscommunication in the longer term (Goto, 2020).

The main challenges of developing communication materials during a health crisis, such as the COVID-19 pandemic, are the limited time and resources, and the uncertainty of the risks. Finset et al. state that open, honest, consistent, specific and emotionally considerate information provision is important when facing the many uncertainties of the COVID-19 pandemic, but they do not explain "how" to do this. Our examples indicate that through a participatory approach, existing networks, and trust among stakeholders can be used in iterative processes of information development and revision to address uncertain risks in a health crisis. Our cases serve as practical examples of how professional-community collaboration can facilitate the development of health communication materials that are understandable to the public in the midst of a crisis. However, our case study lacks a rigorous formative assessment of how the materials influenced the target groups' knowledge, attitudes, and practices, which need to be explored in further research. Another point of concern is how to facilitate communication when a pre-existing close relationship does not exist. The previous example from the Fukushima nuclear accident recommends

strategic implementation of the "multiple layers of translators" (Goto, 2020), in which scientific information is first provided to the key community workers who are close to the target audience, and then disseminated among their peers and a wider audience.

CONCLUSION

The major strength of this study is that we streamlined the development processes we usually use for health communication materials. The retrospective empirical nature of this study shows that in field practice sometimes the limited research rigor can be turned into strengths.

In this analysis we found striking similarities in the two development processes; these two field experiences in Madagascar and Japan shared three common strategies for developing communication materials in a health crisis; both cases developed culturally-tailored and visually-appealing materials in a timely manner and that were disseminated through existing channels. The two experiences show that collaborative and iterative efforts can provide the foundation for a rapid communications response in a health crisis. Such collaboration cannot be created instantly when a crisis occurs. Building these networks of trust between professionals and the community should be a basic principle of disaster preparedness.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

CB and AG contributed to the study design and to write the first draft. CHT contributed to the development of the health communication material and development process. MRR took part in the revision of the paper.

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Communicating Awareness About COVID-19 Through Songs: An Example From Ghana

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Research has shown that music can be used to educate or disseminate information about public health crises. Grounded in the edutainment approach, we explored how songs are being used to create awareness about COVID-19 in Ghana, a sub-Saharan African country. YouTube was searched, and 28 songs met the study inclusion criteria. We conducted a thematic analysis of the song lyrics. Most lyrics were in English, Ghanaian Pidgin English, Akan, Ga, or Dagbani. Reflecting the multilingual population of Ghana, half of the songs contained three languages to convey their message, and only five songs were in one language. Eight themes emerged from the analysis: public health guidelines, COVID-19 is real and not a hoax, COVID-19 is infectious, prayer as method to stop the virus, emotional reaction and disruption of "everyday" activities; verbally expelling the virus, call for unity and collective efforts, and inspiring hope. We show that songs have the potential as a method for rapidly sharing information about emerging public health crises. Even though, it is beyond the scope of this study to draw conclusions about the reception and impact of songs on awareness and knowledge, the study shows that examining song lyrics can still be useful in understanding local attitudes toward COVID-19, as well as strategies for promoting preventive behaviors. We note that additional multidimensional efforts are needed to increase awareness among the general public about the COVID-19 pandemic.

Keywords: infectious disease, edutainment, preventive measure, song lyrics, multilingual population

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INTRODUCTION

On January 30, 2020, the World Health Organization (WHO) announced a "Public Health Emergency of International Concern" related to the spread of a novel coronavirus (SARS-CoV-2) that causes COVID-19. Shortly thereafter on March 12, 2020, the WHO declared COVID-19 a pandemic (1). Following these declarations and other reports about the emergence of a new severe respiratory infection, public health officials rapidly developed and deployed public health messages about the pandemic around the world. Over a short period of time, the general public was provided information about COVID-19 and guidance about how to mitigate spread of the virus (e.g., face coverings, washing hands, physical distancing). However, awareness (attitudes, knowledge) of COVID-19 differs across various parts of the world. For example, low awareness and misperceptions about COVID-19 were reported in some parts of the world, such as North America, Europe and Africa (2, 3). As a result, there have been urgent calls to find innovative ways to increase awareness about COVID-19 and help reduce the outbreak of this infectious disease (4, 5).

Ghana recorded its first two cases of COVID-19 on March 12, 2020 and cases have risen exponentially in the country to 13,717 as of June 20, 2020 (with 85 deaths), prompting presidential directives to increase awareness among citizens by creating and disseminating information on various preventive measures. These directives, mainly in English with direct translation in Ghanaian Sign Language, were disseminated on electronic and social media platforms. However, citizens who do not understand the national or official language must rely on other citizens to be accurately informed. As of April 25, 2020, the National Commission for Civic Education (NCCE), which could effectively educate citizens in every district using various indigenous Ghanaian languages, had been unable to do so due to lack of government funds (6). To compensate for the lack of funding, citizens were educated with regularly posted updates on the NCCE website and social media platforms (7). This strategy, however, does not address citizens who are more isolated and lack access to the internet or citizens who cannot read the official language.

Apart from the updates from the NCCE, some musicians in the country took personal initiatives to compose songs in local languages to educate the public about the disease. These songs were without any government or non-governmental organization support and were also not a part of an official campaign or intervention. Music plays an integral role in the culture of many African countries including Ghana. In addition to serving entertainment purposes, music highlights socio-cultural values and helps in the performances of daily routines. It is also used to recount history, and it forms a part of festivals, ceremonies related to rites of passage and other cultural functions (55). Music can be used as a vehicle for praise and criticism, especially in cases where authority figures are involved (8, 9). Also, it has the ability to alter knowledge, attitudes and behavior (10–13), and the potential to provide a way to access target audiences that could be missed with other methods of communication (14). Broadly speaking, music can play a pivotal role in helping increase awareness or gaining insight into different social issues.

Music forms a part of edutainment, a popular strategy that allows for educational messages to be embedded in entertainment media in order to positively change behaviors and attitudes (15). Edutainment is a combination of education and entertainment (57). It is a theory-based communication process which, according to Ganeshasundaram and Henley (52), "involves the design and implementation of media programs that deliberately incorporate persuasive, educational content in popular entertainment formats to influence audience knowledge, attitudes, behavioral intentions, and practices" (p. 311). This communication process is a tool for implicit persuasion as it is able to suspend disbelief and facilitate changes in the behavior of an audience (16, 17). Govender (53) asserts that in terms of facilitating a desired behavioral or social change, edutainment has been more innovative in Africa than in other parts of the world. As a result, some non-governmental agencies financially support programs and activities that engage members of a community and attempt to solve social problems through creative artistic processes that are receptive and entertaining (18).

Generally, edutainment health interventions are complementary to traditional public health interventions (18). Several studies have reported how songs and music can be used as a means of education and increasing awareness in public health context and clinical experience (12, 19–21, 50). Thus, the use of music to influence knowledge, attitudes and behaviors toward infectious diseases like COVID-19 is not a new phenomenon in Africa. In relation to HIV/AIDS and Ebola, for instance, research shows how popular artists in the region incorporated health-promoting messages and basic information about these diseases, and communicated preventative measures in their songs (14, 22–24). In 2000, a campaign dubbed "Stop AIDS: Love Life" involved a music video produced by Ghanaian musicians to increase awareness about HIV/AIDS in the country. The campaign was implemented by Johns Hopkins University and the Ghana Social Marketing Foundation. It was aimed at de-stigmatizing HIV/AIDS, encouraging compassionate care and support for people living with HIV/AIDS, and encouraging citizens to adopt safe sex behavior (25). Also, various studies document how popular musicians were commissioned by organizations such as WHO and UNICEF in 2014–2016 to compose prevention songs as a response to the Ebola outbreak in Liberia and other parts of Africa (21, 26).

Certain characteristics of songs, such as repetition and the capacity for involuntary recall, enhance the effectiveness of educational messages (27). These characteristics underpin reasons why, as earlier mentioned, HIV/AIDS and Ebola prevention messages were conveyed through songs in various parts of Africa (28–30). In Uganda, for example, music was recognized by healthcare workers as "a more localized and thus more effective medical intervention than outreach efforts in the form of lectures and seminars" ((29), p. 27). The assumption is that in African communities, the performance of songs can facilitate information dissemination and public debate on sensitive health topics (15). It is therefore not surprising that songs have been composed in Ghana and other African nations (e.g., Liberia, Nigeria, South Africa, Uganda, Cameroun, and Kenya) to educate people about the novel coronavirus (31). The purpose of this paper is to describe the content of song lyrics related to COVID-19 messaging and to highlight among other things the preventative measures embedded in them. The songs examined were composed by individual Ghanaian musicians and posted on their YouTube channels during the COVID-19 pandemic.

METHODS

Setting

Ghana is located in West Africa, bordered on the west side by the Ivory Coast, and by the Atlantic Ocean in the south. According to recent census data, the population of Ghana is 29 million (32) with over 81 spoken languages (51). Four languages, including English, Akan, Hausa, and Ghanaian Pidgin English (GhPE), are the most common languages used for broad communication in the country (51).

Akan is the primary language spoken in the south (including the capital, Accra) and Hausa is the primary language spoken in the north (33). However, English is Ghana's official national language used in education, politics, government business, international trade, and technology (34–36). English is also

TABLE 1 | Characteristics of the 28 songs.

Song #	Language(s)	Themes	Symptoms	Safety and preventive measures
1	English Akan Ewe	It is infectious; prayer; public health guidelines	–	Maintain social distancing; stop touching your eyes, nose, mouth; Clean surfaces frequently; wash your hands with soap under running water; sanitize your hand; cover your mouth when sneezing or coughing; wear a face mask; stop shaking hands; stop hugging
2	English GhPE Akan	Inspiring hope; public health guidelines; emotional reaction and disruption of everyday activities; prayer	–	Wash your hands; sanitize; stay home; use your face mask
3	GhPE Akan Hausa	It is real and not a hoax; it is infectious; public health guidelines	–	Hand sanitize; stay home; exercise; social distancing
4	GhPE Akan	Public health guidelines	–	Use sanitizer; wash your hands with soap; drink water regularly; use face mask; Social distancing; stay home
5	Akan English	Public health guidelines	–	No handshaking; social distancing; wash your hands; use sanitizer; go to the hospital if you are not feeling well; don't touch your nose, face, eyes; Stay home
6	GhPE Akan English	It is infectious; Inspiring hope; call for unity and collective efforts; public health guidelines	–	Wash your hands; sanitize your hands; try not to touch your face; social distancing; stay indoors
7	Sisala Waale English	Public health guidelines	–	Cough into your elbow or a handkerchief; sneeze into a handkerchief; wash your hands with soap; Stay home; don't go to funerals or to the beach
8	English Akan	Public health guidelines; call for unity and collective efforts	–	Use sanitizer; wash your hands under running water with soap; avoid handshakes; sneeze and cough into handkerchief; avoid social gatherings; practice social distancing; Stay home
9	Akan Ga English	Public health guidelines; verbally expelling the virus	–	Wash your hands well: use a mask to cover your nose; Stay indoors; let's be clean
10	English Akan	It is real and not a hoax; prayer; public health guidelines	–	Stay indoors; wash your hands with soap and water; use hand sanitizer; avoid touch people
11	Akan English	It is real and not a hoax; prayer; public health guidelines	–	Wash your hands with soap; use sanitizer; remember to wear face mask when going out; practice social distancing
12	GhPE	It is infectious; inspiring hope; public health guidelines	–	User hand sanitizer; wash your hands with soap; wear mask; stay in your room
13	Akan	It is infectious; public health guidelines; prayer; call for unity and collective efforts	–	No handshake; social distancing; use tissue to cover your mouth when coughing; wash your hand under running water; use sanitizer
14	GhPE Akan	It is real and not a hoax; verbally expelling the virus; public health guidelines; prayer	–	Go everywhere with your hand sanitizer; Avoid touch your eyes, mouth, nose; wash your hands with soap and water; stop touching undisinfected surfaces
15	English GhPE	It is real and not a hoax; public health guidelines	Coughing; Sneezing; Sore throat	No handshake; use soap and running water to wash your hands; use alcohol-based sanitizer; keep yourself clean; maintain social distance; if you are coughing, sneezing or have sore throat, stay home and call your doctor
16	GhPE Dagbani	It is real and not a hoax; prayer; it is infectious; public health guidelines	High temperature; Coughing	Use sanitizer; no handshake; isolate people who are sick

(Continued)

TABLE 1 | Continued

Song #	Language(s)	Themes	Symptoms	Safety and preventive measures
17	Akan English	It is real and not a hoax; emotional reaction and disruption of everyday activities; prayer; public health guidelines		Wash your hands with soap; use hand sanitizer; no handshaking; move away from anyone sneezing or coughing; cover your nose and mouth
18	Akan English	It is real and not a hoax; it is infectious; public health guidelines; prayer	High temperature (38–40°C); Running nose; Persistent cough; Difficulty in breathing; Sneezing; Body weakness	Boost your immune system by eating food that contains vitamin C and A, and zinc; keep your surroundings clean; wash your hand with soap; avoid handshakes; sneeze into a tissue or handkerchief; cover your mouth while coughing; cough into your elbow when you have no handkerchief or tissue; dispose of used tissue; Practice social distancing; avoid touching your mouth, ears, eyes, and nose; avoid touching surfaces; use face mask; stay home
19	Akan Ga	It is real and not a hoax; it is infectious; public health guidelines; prayer	Sneezing; Difficulty in breathing; Coughing; Running nose	No handshaking; keep 2-meters away when chatting; don't touch your face; wash your hands; use alcohol-based sanitizer; when coughing or sneezing, cover your mouth; when you have running nose, coughing; sneezing, difficulty in breathing, go to the hospital for a test or call a health worker; stay at home when you are not feeling well; when you return from a trip abroad, allow to be quarantined
20	GhPE	It is real and not a hoax; public health guidelines	Coughing; Headache	Stay indoors; wash your hands with soap; cover your nose; use alcoholic-based hand sanitizer; keep 2-meters away from anyone; don't touch your face, nose, eye
21	English Akan	It is real and not a hoax; it is infectious; public health guidelines; prayer	–	Stay home; wash your hands with soap and water for a min of 20 secs; social distancing
22	English Akan Ga	It is real and not a hoax; It is infectious; emotional reaction and disruption of everyday activities; verbally expelling the virus; public health guidelines; inspiring hope	–	Don't touch your eyes, mouth, nose; wash your hands; wear face mask; Avoid social gathering (naming ceremony, funeral); stay home
23	English Akan Ga Hausa	It is real and not a hoax; public health guidelines; call for unity and collective efforts; inspiring hope; prayer	–	Be neat; wash your hands with soap and water; no handshake; no hugging; no outing; more bathing; quarantine
24	Akan GhPE Ga	It is real and not a hoax; prayer; public health guidelines	–	Wash your hand with soap under running water; use sanitizer; no handshaking; Stay home; don't touch your nose, eyes, mouth
25	GhPE Akan	It is real and not a hoax; prayer; public health guidelines	–	Wash your hand with soap under running water; clean your hands with hand sanitizer; no handshaking; avoid party; no church going, no mosque going; when coughing or sneezing, cover your mouth
26	Akan	It is infectious; emotional reaction and disruption of everyday activities; public health guidelines; prayer	–	Wash your hand with soap under running water; use sanitizer; avoid social gatherings
27	GhPE Ga	It is real and not a hoax; verbally expelling the virus; emotional reaction and disruption of everyday activities; public health guidelines	–	Wash your hand with soap under running water; use sanitizer
28	English GhPE	It is real and not a hoax; it is infectious; emotional reaction and disruption of everyday activities; public health guidelines; call for unity and collective efforts	–	Wash your hand with soap and water; avoid handshakes; don't touch your face; Remember your sanitizer; cover your mouth while coughing; avoid touching your face; stay home

TABLE 2 | Preventive measures as heard in song lyrics in order of frequency.

Information	Frequency (%)
Wash your hands	25 (18)
Use hand sanitizer	22 (16)
Stay home	19 (14)
Social distancing/Avoid social gathering	19 (14)
No handshake/hugging	15 (11)
Cover your mouth when sneezing/coughing	13 (9)
Avoid touching eyes, nose and mouth	10 (7)
Wear face mask	8 (6)
Isolate sick people	4 (3)
Clean/Disinfect surfaces regularly	3 (2)

the language used in print media and most electronic media programs. However, about eight of the written indigenous languages, including Akan, Ewe, Ga, Dagbani, Dagaare, and Gonja, are used for certain programs on radio and television (37, 38).

Data Extraction

YouTube [www.youtube.com], a music sharing website, was searched to identify coronavirus-related songs from Ghanaian musicians. following Google. According to the 2020 Alexa report, following Google [www.google.com], YouTube is the second of 500 top websites frequently used among Ghanaians (www.alexa.com/topsites/countries/GH). This makes YouTube the most popular and most patronized music and video sharing website in Ghana. The search was conducted from April 1, 2020 through May 30, 2020 with the following terms "Ghana coronavirus song," "coronavirus song Ghana," "coronavirus song from Ghana," "coronavirus audio from Ghana," and "coronavirus video from Ghana." A total of 40 songs from both well-established and upcoming musicians were found. We included songs by Ghanaian artists in English or Ghanaian local language with any COVID-19 educative information. We excluded songs that only mentioned COVID-19 without providing any implicit or explicit public health message about the disease. An example can be retrieved from https://www.youtube.com/watch?v=EduNrGL5OwE.

The songs were searched and selected by three bachelor-prepared research assistants based on the exclusion and inclusion criteria. The selected songs were then reviewed by two PhD prepared researchers. Each song was assessed solely in terms of its lyrics and no other features such as tempo, rhythm, or mood. Non-English lyrics were translated and transcribed by language experts from Ghana. The lyrics were then reviewed to obtain information about key issues raised (themes), language(s) used, and references to specific symptoms and preventive measures. Of the 40 songs identified, 28 met the inclusion criteria.

Data Analysis

We conducted a thematic analysis to examine the lyrics of the selected songs. As a qualitative method, a thematic analysis allows for identifying, analyzing, and reporting patterned themes within the songs. The four phases of analysis (immersion, code generation, theme identification, and theme confirmation) that guide a systematic thematic analysis were employed (39). First, we became immersed and acquainted with the data by reviewing the lyrics of each song and noting preliminary points of interest. Secondly, two of the authors engaged with the transcribed lyrics and lyrics were double-coded. Codes were then compared to ensure consistency. We coded any mention of coronavirus, its effects, or how people can avoid it or deal with it. Thirdly, we merged codes and categorized them into major themes. Lastly, we reviewed and made clear definitions for each theme generated from the data. The most representative lyrics for each identified theme were selected to summarize the findings. Non-English lyrics are first presented in italics in the original language, and then followed by an English translation. There was no disagreement between the authors during the analysis.

RESULTS

The final dataset included 28 songs that met study selection criteria. In addition to the themes described below, other characteristics of the lyrics are summarized in **Table 1**, including the languages in which the songs were sung, the signs and symptoms mentioned in the lyrics, and any mention of coronavirus preventive measures. The songs were in various genres of Ghanaian music including Hip-life, Gospel and Highlife. While only five songs were in one language, most were multilingual, with 14 songs in three languages and 10 songs in two languages (See **Table 1**). The languages that dominated the songs were Akan ($n = 21$), English ($n = 16$), and Ghanaian Pidgin English (GhPE) ($n = 13$).

As shown in **Table 1**, all 28 songs mention some way to help prevent the infection. The step that people can take to prevent the transmission of the disease were also integrated in the lyrics. Examples of prevention included: wash your hands with soap under running water; rub your hands with alcohol-based sanitizer on a regular basis; avoid handshakes; use face masks; avoid social gatherings such as parties, funerals, and outdoor ceremonies; cover your mouth with a tissue when coughing or sneezing; and put yourself at a distance of about 2 m (6 feet) from other people during interactions.

Eight major themes emerged from the analysis of the song lyrics: (1) Public health guidelines, (2) COVID-19 is real and not a hoax, (3) COVID-19 is infectious, (4) Prayer as method to stop the virus, (5) Emotional responses and disruption of "everyday" activities, (6) Verbally expelling the virus, (7) Call for unity and collective efforts, and (8) Inspiring hope. Each of these themes is described below.

Public Health Guidelines

The most prevalent theme in all the songs was emphasis on public health guidelines including the need for personal responsibility to avoid getting infected and infecting others. The lyrics suggested that the only way to combat the disease is to adhere to public health guidelines. Lyrics indicated that people can generally take care of themselves during the pandemic by adopting healthy lifestyles and by being compliant with public health guidelines

from the WHO, Ghana Health Service, and Ministry of Health. Examples of lyrics that support this theme are as follow.

Lyrics supporting the theme of public health guidelines

Original Lyrics	English Translation of the Lyrics
If you wanna stay alive stay home I am here to advice ya My dear please use sanitizer *Wash your hands under running water with soap and be wise Avoide handshake Sneeze and cough into handkie. Social gathering onua menk menk nfa nsem pi mma. Stay at home and be safe na practice social distancing eh. Let's help the government fight the corona* **(#8) GhPE and Akan**	"If you want to stay alive stay home I am here to advice you. My dear, please use sanitizer Wash your hands under running water with soap and be wise Avoid handshakes. Sneeze and cough into a handkerchief. Social gathering is not necessary, don't go and bring trouble. Stay at home and be safe and practice social distancing eh. Let's help the government to fight the coronavirus"
Coronavirus is dangerous. Covid-19 is deadly. Coronavirus is a common enemy to the world so beware. Let's maintain our social distancing. Stop touching your eyes, your nose, stop touching your mouth. Beware beware my sister. Beware my brethren beware. It's dangerous, beware **(#1) English**	
Baby take care of yourself before it's too late I told ya Coromental Coro danger *Coro no good Coro too bad Coro Coro Coro Coro too much Coro deadly Coro virus Coro mess up Coro Coro Coro Coro* **(#3) English and GhPE**	"Baby take care of yourself before it's too late. I told you. Coronavirus is dangerous. Coronavirus is not good. Coronavirus is too bad. Coronavirus is prevalent. Coronavirus is deadly Coronavirus has messed up everything"
Regularly drink water. If you're coughing or sneezing nose mask bi the new anthem *nnye saa wobe da ntem* *Social distancing too dey hia. Chale stay home is the best option me nuaa Exercise the body and eat healthy* **(#4) English, GhPE and Akan**	"Regularly drink water. If you're coughing or sneezing, nose mask is the new anthem or else you will die. Social distancing is very important. My friend, staying home is the best option. Exercise the body and eat healthy"
Yen b yen ho ban. Yen hwɛ yen ho yiye. Yen di yen ho nni … Cover wa no sɛ wo cough. *Kata wo hwene sɛ wo hwenten a. Nhyeamu ahorow no nso mo mma yengyae* **(#18) Akan**	"Let's protect ourselves. Let's take care of ourselves. Let's keep ourselves clean … Cover your mouth when you cough. Cover your nose when you sneeze. Let's avoid social gatherings"
Please stay home because of coronavirus. Don't go to funerals or to the beachside Hey, hey coronavirus, coronavirus. Coronavirus will be the death of you **(#7) English**	"Yeah if we live anyhow, then we may suffer, yeah, that is why I'm urging everyone. Friend, stay safe"
Alcoholic sanitizer for your hands Keep two meters away from anyone (#20) GhPE	"Keep alcoholic sanitizer handy. Keep two meters away from anyone"

As seen in **Table 2**, all the preventive measures were found in the song lyrics. Handwashing was the most frequently mentioned measure ($n = 25$). The musicians also emphasized the need for individual responsibility to avoid contracting coronavirus and subsequently, ward off death. They added that in order to maintain health, one must eat healthy, maintain good personal hygiene, keep surroundings clean, remain hydrated, and exercise regularly.

COVID-19 Is Real and Not a Hoax

The songs sought to inform the public that coronavirus is real and not a hoax as believed by some people. Some lyrics indicated that the disease emerged from China and spread to almost all parts of the world including Europe, United States of America, and Africa. Musicians sang about many people dying, and many others being hospitalized in these countries as a result of contracting the disease. Others referred to the fact that Ghana first recorded only two cases but there has since been an exponential growth in the number of infections. Lyrics that support this theme are listed below.

Lyrics supporting the theme that coronavirus is real and not a hoax

Original Lyrics	English Translation of the Lyrics
Yareɛ abae enye ntoro e no b joke. Enye agoro, hwɛ woho yie oo. Take precautions my people. Be vigilant **(#14) Akan and English**	"This disease is not a hoax; it is not a joke. It is not a joke, take very good care of yourself. Take precautions, my people. Be vigilant"
COVID-19 pandemic e shock the whole world like electric. Coronavirus is very dangerous so take am serious make you no joke at all Menfa di agoro. You never know you no go know you never know who dey carry go ooh Make you no joke at all **(#25) GhPE and Akan**	"COVID-19 pandemic has shocked the whole world like electric. Coronavirus is very dangerous so take it seriously and don't joke at all. Don't play with it. You may never know; you will not know who has been infected. Don't joke at all"
The spread is getting this serious. It started from Wuhan in China. Italy recording cases of the day. Spain is in pain … nnɛra nkoaa na yɛ recorded cases two. Nanso bɛhwɛ nnɛ more than 132 **(#22) English and Akan**	"The spread is getting this serious. It started from Wuhan in China. Italy recording cases of the day. Spain is in pain … it was just yesterday we recorded two cases. But today, there are more than 132 cases"
Alubu bunti paa tiŋna? Ghana Ghana Ghana, Ghana Ghana Alubu bunti paa tiŋna? Duru ŋ, ti daa wumla diyala China kadi gungu ti paai tina Ghana. Ashebti shab dumi shab dumi N baye Pam kpemi, pam kpemi, pam kpemi N baye Dimalla nandahama **(#16) Dagbani**	"What is this calamity that has befallen us? Ghana Ghana Ghana, Ghana Ghana What is this calamity that has befallen us? This is a disease we heard was in China and it has roamed and roamed, and it is now with us in Ghana. Some have been hospitalized, some have been hospitalized so many have died, so many have died, so many have died. It is sorrowful"
Corona yi deɛ ɛde asem aba. Barima, ama yɛ sre a ehu ab yɛn. Hwɛ, ehyɛ ase ɛw China. Na anantɛɛ abe duru America. Yen deɛ anka nfa yɛn ho o. Ɔman Ghana yɛ te yen bebi o. Nanso nnɛ aduru ha **(#11) Akan**	"This coronavirus will bring issues. Man, it is making us scared. Look, it started from China, went to America. We, in Ghana, were minding our business but today it is here"

(Continued)

Original Lyrics	English Translation of the Lyrics
Corona Corona, e kill more people for china; e go Italy, Verona, Burkina, over to Ghana. Corona Corona, e kill more people for America, from Belgium down to Nigeria, now down down into my area **(#10) GhPE**	"Coronavirus Coronavirus, it has killed more people in china; It has gone to Italy, Verona, Burkina, over to Ghana. Coronavirus Coronavirus, it has killed more people in America, from Belgium down to Nigeria, now it is my area"

COVID-19 Is Infectious

In addition to informing the public that COVID-19 is real and not a hoax, the songs warned that the virus is very infectious. Some lyrics made it clear that the novel coronavirus is even more infectious than other viral diseases including HIV, SARS, and Ebola, and older adults are the most vulnerable. The songs that projected this theme also had content about the disease affecting all categories of people, regardless of race, age, or social status. Below are examples of lyrics to support this theme.

Lyrics supporting the theme that coronavirus is infectious

Original Lyrics	English Translation of the Lyrics
Wei nyɛ bacteria, wei ɛyɛ virus kyen bird flu, SARS ɛne Ebola **(#19) Akan**	"This is not bacteria, it is a virus, it is worse than bird flu, SARS, and Ebola"
Yarebae a w'abae nsuro bibini. Nsuro obroni, nsuro Indian ni. nsuro obia w wiase mu **(#21) Akan**	"This disease is not afraid of the blacks, not afraid of whites, not afraid of Indians, not afraid of anyone in this world (It can infect anyone)"
From China to Italy You dey kill around more than HIV. Africa mama eh Just tell your people to be careful Don't you panic just be careful. Just do needs and be careful **(#27) GhPE**	"From China to Italy, you are killing more than HIV. Africa mama eh, Just tell your people to be careful. Don't panic, just be careful. Just do the needful and be careful"
Corona virus yi deɛ ɛyɛ hu… ensuro obolo na ensure tsingilingi. Nsuro nnipa tenten na nsuro … Nfa ho sɛ wo ho yɛ fɛ anaa wo ho yɛ tan. The whole world one word, quarantine **(#22) Akan**	"Coronavirus, this is scary … It is not afraid of the fat person or afraid slim person It is not afraid of a tall person or afraid of … It doesn't matter whether you are beautiful or ugly The whole world, one word, quarantine"
Nidi degbaaga. Domini din gbaaga N baye din gbaagama. Dimi ni gbaama, din tuui lui so. Coronavirus zalizaa Corona beche bundan bii nandana. Debiche beble bii ninkurigu Din zuɤu, anyama tima nuu kambi dee. Dibi wuhi ni zilman kai kambi dee N gula nmang, ka gua zuɤu kambi dee **(#16) Dagbani**	"It should not infect you, because if it infects you, it will infect me. If it infects me, I can pass it to someone else. 'Coronavirus has brought a difficult situation. Coronavirus does not leave out the rich or the poor; it does not leave out the child or the elderly so, if you see me and extend a shaking hand and I don't receive it, it does not mean it is out of disrespect. I have not received your handshake because I want to protect you and myself"

Prayer as Method to Stop the Virus

More than half of the songs expressed the idea that divine intervention is needed to curb the spread of the virus, and to heal and protect people. Some of the lyrics urged their audience to pray to God. For example:

Original Lyrics	English Translation of the Lyrics
Yen sre Twedeampn na obehu yen mb **(#17 Akan)**	"Let us plead with the Almighty and he will show us mercy"
Yen su fre Nyame, obehu yen mb **(#18 Akan)**	"Let us cry unto God, he will show us mercy"
We for pray say Baba go come save **(#23 GhPE)**	"We need to pray that the Father will save us"

Other lyrics were actual prayers asking God to help find a vaccine, restore calm to the world, or protect the people. The following are three such examples:

Original Lyrics	English Translation of the Lyrics
Deadly virus is spreading, oh my God in Heaven, abeg give us a vaccine to clear out this worldwide burden **(#14 GhPE)**	"Deadly virus is spreading, oh my God in Heaven, please give us a vaccine to clear out this worldwide burden"
ɛpo ne asorkyeɛ wura, esum ɛyɛ duru yɛn, kasa na ɛnyɛ dinn, kasa na ɛnyɛ komm, kasa na ɛnyɛ hann **(#26 Akan)**	"Owner of the sea and waves, darkness is covering us, speak and let it be silent, speak and let it be quiet, speak, and let there be light"
Kpeŋlan naawuni … Zaŋmi a nam, yeko gulibu guliti **(#16 Dagbani)**	"Almighty God … use your power, your protective ability to protect us"

Emotional Reaction and Disruption of "Everyday" Activities

Apart from the health implications of coronavirus, other effects of the disease highlighted in the data include the fear it has induced in people and the emotional reactions to disruptions in social and economic activities. In the examples below, the world in general is identified as a fearful place, and some specific countries have been described as "ghost towns" due to the restrictions placed on movement.

Original Lyrics	English Translation of the Lyrics
Yareɛ yi yɛ hu o. Asia, Europe adane nsaman kurow No, no, no ɛnyɛ fadi agor o **(#17) Akan**	"This disease is very scary. Asian and Europe have become like ghost towns. No, no, no, it is not a joke."
Everybody, living in fear, hoping that this virus disappears **(#23) English**	
Coro Aunty Coro, Mama mesuro. Coronavirus mesuro. Me deɛ mesuro **(#24) Akan**	"Coro Aunty Coro, Mama, I am afraid Coronavirus, I am afraid, As for me, I'm afraid."

Other lyrics mentioned that social gatherings are no longer allowed, thus no more public entertainment, sports, or religious activities. Consequently, people are feeling lonely because they cannot see their partners, loved ones or friends. Here are examples of lyrics that support this theme.

Lyrics supporting the theme of coronavirus emotional reactions to disrupted activities

Original Lyrics	English Translation of the Lyrics
You dey put my people for sorrow. We no fit come together no more. Social distancing is killing industry. We no fit come together and play shows We no fit come together act movies. We no fit come together play football Weytin dey happen? African dey panic. Europe dey panic. Americas dey panic, Asia dey panic **(#27) GhPE**	"You are putting my people in sorrow. We are not able to come together anymore. Social distancing is killing our businesses. We are not able to come together for entertainment shows. We are not able to come together to act movies. We are not able to come together to play football. What is happening? Africa is panicking, Europe is panicking, America is panicking. Asia is panicking"
I can't go out I can't go out I'm so alone now I miss Bloombar I miss Bloombar I want to chill now. Want to bolingoooo I want to link up … Life start dey bore lately. What's on the news? Everyday, all day bad news soor **(#6) English and GhPE**	"I can't go out, I can't go out, I'm so alone now I miss Bloombar, I miss Bloombar, I want to chill now. I want to have fun; I want to socialize … Life is boring lately. What's on the news? Everyday, all day, it is only bad news"
Hello COVID-19, w'ama m'afe me wifey. Home alone in loneliness … As fo aka dan mu; Asre bia aka dan mu **(#2) English and Akan**	"Hello COVID-19, you have made me miss my wife. I am home alone in loneliness … Pastors are stuck in their rooms; all the churches are no more open"

Verbally Expelling the Virus

On the basis of belief in the power of words by Ghanaians in general, some musicians verbally expelled the virus in their lyrics. Some clearly stated the world does not want this disease, while others asked the virus to go back to where it came from. Four examples of this theme are presented below.

Lyrics supporting the theme of verbally expelling the virus

Original Lyrics	English Translation of the Lyrics
Coronavirus we taya, go back from you dey come from. You came in unannounced; you never tell nobody where you from **(#27) GhPE**	"Coronavirus we are tired, go back to where you came from. You came in unannounced; you didn't tell anyone where you came from"
Coronavirus yɛmpɛ; sɛ Ghana ha, daabi Coronavirus yɛnpɛ; sɛ Africa, daabi Coronavirus yɛmpɛ; sɛ USA, yɛmpɛ; Coronavirus daabi; sɛ Italy, yɛmpɛ ***(#9) Akan***	"Coronavirus, we don't want it in Ghana, no, Coronavirus we don't want it in Africa, no. Coronavirus we don't want it in USA, we don't want it; Coronavirus, no; in Italy, we don't want it"
Coronavirus, hela nɛɛ na waa ts … Hela nɛɛ wsum wsum wsum kwraa **(#9) Ga**	"Coronavirus, this disease is too strong … We don't want this disease, we don't want it, we don't want it at all"
Oh yeah wherever you dey come from. I tell you say hey hey hey hey abeg make you lost–Yesu mogya ka w'anim. Abeg make you lost. Ogya ogya hyew w'anim. Coronavirus wherever you dey come from. I tell you say abeg make you lost **(#14) GhPE and Akan**	"Oh yeah wherever you are coming from. I am saying, hey hey hey hey please get lost–May the blood of Jesus rebuke you. Please get lost. May fire burn you. Coronavirus, wherever you are coming from, I am telling you that, please, get lost"
Yɛmpɛ, yɛmpɛ, yɛmpɛ, Corona yɛmpɛ Yɛmpɛ o, yɛmpɛ, yɛmpɛ **(#22) Akan**	"We don't want it, we don't want it, we don't want it. We don't want Coronavirus. We don't want it, we don't want it, we don't want it"

Call for Unity and Collective Efforts

In the face of the COVID-19 pandemic, many lyrics in the data have called for a more collaborative mindset among individuals at the national level and among nations of the world at the global level. As everyone struggles to adapt to the current reality, people must recognize the need to support and collaborate across borders, to share what works and what does not work in fighting the disease. Some musicians described coronavirus as "a common enemy" and thus reinforced the need for unity and collective efforts at both national and global level to help defeat the virus. Some examples of this theme are included below.

Lyrics supporting the theme that coronavirus requires unity and collective efforts

Original Lyrics	English Translation of the Lyrics
Let's come together to stop Corona Corona. We can if we try and we can start all over **(#28) English**	
Coro be enemy wanna enemy I call on the whole nation. Let's fight our enemy, our enemy, Coro be enemy. Ghana Ghana Ghana, Ghana Ghana **(#16) GhPE**	"Coronavirus is an enemy, our enemy I call on the whole nation. Let's fight our enemy our enemy, Coronavirus is an enemy. Ghana Ghana Ghana, Ghana Ghana"
Global war but everybro jie eye dey protect their own We should come together That's when we stand a chance so my friend This no bi time to point fingers. The thing dey spread, Corona **(#6) GhPE**	"This is a global war, but everyone is focusing on protecting their own. We should come together That's when we stand a chance so my friend this is not the time to point fingers. The thing is spreading, Coronavirus"
It's time to love one another. It's time for the world to come together. No black no white no yellow. Cos nobody is promised tomorrow **(#23) English**	
Presenters mo mb dawuro o, yenkyia biom TV stations ahorow nyinaa, yenkyia biom na yadeɛ ne ho yɛ hu yiye paa nti yenkyia biom oo o. Mo mb yadeɛ ne ho dawuro oo na yadeɛ ne ho yɛ hu yiye paa, yenkyia biom **(#13) Akan**	"Presenters should spread the news, no more handshaking, all the different TV stations, no more handshaking. No more shaking of hands because the disease is very scary. Spread the news about the disease, for the disease is very scary, no more handshaking"

Inspiring hope

There were also lyrics that assured their audience that this pandemic will not last forever, and that soon the world will recover from its negative impact. Some musicians also expressed their belief that God will heal those infected and deliver the world from this pandemic.

(Continued)

Lyrics that illustrate the theme of inspiring hope:

Original Lyrics	English Translation of the Lyrics
Nyame beyi yɛn afiri mu, yareɛ ne amaneɛ wei mu **(#22) Akan**	"God will deliver us from this sickness and trouble"
Sing Africa oh oh oh Sing America oh oh ho Sing Asia oh oh oh We will survive, yes. We will survive, together you and I We will survive coronavirus. We will survive. Together we will overcome. It doesn't matter anywhere you from. We will survive, Coronavirus. We will survive, together you and I. We will survive. We will survive, yes **(#23) English**	
Soldiers in green but corona looks like it's in patrol. But wait wait God will never fail. His holy name I hail. He go give we bail, bail to conquer. But wait wait, he is the king of kings. He never lose he always wins … We go conquer, we go conquer. Ebola came, we conquered it. Corona dey, we no dey shake. We're staying safe, build up our faith. Pray everyday cos we go conquer **(#2) English and GhPE**	"Soldiers in green but coronavirus looks like it's in patrol. But wait wait God will never fail. His holy name I hail. He will give us bail, bail to conquer. But wait wait, he is the king of kings. He never lose he always wins … We will conquer, we will conquer. Ebola came, we conquered it. Coronavirus exists, we are not afraid. We're staying safe. Build up our faith. Pray everyday because we will conquer"

DISCUSSION

As evident in **Table 1**, the lyrics analyzed in this study involved various topics to create awareness about COVID-19. The major themes found from the analysis are "public health guidelines;" "COVID-19 is real and not a hoax;" "COVID-19 is infectious;" "prayer as method to stop the virus;" "emotional responses and disruption of "everyday" activities;" "verbally expelling the virus;" "call for unity and collective efforts;" and "inspiring hope." The lyrics provided content on the prevalence of the disease, how indiscriminating and infectious it is, and how it has disrupted social activities on both personal and global level. Some signs and symptoms were identified in the lyrics, along with steps that people can take to prevent the transmission of the disease.

The song lyrics tend to identify COVID-19 as a global social crisis with significant public health impact rather than a local health issue. Thus, some of the musicians resorted to prayer and asked for divine intervention. They inform the public that COVID-19 has no cure, and infected people may be asymptomatic. They also conveyed emotional appeals that warned listeners that the disease is "an (common) enemy," "highly infectious," "dangerous," "wicked," "scary," "serious," and "deadly." While some of these descriptions may induce fear, the message that many people all over the world have been infected irrespective of age, race, nationality, physical stature or social status, can be viewed as an essential step in de-stigmatizing the disease.

Acknowledging that loneliness is a common feeling during social isolation can help to address mental health issues, and the act of inspiring hope in some lyrics may also enhance the quality of life of persons who are already infected (54) or assure listeners who are not yet infected that overcoming the disease is possible. The theme of inspiring hope in this study highlights a belief among Ghanaians that reassurance is needed in every predicament, and thus important in health and social care (40). Together, these songs propose a collective effort to completely fight the virus, but at the same time encourage listeners to take responsibility for their own health and adopt the necessary precautions to avoid the impact of the disease. The theme of "call for unity and collective efforts" reflects the communal nature of the Ghanaian society. The collectivity that is projected in the lyrics of the songs implicate not only those who are affected (in)directly by the disease but also, everyone around them (41, 42).

In addition to promoting the public health guidelines for COVID-19, some of the musicians encouraged the use of prayer as well as verbally expelling the virus as methods of combating the disease. This is unsurprising because research has revealed that in Ghana, some people conceptualize the causes and cures of diseases through both biomedical and religious/spiritual means (43, 44, 56). As noted by Okyerefo and Fiavi (56), among Ghanaians, the religious/spiritual methods are viewed as complementary rather than challenging or competing with the biomedical models of healthcare. Seeking divine intervention through prayer during the COVID-19 pandemic can be attributed to the belief that "doctors can treat certain conditions, but only God heals" ((56), p. 308). The act of verbally expelling the virus is a display of belief in the power of words among Ghanaians. The general notion is that the power of spoken words just as the health of a person has a link with the metaphysical and supernatural world. As a result, words can be effective in dismissing diseases and healing practices (45). In a broad sense, the themes of prayer and verbally expelling the virus in this study provide us with the understanding that in Ghana, biomedical models exist and operate alongside other healthcare practices.

The multilingual nature of Ghana was also reflected in the song lyrics. Akan, English, and GhPE were the languages used most often in the composition of these songs. This finding is not surprising, rather it validates the assertion that these languages serve as "*lingua francas*" in Ghana. Akan is the most widely used local language in different social contexts (46) while English is the defacto official/national language and a cross-ethnic "*lingua franca*" in Ghana (35, 36). GhPE, however, functions as the only medium of communication between English speakers and non-English speakers who do not share a common local language or non-English people of different linguistic backgrounds (47, 51). Most of the musical artists displayed their bilingual/multilingual identity as Ghanaian and primarily used these languages of wider communication to ground their messages in socio-culturally relevant contexts.

Even though there are several local languages spoken in sub-Saharan Africa (48), most of the WHO and national educational guidelines on COVID-19 are in the country's official language (English or French). It is therefore important for public health specialists, politicians, media experts, and social leaders to employ strategies that use local languages rather than an official language only understood by smaller portions of a country's population. The use of songs composed in local languages could be an important means of sensitizing vulnerable citizens to the

awareness and health implications of COVID-19. Music has much to offer to the communication efforts related to COVID-19 and is especially appropriate for educational needs due to its inherent participatory nature (see (49)). In addition to musicians, other artistic entertainers such as comedians and poets should also be involved in the broader efforts to engage and educate the public through messages conveyed in their spoken words. This should be done in consultation with public health workers to avoid misinformation.

Despite educational efforts targeted at creating awareness about COVID-19, the number of cases continues to soar in many parts of the world. This increase would suggest the need for new and novel approaches that can complement the existing mechanisms for raising COVID-19 awareness and prevention. Song lyrics may be one such approach. Although some lyrics may be controversial or irrelevant just for the purpose of creating a rhythm, music still represents an inexpensive yet innovative and powerful tool for discussing the novel coronavirus and best practices for preventing its spread. It is also noteworthy that not all song lyrics will make a positive contribution to promoting preventive behaviors; however, analysis of song lyrics can provide insight into local attitudes toward the virus. In addition, collaboration between health workers and musicians can offer a means to disseminate information in an accessible way.

Undoubtedly, additional research is needed in order to fully understand the impact of using music and lyrics to educate the public on COVID-19, however existing literature clearly demonstrates that music contributes a great deal to public education efforts related to HIV/AIDS and other infectious diseases. The messages embedded in the lyrics of songs are designed to reach a large segment of the population faster and in a meaningful and more memorable fashion. People with a broad range of literacy and access to information can better retain these types of messages and thus achieve the goal of public health knowledge.

LIMITATIONS

The major limitations of this study include the limited focus on Ghana music and the potential for missing some songs created during this short time frame or not having access to other songs that were short-lived in the media. In addition, many of the songs used as data for this study could benefit from a more detailed lyrical analysis (9), which we hope will be undertaken in future research. Nevertheless, this paper focused on the unique and novel contribution of music to creating awareness about COVID-19 in Ghana and similar studies should also be conducted in other countries. Also, we did not assess the impact of the song lyrics on attitudes, beliefs, and behaviors; therefore, a more comprehensive ethnographic study is needed to understand the impact of the songs on the society.

CONCLUSION

Raising public awareness on any social issue or health crisis often demands an increase in information dissemination through both formal and informal means. While it was not our intention to prioritize any one dissemination strategy, educating the public through diverse musical genres and other non-deliberative means could yield valuable global results. Music is one such information dissemination vehicle or promotion strategy utilized in health communication in many places over time, mainly because it has the potential to facilitate the process of behavioral change among specific sectors of the population. We showed that the lyrics in the songs used as data are informative and encourage people that they can and should take responsibility for their health and adhere to necessary safety protocols. Thus, the discourse on COVID-19 expressed through songs has relevance for the development of culturally appropriate health messaging. Results from this study support the idea that music has the ability to contribute to the fight against coronavirus and can be employed as an enjoyable supplement that reinforces or amplifies educational efforts in various communities around the world.

Results from this study can also be used to inform policymakers that investing in health communications using music could be worthwhile. Supporting musicians with sufficient resources to engage and educate citizens about the ongoing pandemic could be cost-effective. This study should be viewed as the beginning of a journey to document how music can be used to raise awareness about COVID-19. Generally, music is not immune to the problems of misinformation, and attention to song lyrics may provide broad insight into local discourse, including ideas that may contradict accepted public health messages. Therefore, a future study could focus on some recognition of the diversity of messages that may be communicated through songs in order to provide a more nuanced perspective. Further research is required to assess the impact of song lyrics as well as melodies and rhythms. However, results from this study should stimulate interest in how to use songs and tailor them to local communities to fight against COVID-19 and other future pandemic health crises.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Materials**, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

RT participated in the design of the study, analyzed all the research data, and drafted the manuscript. JN participated in the design of the study, analyzed the data, and reviewed the manuscript. JJ reviewed the manuscript and supervise the study. All authors read and approved the final manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2020.607830/full#supplementary-material

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Revising the "Hype Pipeline" Model in Scientific Communication

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1 INTRODUCTION

In this article, we present a new model for hype formation in science communication and in the public understanding of science. In this new model, the blame for hyping scientific results and/or the significance of research discoveries lies not in the traditional structures of science communication publicists and journalists but in politicians and social media celebrities, with grave consequences for public policy, as seen in the case of the hydroxicloroquine (HCQ) in Brazil.

Hype can be both cause and effect of public interest in any scientific topic. The COVID-19 pandemic has brought about a sharp increase in public interest in health science–related news coverage; the online search for news stories containing the words "virus" and/or "vaccine," for instance, increased substantially this year, according to Google Trends data, going to the highest level since 2008, the first year covered by the database, in March ("virus") and in May ("vaccine"). But, whenever there is a peak interest in health science issues, it is usually followed by sensationalism (Ransohoff and Ransohoff, 2001). When dealing with medical and health science, sensationalism is usually a product of exaggerated interpretations from scientific papers that can both scare or delude the population (Ransohoff and Ransohoff, 2001). The same phenomenon is also addressed as "hype" (Weingart, 2017).

Media attitudes tend to get most of the blame for hyping science, and low quality science is usually more attractive. There is literature suggesting that low quality research in health and medicine tends to attract more attention from journalists than well-designed and carefully executed studies (Bartlett et al., 2002). More complex models of hype creation and hype dynamics, however, tend to distribute blame more equally among scientists, press officers, business people, and the conventional media (Ransohoff and Ransohoff, 2001; Marcinkowski and Kohring, 2014).

And what about the public? The public is commonly seen as a passive receptor/consumer/"victim," who may perhaps lash out in anger when the dangers or benefits promised by the hype fail to materialize (Ransohoff and Ransohoff, 2001). This view of the public is a gross simplification, and many scholars recognize this fact (Caulfield and Condit, 2012).

Models don't mirror reality exactly. But, simplifications can be, and often are, useful in all branches of science. As the late great physicist Sir Arthur Eddington wrote in his classic *The Internal Constitution of the Stars*, replying to a complaint against the "loose" use of mathematics by physicists, "a legitimate approximation is not just an unavoidable evil; it is a discernment that certain factors—certain complications of the problem—do not contribute appreciably to the result." However, it is no longer tenable, not even in a simplified model, to see the public as a passive pole in the hyping process. The kind of modeling that places the public in a passive or, at most, reactive role in the health science hype dynamics has become direly inadequate in the context of the present pandemic; here, the public indeed does "contribute appreciably to the result."

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1.1 The Old Model

Old models emphasize a hype-producing system centered in scientific institutions and media outlets. The "hype pipeline" proposed by Caulfield and Condit (2012) can describe the old information ecosystem very well; pressures from the "publish or perish" culture and from expectations of financial gain are taken up by institutional press releases; the news media may fail to filter the exaggerations in the releases and also has its own stake in making the content "sexy." If the hype gains momentum, a "scientific bandwagon" emerges, with other research groups diving into the hyped research area, which will generate more press releases and news stories.

In this pipeline model, the only input from the public is what are perceived as their preferences: they influence the journalists on what to write and the press officers of research institutions on how to "angle" their press releases. This model, however, becomes quite inadequate to deal with what can be considered as the greatest hype of the pandemic—the hydroxychloroquine craze.

1.2 Background

Chloroquine (CQ) and its less aggressive version, hydroxychloroquine (HCQ), are both molecules that have been used for almost a century in the control of malaria and, more recently, for autoimmune diseases such as lupus erythematosus (SLE) and rheumatoid arthritis (RA).

The drugs have exhibited antiviral activity *in vitro*, attributed to blocking viral entry through the disruption of endosomal pH. Anecdotal evidence of the use of HCQ in SLE patients became available during the early days of the pandemic in China, and the Chinese government issued a statement—not a scientific paper—detailing the use of CQ as a possible treatment for COVID-19 (Gao et al., 2020).

The now infamous clinical trial conducted in France, at the Institut Hospital-Universitaire in the city of Marseille (IHU), by prominent doctor and researcher Didier Raoult, that created the HCQ hype, had several serious methodological flaws: it was not randomized, control patients were treated in different hospitals and not with a standardized protocol, there was no intention-to-treat, data were missing from several patients, and six patients in the treatment group were simply excluded from the final analysis, all of whom had deteriorated, left voluntarily because of side effects, or died (Gautret et al., 2020).

Nevertheless, Raoult went to social media announcing that HCQ was a "game changer" that would end the pandemic and cure COVID-19. The news reached President Donald Trump in the United States and echoed in Brazil in President Bolsonaro's ears. There followed a great number of deeply flawed studies, with no control groups, questionable statistics, and biased methodology.

Good science, however, soon began to tell a different tale. Of note, an article published in NEJM analyzed postexposure prophylactic use and found no benefits (Boulware et al., 2020), and the Recovery trial, a thorough and comprehensive randomized trial conducted in the United Kingdom, found no benefits in mortality or time to recovery. After these results, HCQ trials enrollments were halted in the United Kingdom and in the Solidarity trials conducted by the WHO.

These decisions were echoed in the United States, and the FDA revoked its previous decision to allow emergency use of HCQ. In Brazil, the Ministry of Health carried on as if nothing happened. Not only did the Brazilian Ministry authorize and recommend the use of HCQ for COVID-19, at the earliest appearance of symptoms, it has recently extended the recommendation for pregnant women and pediatric use.

The politicization of the issue was doubly enhanced in Brazil after the announcement that President Jair Bolsonaro had contracted the new coronavirus, and the President himself went online to say that he was recovering well "thanks to chloroquine." All in all, the chloroquine affair appears as one of those instances in which hype is no longer just an exaggeration of scientific research but simply becomes one more claim not backed by evidence, which in turn cannot be different from plain fraud (Weingart, 2017).

The hyping of HCQ had serious public policy and public health consequences for Brazil. The Ministry of Health issued two national guidelines for its use, recommending it for both hospitalized and early-stage patients (Ruprech, 2020), and Bolsonaro himself said, without presenting any evidence, that the use of HQC could have avoided 30% of all COVID-19 deaths in Brazil (Bolsonaro 2020). The widespread belief—fostered by the Federal Government—that the early use of HQC could prevent more serious forms of COVID-19 very likely contributed to the low public adherence to social isolation and mask-use protocols (Fávero, 2020; Afiune et al., 2020).

1.3 The New Model

In the new model, hype generation is no longer the end-product of a pipeline with the public in the receiving end but of an explosion with the public at the epicenter. In the present information ecosystem, it is no longer reasonable—even under a simplified model—to see the public as a passive target of hype. In an informational ecology dominated by social media, the public takes on an active role in propagating and amplifying hype.

The history of the CQ/HCQ hype is one of intense direct interaction between social media influencers and the public, without intermediaries. The hype began online, on YouTube, with Didier Raoult announcing the "cure" for COVID-19, on a video posted in February with the title "Coronavirus: Game Over!" and the warning: "The only thing I'll tell you is, be careful: Soon the pharmacies won't have any chloroquine left!" (Sayare, 2020). With this, Raoult subverted the "pipeline" order, from the scientific paper to press release; he went public before having a paper to back up and stabilize his claims (which is usually seen as bad form), and he did not use press releases at all.

Raoult's announcement was amplified by people with large numbers social media followers. The next chapters played out on Twitter: James Todaro, a medical doctor who is also a financial market investor, and Elon Musk, owner of companies like SpaceX and Tesla Motor, tweeted about the "promise" of chloroquine (**Figure 1**).

The role of social media in disseminating falsehoods had already been established. An article published in *Science* showed that, on Twitter, false information travels way faster, deeper, and with greater reach than fact-based information, and

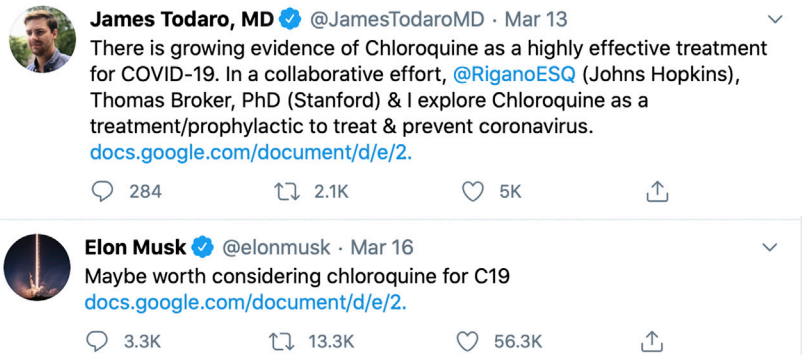

FIGURE 1 | James Todaro's and Elon Musk's tweets.

FIGURE 2 | Donald J. Trump's and Jair M. Bolsonaro's tweet. Bolsonaro's tweet says: "The treatment of COVID-19, based on hydroxychloroquine and azithromycin, has been shown to be effective in patients undergoing treatment. In the coming days, results shall be presented to the public, bringing the necessary atmosphere of tranquility and serenity to Brazil and the world."

this is true for all categories of information (Vosoughi et al., 2018). Importantly, Vosoughi et al. determined that falsehoods do not succeed because they are falsehoods but because they tend to be more novel, unusual, or surprising than truths; also, that politically motivated novelties are more retweeted (Vosoughi et al., 2018). Such motivation was brought to bear by the early adoption of chloroquine by both the President of the United States, Donald Trump, and the President of Brazil, Jair Bolsonaro. Both presidents went to Twitter to brag about the medicine (**Figure 2**) and later went public to say that they were taking the drug, Trump as a preventive, Bolsonaro as therapy.

The new information ecosystem requires new tools to deal with hype. Most of the literature about the management of hype in science communication deal with suggestions of how to stop it at the source (Weingart, 2017) not on how to defuse it after it has been released. But, in the new information ecosystem, when the public—including national leaders and their hundreds of thousands of social media followers—is a fundamental part of the hype engine, defusing becomes essential. If the media can no longer take the blame for spreading hype but rather hype comes directly from the public, influenced by political leaders, doctors, medical associations, and media influencers, techniques to defuse misinformation must also be adapted. These new tools should come from studies on fighting conspiracy theories and long ingrained misconceptions about science. There is literature that deals with the correction of misconceptions, "rebutting" and "debunking" (Schmid and Betsch, 2019; Caulfield, 2020). In the pandemic scenario, the CQ/HCQ hype becomes part of the "infodemic" described by the World Health Organization (Zarocostas, 2020).

For some years, the mere possibility of fighting ingrained misconceptions has been in doubt, but this scenario is changing. During the past decade, the perspective for debunking and rebutting has been gloomy. An article by Nyhan and Reifler (2010) suggested that attempting to correct misinformation often "backfired," reinforcing unwarranted beliefs in the mind of the people one is trying to inform. But, a review of recent research showed that the backfire effect was not that common (Caulfield, 2020). In one study, Wood and Porter (2019) conducted five experiments, with more than 10,000 subjects and tested "52 issues of potential backfire." The authors found no backfire effect for all debunking corrections tested, even though they included controversial and polarized themes, where this effect should be expected. Among the issues tested were a few "hot" topics on the borderline between science and politics, like the environmental dangers of fracking for oil or the real cause of the pay gap between men and women.

To combat the conjoined issues of hype and blame in the general population in COVID-19, it may be worth considering research from "debunking" in cognitive psychology. Techniques from "debunking" have been tested with some success. Viable strategies are presented in the study by Caulfield (2020) and Schmid and Betsch (2019). Suggestions include presenting facts in a causal and explanatory manner, so they will have a better chance to fill the cognitive "gap" left by the misconception and,

when dealing with promoters of misconceptions, to lay bare their rhetorical tricks for the public. When social media-fueled hype gains momentum, the "bandwagon effect" predicted by the "pipeline" model takes up not only other research groups—which HCQ also did—but also the public, its hopes, and political passions. In the face of this, science communicators will have to adapt debunking techniques for the control of hype. The creation of hype in this new ecosystem may be diffused, but the blame is not, necessarily. In the new model, with the public front-center in the hype-generating machinery, it may seem that the blame for creating hype and for its social, medical, and scientific consequences gets diluted among the multitude. This is not true: the new communication ecosystem is not an evenly distributed network but has its own privileged voices, nodes, and influencers (Garibay et al., 2019; Wadman, 2020). In social media, every member of the public is responsible for the content they choose to divulge, but there are focal points where most of the blame can be placed. As a science communication strategy, such points ought to be mapped and surveilled, and its content countered as quickly as it is produced. When such focal points become the focus of misguided public policy, as it happened in Brazil and, to a lesser extent, in the United States, the debunking efforts should be coupled with societal and political reaction.

AUTHOR CONTRIBUTIONS

NT and CO contributed equally to this manuscript by reviewing the literature and wrote the manuscript. LA participated in the review and wrote the manuscript.

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Assessing Attitude Toward COVID-19 Vaccination in South Korea

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Vaccines are the most effective strategy to safeguard against COVID−19 and it is crucial to assess community acceptance of COVID-19 vaccination. This exploratory study aimed to assess the attitude of immigrants toward the acceptance of COVID-19 vaccines in South Korea. A web-based anonymous study was completed by 463 immigrants. The data were statistically analyzed using a logistic regression model and ANOVA test. On a scale of 0–6, the average attitude toward the COVID-19 vaccination was 4.17 ± 1.73, indicating generally positive attitudes. The proportion of the immigrants who were certain to get COVID-19 vaccination was 55.3%. Only 36.7% reported that the COVID-19 vaccines are safe. Of the immigrants, 72.6% showed high acceptance and 27.4% low acceptance toward the COVID-19 vaccines. Vaccine safety concern was the major predictor for COVID-19 vaccine acceptance. Up-to-date, valid information on COVID-19 vaccine safety, and vaccine risk communication strategies are required to increase vaccine acceptability.

Keywords: COVID-19 vaccine, attitudes, perceptions, vaccine acceptance, safety

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INTRODUCTION

Vaccines are the most effective strategy to protect the population from COVID−19. It is critical to assess community acceptance of COVID-19 vaccination now since COVID-19 vaccination has started globally (Islam et al., 2021). Although data suggest that the approved vaccines are safe and effective, long-term effectiveness and side effects are unknown. Understandably, the general public are uncertain of the current vaccine's acceptance (Mannan and Farhana, 2020; Machida et al., 2021). Immigrant groups are not homogeneous, and their experiences of and attitudes toward vaccines vary greatly. Globally, immigrants are at increased risk of COVID-19 infection due to factors such as ongoing stigma and discrimination, economic disenfranchisement, and barriers to public health care. Limited studies have looked at individual vaccine uptake results by minorities including associated factors with any differences in vaccine acceptance (Caserotti et al., 1982; Mannan and Farhana, 2020; Islam et al., 2021; Thomas et al., 2021).

Although the most efficient way of controlling the spread of the virus is to protect oneself from being exposed to COVID-19, it is very important to vaccinate the community's vulnerable group, such as immigrants (Acharya et al., 2020; Mannan and Farhana, 2020; Lake et al., 2021). A study found that only 54% of the respondents said that they intended to have the vaccination (Lin et al., 2020). Furthermore, a global survey of potential COVID-19 vaccine acceptance showed that 48% of their study population were uncertain and unsure about the acceptance of COVID-19 vaccination (Lazarus et al., 2021). These relatively low proportions of people willing to get vaccinated is a serious issue (Schaffer DeRoo et al., 2020).

Vaccination against COVID-19 is voluntary in Korea therefore it's critical to assess the existing attitudes of specific communities in order to have a successful vaccine campaign. At the time of writing (February 2021) in South Korea, both the AstraZeneca and Pfizer vaccines have received approval and are currently in use in the country's vaccination programme (Korea Disease Control and Prevention Agency, 2021). People's attitudes and perceptions about COVID-19 are critical for government and policymakers in addressing many of the hurdles to vaccination in such a setting. Vaccine hesitancy may pose a significant barrier in the COVID-19 immunization campaign (Al-Qerem and Jarab, 2021; Bhartiya et al., 2021). However, herd immunity requires a certain percentage of the population to be vaccinated. This goal is unlikely to be achieved unless the immigrant community also gets fully vaccinated (COCONEL Group, 2020; Schaffer DeRoo et al., 2020). In Korea, the perspective on the COVID-19 vaccines has not been studied, and it is expected that vaccine-related attitudes will be very diverse based on demographic factors, ethnic group, knowledge regarding COVID-19 and the vaccine's availability. COVID-19 vaccine risk communication during the vaccine distribution timeline, and prioritization of the group for vaccination programs, have been identified as a major concern around the world (Kerr et al., 2021; Warren and Lofstedt, 2021). To prevent differences in vaccination reluctance, different communication tools are necessary within and between communities (Larson et al., 2015).

Furthermore, immigrants encounter hurdles to adequate access to health care services due to risk communication in culture, language, and economic conditions which inadvertently influenced their attitudes toward vaccination. In the context of vaccine risk communication, COVID-19 risk communication has varied widely (Warren and Lofstedt, 2021). Since globally immigrants were blamed for the coronavirus transmission, risk communication plays an important role in any risk management plan, particularly in light of the COVID-19 pandemic (Kerr et al., 2021; Thomas et al., 2021). Immigrants are unlikely to be well informed and tend not to access to health care enough leading to specific COVID-19 vaccination attitudes (Galanis et al., 2013). To date, there is no prior study on attitudes toward the COVID-19 vaccine among immigrants in South Korea. In this study, we analyze the attitude of immigrants toward the COVID-19 vaccination.

MATERIALS AND METHODS

Setting and Sampling

This was a cross-sectional study conducted among 463 immigrants in South Korea through an anonymous internet-based survey. The study was conducted between 25 January and 10 February 2021. A semi-structured questionnaire was designed with a google survey tool and disseminated publicly on the various social platforms (Facebook pages/groups for immigrants, LinkedIn) and was also shared personally (WhatsApp, Viber, Email, KakaoTalk) with the study population. The survey questionnaire was conducted in the English language. The majority of the participants (421) responded through social platforms. Immigrants over 18 years old, living in Korea for more than 1 year and who were able to provide consent were included in the study. The sample size was calculated by using the formula: $n = Z^2pq/d^2$ (Hasan et al., 2021).

n- desired sample size for the study

Z- the standard normal variate which corresponds to 95% confidence interval

p- proportion of the estimated population = 50%

q- 1-p = 0.5

d- precision = 0.05.

As there is no study available on attitude toward the COVID-19 vaccines in South Korea focusing on immigrants, with a proportion (p) of 50%, at a confidence interval of 95% and a 10% non-response rate, a sample size of 424 was estimated. Our sample size exceeded this estimate. In total, 468 participants participated in the study, but only 463 participants provided the consent for the study.

Measures

Sociodemographic Variables

Participants reported their sex, age, vaccination history, marital status (single/married), region (Asia/Europe/Africa/North & South America), residential area (capital/non-capital), and living type (alone/with family), education status (college/ university level) and income (<3000$/ > 3000$).

Attitude Assessment Toward COVID-19 Vaccination

The attitude section consisted of validated three-items (Hogan et al., 2020; Bhartiya et al., 2021; Islam et al., 2021; Seale et al., 2021; Verger et al., 2021) (e.g., *The COVID-19 vaccines are safe; I will get the COVID-19 vaccine without any hesitation*) and the response of each item was indicated on a three-point scale (*0 = Disagree, 1 = Probably,* and *2 = Agree*). The scores obtained from all three questions per respondent were added to obtain the attitude score (Cronbach's alpha: 0.76, range: 0–6). For the purpose of logistic regression, we further categorized the attitude scores based on the median to interpret the "COVID-19 vaccine acceptance" as high acceptance (≥4) and low acceptance (<4).

Data Collection and Statistical Analysis

The data were collected online due to the strict social distancing measures in effect at that time. The data were analyzed using IBM SPSS 23.0. Descriptive statistical analysis (means, standard deviations) was performed for basic information of immigrants and attitude responses. ANOVA test was performed to determine significant relations of the mean attitudes scores with socio-demographic information. Finally, logistic regression was used to investigate the factors associated with COVID-19 vaccine acceptance among immigrants categorized into low and high acceptance levels based on attitude scores. All statistical tests were considered significant at a 95% confidence interval with a *P*-value < 0.05. Ethical consideration was taken from the ethical review board of Inje University. Participants received electronic informed consent to complete the online questionnaire which appeared on the first page of the survey.

RESULTS

Among the 463 immigrants, most were above 25 years (81.6%), male (67.8%) and married (61.3%). Majorities of the immigrant (74.7%) were from Asian countries. More than half of the immigrants were living alone (55.9%) and had college or below levels of education (58.7%). The vast majority of participants (90.5%) reported they received all other recommended vaccines in their lifetime (e.g., measles vaccine) (**Table 1**).

The mean score of attitudes toward the COVID-19 vaccines was 4.17 ± 1.73 on a scale of 0–6. About a third (36.7%) of participants indicated that a vaccine developed during an epidemic/pandemic situation could not be considered guaranteed and reported that the COVID-19 vaccines are safe. Meanwhile, 7.8% disagreed with the statement that the COVID-19 vaccines are safe. More than half of the immigrants (55.3%) agree to be vaccinated with the COVID-19 vaccine without any hesitation whereas 64.8% of immigrants mentioned that they will surely recommend the COVID-19 vaccination to their family and friends (**Table 1**). The mean score of attitudes was significantly higher among immigrants who reported being not married (**Table 2**). Of the sampled population, 72.6% (n = 336) showed high acceptance and 27.4% (n = 127) low acceptance toward the COVID-19 vaccines. The Immigrants who agreed to the statement "vaccine developed during an epidemic/pandemic situation could not be considered guaranteed" were 1.7 times (95% CI: 1.084–2.673) more likely to get COVID-19 vaccination (**Table 3**).

TABLE 1 | General characteristic of participants and distribution of each attitude items.

Variables	Frequency (%) (n = 463)		
Age (years)			
18–25	85 (18.4)		
>25	378 (81.6)		
Gender			
Male	314 (67.8)		
Female	149 (32.2)		
Education			
College or below	272 (58.7)		
University or above	191 (41.3)		
Family type			
Alone	259 (55.9)		
Family	204 (44.1)		
Residence			
Capital	221 (47.7)		
Non-capital	242 (52.3)		
Income			
<3000$	346 (81)		
>3000$	88 (19)		
Marital status			
Single	179 (38.7)		
Married	284 (61.3)		
Region			
Asia	346 (74.7)		
Europe & Australia	37 (8)		
North America	14 (3)		
South America	38 (8.2)		
Africa	28 (6)		
Vaccination history (received all necessary vaccines in your life?)			
Yes	419 (90.5)		
No	44 (9.5)		
Vaccine developed during an epidemic/pandemic could not be considered guaranteed			
Agree	170 (36.7)		
Disagree	293 (63.3)		
Attitude questions	**Agree**	**Probably**	**Disagree**
COVID-19 Vaccines are safe	170 (36.7)	257 (55.5)	36 (7.8)
I will take the COVID-19 vaccine without any hesitation	256 (55.3)	123 (26.6)	84 (18.1)
I will recommend to my family/friends/relatives to get vaccinated	300 (64.8)	99 (21.4)	64 (13.8)

DISCUSSION

Understanding the epidemiological aspects of disease control, as well as the efficacy and progress of the vaccination program, demands an understanding of the local population's attitudes and practices toward the COVID-19 vaccines. Our study aims to highlight the attitude regarding the COVID-19 vaccines, and also the predictors of vaccine acceptance among immigrants in South Korea.

TABLE 2 | Group difference analysis with attitudes toward COVID-19 vaccination.

Variables	Attitudes toward the COVID-19 vaccine		
	Mean (S.D)	*t/F*	*P-value*
Age (years)			
18–25	4.18 (1.79)	0.01	0.973
>25	4.17 (1.71)		
Gender			
Male	4.25 (1.67)	1.97	0.161
Female	4.01 (1.82)		
Education			
College or below	4.07 (1.79)	2.24	0.135
University or above	4.31 (1.63)		
Family type			
Alone	4.15 (1.77)	0.51	0.821
Family	4.19 (1.68)		
Residence			
Capital	4.17 (1.64)	0.01	0.988
Non-capital	4.17 (1.80)		
Income			
<3000$	4.15 (1.74)	0.29	0.585
>3000$	4.26 (1.68)		
Marital status			
Single	4.37 (1.57)	4.06	**0.044***
Married	4.04 (1.81)		
Region			
Asia	4.20 (1.69)	1.12	0.344
Europe & Australia	4.22 (1.91)		
North America	3.21 (2.25)		
South America	4.26 (1.78)		
Africa	4.14 (1.53)		
Vaccination history (received all necessary vaccines in your life?)			
Yes	4.17 (1.75)	0.02	0.964
No	4.18 (1.46)		

**Statistically significant at $p < 0.05$.*

TABLE 3 | Logistic regression analysis with low and high acceptance toward COVID-19 vaccine.

Factors	COVID-19 vaccine acceptance[a]				
	Low	*High*	*B*	*P-value*	*OR (95% CI)*
Gender (ref: female)					
Male	85 (27.1)	229 (72.9)	0.044	0.847	1.045(0.667–1.638)
Female	42 (28.2)	107 (71.8)			
Age (ref: > 25 years)					
18–25	21 (24.7)	64 (75.3)	0.096	0.747	1.100(0.616–1.966)
>25	106 (28)	272 (72)			
Residence (ref: non-capital)					
Capital	61 (27.6)	160 (72.4)	−0.055	0.800	0.947(0.621–1.444)
Non-capital	66 (27.3)	176 (72.7)			
Marital status (ref: married)					
Single	40 (22.3)	139 (77.7)	0.377	0.120	1.457(0.907–2.342)
Married	87 (30.6)	197 (69.4)			
Living type (ref: with family)					
Alone	74 (28.6)	185 (71.4)	−0.254	0.245	0.776(0.506–1.190)
With family	53 (26)	151 (74)			
Education (ref: university or above)					
College or below	82 (30.1)	190 (69.9)	−0.289	0.211	0.749(0.476–1.178)
University or above	45 (23.6)	146 (76.4)			
Income (ref: 3000$)					
<3000$	105 (28)	270 (72)	−0.059	0.838	0.943(0.538–1.652)
>3000$	22 (25)	66 (75)			
Vaccination history (received all necessary vaccines in your life?) (ref: no)					
Yes	115 (27.4)	304 (72.6)	−0.039	0.914	0.961(0.472–1.961)
No	12 (27.3)	32 (72.7)			
Vaccine developed during an epidemic/pandemic could not be considered guaranteed (ref: disagree)					
Agree	36 (21.2)	134 (78.8)	0.532	**0.021***	1.702(1.084–2.673)
Disagree	91 (31.1)	202 (68.9)			

**Statistically significant at $P < 0.05$.*

[a]High acceptance indicates surely get vaccinated and will surely recommend vaccinations to family and friends; low acceptance indicates maybe self-vaccinate and probably/maybe recommend the vaccine to family and friends.

Our study shows more than half of the study participants (55.3%) were willing to take the COVID-19 vaccines. In comparison, a survey from China reveals only about 28.7% reported a definite intention (Lin et al., 2020). A study showed a higher COVID-19 vaccine intention in Malaysia (94.3%) (Wong et al., 2020) of which 48.2% reported a definite intention, Indonesia (67%) (Harapan et al., 2020) and Japan (67.1%) (Machida et al., 2021). Also, an online survey also found a higher vaccine intention in France (74%) (COCONEL Group, 2020), United States (74.1%) (Hogan et al., 2020) and Europe (73%) (Neumann-Böhme et al., 2020).

According to a global survey of 19 nations, 71.5% of the participants said they would get the COVID-19 vaccine if available (Lazarus et al., 2021) which is higher than the results of our analysis. This may be attributed to cultural differences between South Korea and the rest of the world (Lee et al., 2021). Vaccine acceptance may need to be improved further, as high vaccination coverage is needed to combat epidemics (Machida et al., 2021). Vaccine reluctance among not only the general public but also medical practitioners has become a concern in recent years. Vaccine reluctance varies by time, location, and vaccine type, and is affected by a range of factors (Caserotti et al., 1982; Machida et al., 2021; Verger et al., 2021). Therefore, to arrange promotional activities to improve vaccine acceptance, it is vital to ascertain vaccine acceptance of the COVID-19 vaccines and the factors that influence it in each location.

A range of reports has shown that up to 40% of the general population had unfavorable views about potential COVID-19 vaccines (Bhartiya et al., 2021; Lake et al., 2021; Verger et al., 2021). One of the principal factors behind these attitudes seems to be a concern that the new vaccines will not be safe (Lin et al., 2020; Verger et al., 2021). In this study period almost three-quarters of the respondents (72.6%) reported high acceptance of the COVID-19 vaccine which is considerably higher than the European study (48.6%) (Verger et al., 2021). In our work, the perception that vaccines developed in an emergency cannot be guaranteed safe appeared to be significantly associated with the acceptance of COVID-19 vaccines (Verger et al., 2021). The key factor found to be consistent with COVID-19 vaccination acceptance was the vaccine's safety and effectiveness, which has

also been documented in other research related to the new vaccine. The observed result indicates that these outcomes are reliable and, most importantly, that they encompass contextual cultural, educational, and social factors (Caserotti et al., 1982; Islam et al., 2021; Machida et al., 2021; Verger et al., 2021).

Even in well-established vaccination systems, vaccine reluctance remains a major obstacle to population vaccination. There may also be specific vaccine factors or misinformation that make a vaccine more or less acceptable to certain groups (Lazarus et al., 2021). Before and during vaccine rollout, practical ways to eliminate vaccination barriers in immigrant populations must be implemented, including effective communication and supervision. Cultural considerations, differing understanding and attitudes about disease causes, and healthcare access issues are all hurdles to vaccination faced by immigrant populations (Thomas et al., 2021). In the following periods, it is essential to regularly monitor the attitudes and practices of all specific groups of the community toward the COVID-19 vaccines. COVID-19 vaccines should be prioritized for disadvantaged populations due to the strong demand (COCONEL Group, 2020; Lazarus et al., 2021).

LIMITATIONS

There are certain drawbacks to this research. Since it was a cross-sectional study, so the causality cannot be attributed to the findings in the regression models. This was a web-based analysis with the potential for bias. The findings of our study demonstrate immigrants' attitudes toward the COVID-19 vaccine. This result might be different in the general population.

CONCLUSION

Interventional programs targeting vulnerable populations with a higher risk of vaccine reluctance are most crucial to minimize the poor vaccination rates. Nevertheless, this is the first-ever study of immigrant's perspectives about the COVID-19 vaccination in South Korea which will be very crucial for health policymakers and government to address proper vaccination among the vulnerable and neglected group of communities to mitigate the impacts of the pandemic. Adequate knowledge, positive attitudes and perceptions toward COVID-19 vaccination should be ensured to reduce vaccine hesitancy. Regular monitoring of the vaccination program and vaccination risk communication strategies are essential to ensure trust in COVID-19 vaccines. Furthermore, to minimize vaccine reluctance, a variety of vaccination methods targeting COVID-19 vaccine risk communication should be implemented adequately.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board of Inje University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

SA interpreted the study data, analysis, and manuscript writing. YS and DM performed research concept and literature discussion. All authors contributed to the article and approved the submitted version.

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Mental Health of Nursing Students amid Coronavirus Disease 2019 Pandemic

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The coronavirus disease 2019 (COVID-19) pandemic is a global disaster, and recent studies have shown its association with increasing mental health problems such as post-traumatic stress disorder (PTSD), depression, anxiety, and stress. Nursing students, especially nursing interns, may be shunned, harassed, and even blamed as potential COVID-19 spreaders, though they were an important reserve force against COVID-19 and other diseases. Of note, the psychological influences of COVID-19 on nursing students remained unclear. The aim of this study was to evaluate the mental health of nursing students during the COVID-19 pandemic. A cross-sectional online survey was conducted on nursing students in a vocational college from April 12 to 23, 2020. The Impact of Event Scale–Revised, 21-item Depression, Anxiety and Stress Scale, and Pittsburgh Sleep Quality Index were used to assess the degree of symptoms of PTSD, depression, anxiety, stress, and insomnia, respectively. Multivariable logistic regression analysis was performed to determine the potential risk factors for the psychological symptoms. A total of 1,780 college nursing students were asked to participate in this online survey, with 1,532 complete responses. In total, 682 (44.5%) college nursing students reported having PTSD, 358 (22.8%) students reported insomnia, and few students reported depression ($n = 45$, 2.9%), anxiety ($n = 44$, 2.9%), and stress ($n = 17$, 1.1%) symptoms. As compared with junior, female, and rural nursing students, the senior, male, and urban nursing students had higher rates of PTSD, depression, anxiety, stress, respectively, whereas male nursing students had a higher insomnia rate. Multivariable analysis showed that senior nursing students had higher risks of PTSD, depression, anxiety; being male was associated with higher risks of PTSD, depression, anxiety, stress, and insomnia; and urban nursing students had higher risks of PTSD, depression, anxiety, and stress. In summary, a considerable number of nursing students reported mental symptoms of PTSD and insomnia, though few reported mental symptoms of depression, anxiety, and stress. Furthermore, senior, male, and urban nursing students are at risk for developing mental symptoms. Appropriate psychological interventions should be implemented to assure the mental health of nursing students.

Keywords: mental health, PTSD, depression, anxiety, stress, nursing students, COVID-19

INTRODUCTION

The coronavirus disease 2019 (COVID-19) was first identified in Wuhan, China on December 8, 2019, and it has rapidly spread all over the world (Pan et al., 2020). This pandemic has been a global disaster, greatly influencing social lives, economics, mental conditions, and health security, and it seemed that there was no end to this disaster (Firth et al., 2020; Pfefferbaum and North, 2020). As of June 4, 2021 (the moment of writing), WHO reported 171,782,908 confirmed cases of COVID-19 globally, with 3,698,621 deaths (World Health Organization, 2021).

To limit the spread of this outbreak, a series of important and effective public-health measures were implemented in China and in many other countries, such as mass vaccination, lockdowns, maintaining social distancing, wearing masks, hand hygiene, population surveillance, abundant COVID-19 tests, rigorous contacts tracing, mandatory quarantine for confirmed or suspected cases with COVID-19 infection and their close contacts, and the building of makeshift hospitals (Budd et al., 2020; Firth et al., 2020; Pan et al., 2020; Ruktanonchai et al., 2020). Despite the initiation of these public-health measures, cases continued to rise. Many infected patients had returned to China from other countries, and imported infections as well as asymptomatic cases were the main challenges in China (Chen et al., 2020). In order to curb the spread of COVID-19, Chinese students had experienced prolonged school suspensions and subsequent online education at home.

During the initial stage of the COVID-19 epidemic, the results of a survey conducted among the general population in China had shown that more than half of the respondents (53.8%) rated the psychological impact of the COVID-19 epidemic as moderate to severe (Wang X. et al., 2020). With the increasing mental health burden amid the COVID-19 pandemic, it became crucial and necessary to enhance mental health assessments and support so as to maintain public mental health, and the Chinese National Health Commission has issued guidelines for emergency psychological crisis intervention and established psychological assistance hotlines (Lai et al., 2020; Wang Y. et al., 2020). Many mental healthcare workers have been bravely and voluntarily involved in providing frontline or online psychological care (e.g., WeChat, TikTok, Weibo, and hotlines) to patients with COVID-19 as well as to the general population (Wang Y. et al., 2020). These mental health services might improve the mental resilience and reduce the incidence of psychological diseases. However, several people have not requested for mental health assistance due to the fear of discrimination and stigmatization, despite having severe psychological symptoms (Lyndon et al., 2019; Javed et al., 2021).

Healthcare workers, including nurses, played very important roles in fighting the COVID-19 pandemic and have made invaluable contributions. Many nurses were brave and heroic, working at the frontlines to treat patients with COVID-19 pneumonia despite the very high risk of infection (Hartmann et al., 2020; Hughes et al., 2020). Recent studies have shown that healthcare workers such as frontline nurses, especially women, experienced a large psychological burden which manifested as symptoms of post-traumatic stress disorder (PTSD), depression, anxiety, and insomnia (Lai et al., 2020).

Some studies had shown that the psychological consequences of the COVID-19 epidemic on college students could be serious. Chinese college students suffered from symptoms of PTSD, stress, anxiety, and depression in the early stage of the COVID-19 pandemic (Li H. Y. et al., 2020; Tang et al., 2020; Zhang et al., 2020). In addition, medical students may suffer from more stress than non-medical students following the COVID-19 outbreak (Ye et al., 2020).

Nursing students are a new and important reserve force against COVID-19 and other diseases. In China, nursing students in general are required to receive 3–5 years of a college education. They also need to undergo clinical training as interns in the hospital during their previous year. Later, some nursing students continue further studies, whereas most nursing students begin working as formal clinical nurses after graduation.

At the early beginning of the COVID-19 epidemic, though WHO was informed of a cluster of pneumonia of unknown cause in Wuhan city on December 31, 2019 (World Health Organization, 2020), much remained unknown except for patients with COVID-19 were infected by direct exposure at the seafood market (The Lancet, 2020b), and Chinese nursing students were still learning at schools or hospitals during this period. On January 20, 2020, the eminent SARS specialist Zhong Nanshan announced that 14 medical workers had been infected by one virus carrier and confirmed that COVID-19 could spread from human to human (Nature, 2020). Also on January 20, the Chinese president and government announced the COVID-19 outbreak and it should be resolutely contained (Nature, 2020). At this time, most junior nursing students had been back home to celebrate Chinese New Year, but nursing seniors (interns) still remained in their clinical training in the hospital. Massive actions including all sectors from business to factories and to schools were taken the next day to curb the COVID-19 epidemic (Chen and Yu, 2020). As of January 23, 2020, a total of 835 confirmed cases (549 from Hubei Province and 286 in 32 provinces, municipalities, and special administrative regions in China) were detected; in order to contain the COVID-19 spread, Wuhan City was locked down, and soon followed by many other areas in China (The Lancet, 2020b; Wang et al., 2020a,b). Of note, as cases increased, medical workers were recognized as a high-risk group to acquire the COVID-19 infection. As of February 11, 2020, a total of 72,314 COVID-19 cases were reported in mainland China, with 3,019 medical workers (1,716 were confirmed) (Epidemiology Working Group for NCIP Epidemic Response Chinese Center for Disease Control Prevention, 2020). Since senior nursing students needed to work as interns in the hospital before Spring Festival, they were considered as medical workers by the general population. The public, including friends and relatives, had a fear of getting COVID-19 infection, so as to the medical workers such as nurses even nursing students were shunned, harassed, and even blamed as potential COVID-19 spreaders by some people (Bagcchi, 2020; Koh, 2020; Abdulah et al., 2021). Besides, the nursing students who worked in the hospital were also anxious about the chance of getting the COVID-19 infection and passing the infection to their families

(The Lancet, 2020a). Nursing students experienced extreme psychological stress and a range of feelings such as excitement, doubt, and helplessness after the COVID-19 outbreak (Huang et al., 2020).

To date, it is still unclear whether the COVID-19 pandemic and the subsequent quarantine and online education could give rise to mental health symptoms among college nursing students. According to the official website, from April 12 to 23, 2020, there were 1,273 COVID-19-confirmed patients in the Henan Province (with no new increases), and confirmed cases in China increased from 83,597 to 84,303 (moving into mitigation stage), whereas confirmed cases all over the world rapidly increased from 1,713,517 to 2,548,755 (World Health Organization, 2021). During this period, we conducted a survey that focused on the mental health (including symptoms of PTSD, depression, anxiety, stress, and insomnia) among nursing students studying in Henan Technical Institute, a comprehensive vocational college with a 3-year nursing college education with almost 2,200 nursing students located in Zhengzhou, Henan Province, China, in order to provide evidence for the formation of specific and effective mental health interventions for nursing students.

MATERIALS AND METHODS

Study Design and Participants

A cross-sectional online survey regarding the mental health of college nursing students was conducted from April 12 to 23, 2020 according to the principles of the Declaration of Helsinki. Most nursing students ($n = 1{,}780$) in Henan Technical Institute were asked to voluntarily participate in this study by their teachers via QQ groups (a widely used instant messaging and social platform, Tencent Inc., Shenzhen, China), and all the participants were informed that they had the right to terminate their participation in the study anytime they desired. All these students received online education at home in order to avoid infection with COVID-19, hence the survey was completed *via* an online platform (SurveyStar, a professional online survey, examination, and voting platform, Changsha Ranxing Information Technology Co., LTD, Shanghai, China), especially WeChat/Weixin (a widely used communication and social platform in China, Tencent Inc., Shenzhen, China), using a cellphone or computer. The questions of this survey could be revisited and answered using the same WeChat account, but they could not be corrected or answered again once these were submitted. Students who responded were divided into two groups according to their year level: 1,135 were junior nursing students (grades 1 and 2) and 397 were senior nursing interns (grade 3).

Participation in this study was anonymous and the personal information of participants was kept confidential. This study protocol was approved by the Ethics Committee of Henan Technical Institute.

Measurements

The mental health conditions of nursing students amid the COVID-19 pandemic were evaluated through an online structured questionnaire. The 22-item Impact of Event Scale–Revised (IES-R) (Christianson and Marren, 2012), 21-item Depression, Anxiety, and Stress Scale (DASS-21) (Lovibond and Lovibond, 1995; Henry and Crawford, 2005), and Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989) were used to assess the symptoms of PTSD, depression, anxiety, stress, and insomnia among college nursing students, respectively. IES-R included intrusion (items of IES-R 1, 2, 3, 6, 9, 14, 16, 20), avoidance (items 5, 7, 8, 11, 12, 13, 17, 22), and hyperarousal (items 4, 10, 15, 18, 19, 21) subscales, with five choices including not at all (score 0), a little bit (score 1), moderately (score 2), quite a bit (score 3), and extremely (score 4). The severity of PTSD symptoms was evaluated by the sum of the intrusion and avoidance subscales (Christianson and Marren, 2012). The DASS-21 included depression (items of DASS 3, 5, 10, 13, 16, 17, 21), anxiety (items 2, 4, 7, 9, 15, 19, 20), and stress (items 6, 8, 11, 12, 14, 18) subscales, with four responses including do not apply to me at all (score 0), apply to me to some degree or some of the time (score 1), apply to me a considerable degree or a good part of the time (score 2), and apply to me very much or most of the time (score 3). The final score of each subscale was equal to the sum of its items and then multiplied by two, as the DASS-21 was a short form version of the 42-item DASS (Lovibond and Lovibond, 1995; Henry and Crawford, 2005). The PSQI evaluated seven components of sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction. The score ranged from 0 to 3 for each component, and the PSQI score was equal to the sum of the seven component scores (Buysse et al., 1989). The detailed questions and scoring methods are shown in **Supplementary Material**. The scales above have been shown to have excellent reliability and validity in previous studies (Yohannes et al., 2019; Chew et al., 2020; Lai et al., 2020; Xiao et al., 2020).

The scores of the above scales were graded as follows: scores on the IES-R (sum of intrusion and avoidance subscale scores) were classified as normal (0–8), mild (9–25), moderate (26–43), and severe (44–64) PTSD (Christianson and Marren, 2012; Lai et al., 2020). For the DASS-21 depression subscales, participants were classified as being normal (0–9) or having mild (10–13), moderate (14–20), severe (21–27), or extremely severe (28–42) depression. For the DASS-21 anxiety subscale, classifications included normal (0–7), mild (8–9), moderate (10–14), severe (15–19), and extremely severe (20–42) anxiety. For the DASS-21 stress subscale, classifications included normal (0–14), mild (15–18), moderate (19–25), severe (26–33), and extremely severe (34–42) stress (Lovibond and Lovibond, 1995; Henry and Crawford, 2005; Yohannes et al., 2019; Chew et al., 2020). Finally, the PSQI included categories such as normal (0–5), mild (6–10), moderate (11–15), and severe (16–21) insomnia (Buysse et al., 1989; Xiao et al., 2020).

In addition, the educational and living conditions of nursing students during the COVID-19 pandemic were also inquired about in this survey. There were three questions related to their education: (1) attitude toward online education, with four responses including very satisfactory, satisfactory, average, or unsatisfactory; (2) mental states during online learning, with three responses including better, as usual, or worse; and (3) attitude toward going back to school, with two responses including expected and not expected. There were five questions

related to their living conditions: (1) family economic income (higher, as usual, or lower); (2) body weight (increased, unchanged, or decreased); (3) quality of life (good, average, or bad); (4) attention to COVID-19 (always, usually, sometimes, or almost never); and (5) attitude toward being a frontline nurse (sure, maybe, maybe not, or impossible).

Covariates

Demographic data such as gender (male or female), educational status (junior or senior), and place of residence (urban or rural) were collected in the survey. The COVID-19 status of the nursing students and their families was also investigated.

Statistical Methods

All statistical tests were performed using SPSS software (version 22.0, SPSS, IBM Corporation, Armonk, New York). Scores of measurement scales had a skewed distribution, and these were presented as medians and interquartile ranges (IQR). A non-parametric Mann–Whitney *U*-test was used to compare the differences between the two groups. Categorical variables, such as the severity classifications of PTSD, depression, anxiety, stress, and insomnia symptoms, were presented as numbers and percentages, and group differences were assessed using the Mann–Whitney *U*-test of ranked data.

Multivariable logistic regression analysis was applied to evaluate the influences of educational status, gender, and location on PTSD, depression, anxiety, stress, and insomnia symptoms, and their associations were demonstrated as OR with a 95% CI.

A $P < 0.05$ was considered significant, and all tests were two-tailed.

RESULTS

Demographic Characteristics

In this study, a total of 1,780 college nursing students were asked to fulfill the online survey (the count included QQ groups of teachers who asked their students and sent the link to the survey), and we received 1,532 complete responses, with a response rate of 86.1%. Among these 1,532 nursing students, the average age was 19.95 (SD, 1.24) years, 397 (25.9%) were senior interns, 1,135 (74.1%) were juniors, 666 (43.5%) came from an urban area, 866 (56.5%) came from a rural area, and 1,400 (91.4%) lived in the Henan Province. The majority of respondents were females ($n =$ 1,351, 88.2%), with 181 (11.8%) males. There were no confirmed or suspected COVID-19 infected cases in this research according to self-reports and official data from the school.

The Educational and Living Conditions Influenced by COVID-19

Table 1 presents the educational and living conditions of respondents. As for educational condition, many college nursing students were satisfied with their current online education (satisfactory, $n = 1{,}036$, 67.6%; very satisfactory, $n = 234$, 15.3%). However, only 164 (10.7%) respondents reported having better mental states during online learning, whereas many students ($n = 883$, 57.6%) reported worsening mental states and 1,359 (88.7%) students expected to go back to school. As for their living condition, 1,261 (82.3%) suffered a loss in their family income, 265 (17.3%) reported the same economic income as usual, and only 6 (0.4%) reported a higher economic income. Surprisingly, only 52 (3.4%) students thought they had a poor quality of life. Furthermore, 675 (44.1%) students had gained weight. Of the 1,532 respondents, 696 (45.4%) reported that they usually paid attention to the COVID-19 pandemic, and 633 (41.3%) reported always paying close attention to COVID-19. Finally, an overwhelming majority of students had a positive attitude ($n = 1{,}504$, 98.2%) toward becoming frontline nurses against COVID-19 in the future.

On comparing junior and senior nursing students, senior nursing students (interns) reported having better mental states during the online learning period (worse, 51.9 vs. 59.6%, $P < 0.01$) but worse family economic incomes (lower, 86.6 vs. 80.8%, $P < 0.01$). They also paid more attention to COVID-19 (always and usually, 90.4 vs. 85.5%, $P < 0.01$) and were more willing to become frontline nurses against COVID-19 (sure, 73.8 vs. 66.1%, $P < 0.01$). When compared with female nursing students, male nursing students also reported paying more attention to COVID-19 (always and usually, 89.5 vs. 86.3%, $P < 0.01$) and being more willing toward becoming frontline nurses against COVID-19 (sure, 78.5 vs. 66.7%, $P < 0.01$). However, they reported worse mental states during the online learning period (worse, 65.2 vs. 56.6%, $P < 0.05$). There were no significant differences in changes in family economic income according to sex. With respect to the rate of nursing students who expected to go back to school, this was higher among males than females (95 vs. 87.9%, $P < 0.01$), but there was no significant difference between senior and junior nursing students. There were no significant differences between junior and senior nursing students in terms of their degree of satisfaction with online education, changes in body weight, and quality of life.

With regard to rural and urban nursing students, urban nursing students reported better family economic incomes (lower, 79.1 vs. 84.8%, $P < 0.01$) and they paid more attention to COVID-19 (always and usually, 88.6 vs. 85.3%, $P < 0.05$) as compared with rural nursing students; however, there were no significant differences in all other educational and living indexes.

Mental Health Outcomes

As shown in **Table 2**, the median (IQR) score of IES-R for PTSD was 7 (3–14), the median (IQR) scores of DASS-21 for depression, anxiety, and stress were 0 (0–2), 0 (0–2), and 1 (0–3), respectively, and the median (IQR) score of PSQI for insomnia was 3 (2–5). As shown in **Table 3** and **Figure 1**, a considerable number of college nursing students ($n = 682$, 44.5%) reported having symptoms of PTSD, few students reported symptoms of depression ($n = 45$, 2.9%), anxiety, ($n = 44$, 2.9%), and stress ($n = 17$, 1.1%), whereas the number of students with insomnia ($n = 358$, 22.8%) was also considerable. Among these students, only a few experienced symptoms of severe PTSD ($n = 5$, 0.3%), depression ($n = 2$, 0.1%), anxiety ($n = 3$, 0.2%), stress ($n = 1$, 0.1%), and insomnia ($n = 2$, 0.1%).

Moreover, the results of subgroup analysis indicated that as compared with juniors and female nursing students, senior interns and male nursing students reported higher scores of

TABLE 1 | Educational and living conditions of all and subgroup participants.

Variables	Total	Educational status				Gender				Location			
	N = 1,532	Junior *N* = 1,135	Senior *N* = 397	*Z*	*P*	Female *N* = 1,351	Male *N* = 181	*Z*	*P*	Rural *N* = 866	Urban *N* = 666	*Z*	*P*
Education													
Attitude toward online education				1.721	0.085			0.455	0.649			1.925	0.054
Very satisfactory	234 (15.3)	158 (13.9)	76 (19.1)			201 (14.9)	33 (18.2)			115 (13.3)	119 (17.9)		
Satisfactory	1,036 (67.6)	781 (68.8)	255 (64.2)			927 (68.6)	109 (60.2)			599 (69.2)	437 (65.6)		
Average	216 (14.1)	163 (14.4)	53 (13.4)			186 (13.8)	30 (16.6)			124 (14.3)	92 (13.8)		
Unsatisfactory	46 (3%)	33 (2.9)	13 (3.3)			37 (2.7)	9 (5.0)			28 (3.2)	18 (2.7)		
Mental states during online learning				2.797	0.005			2.453	0.014			0.911	0.362
Better	164 (10.7)	112 (9.9)	52 (13.1)			153 (11.3)	11 (6.1)			101 (11.7)	63 (9.5)		
As usual	485 (31.7)	346 (30.5)	139 (35.0)			433 (32.1)	52 (28.7)			272 (31.4)	213 (32.0)		
Worse	883 (57.6)	677 (59.6)	206 (51.9)			765 (56.6)	118 (65.2)			493 (56.9)	390 (58.6)		
Attitude toward going back to school				0.153	0.878			2.860	0.004			0.943	0.346
Expected	1,359 (88.7)	1,006 (88.6)	353 (88.9)			1,187 (87.9)	172 (95.0)			774 (89.4)	585 (87.8)		
Not expected	173 (11.3)	129 (11.4)	44 (11.1)			164 (12.1)	9 (5.0)			92 (10.6)	81 (12.2)		
Living													
Family economic incomes				2.635	0.008			1.562	0.118			2.858	0.004
Higher	6 (0.4)	5 (0.4)	1 (0.3)			2 (0.1)	4 (2.2)			3 (0.3)	3 (0.5)		
As usual	265 (17.3)	213 (18.8)	52 (13.1)			230 (17.0)	35 (19.3)			129 (14.9)	136 (20.4)		
Lower	1,261 (82.3)	917 (80.8)	344 (86.6)			1,119 (82.8)	142 (78.5)			734 (84.8)	527 (79.1)		
Body weight				0.296	0.767			0.953	0.341			0.665	0.506
Increased	675 (44.1)	501 (44.1)	174 (43.8)			590 (43.7)	85 (47.0)			383 (44.2)	292 (43.8)		
Unchanged	725 (47.3)	530 (46.7)	195 (49.1)			642 (47.5)	83 (45.9)			418 (48.3)	307 (46.1)		
Decreased	132 (8.6)	104 (9.2)	28 (7.1)			119 (8.8)	13 (7.2)			65 (7.5)	67 (10.1)		
Quality of life				1.497	0.134			0.952	0.341			0.873	0.382
Good	897 (58.6)	678 (59.7)	219 (55.2)			796 (58.9)	101 (55.8)			499 (57.6)	398 (59.8)		
Average	583 (38.1)	418 (36.8)	165 (41.6)			512 (37.9)	71 (39.2)			336 (38.8)	247 (37.1)		
Bad	52 (3.4)	39 (3.4)	13 (3.3)			43 (3.2)	9 (5.0)			31 (3.6)	21 (3.2)		
Attention to COVID-19				2.866	0.004			2.683	0.007			2.558	0.011
Always	633 (41.3)	449 (39.6)	184 (46.3)			541 (40.0)	92 (50.8)			336 (38.8)	297 (44.6)		
Usually	696 (45.4)	521 (45.9)	175 (44.1)			626 (46.3)	70 (38.7)			403 (46.5)	293 (44.0)		
Sometimes	202 (13.2)	164 (14.4)	38 (9.6)			183 (13.5)	19 (10.5)			126 (14.5)	76 (11.4)		
Almost never	1 (0.1)	1 (0.1)	0 (0.0)			1 (0.1)	0 (0.0)			1 (0.1)	0 (0.0)		
Attitude toward being frontline nurse				2.788	0.005			2.917	0.004			0.181	0.857
Sure	1,043 (68.1)	750 (66.1)	293 (73.8)			901 (66.7)	142 (78.5)			591 (68.2)	452 (67.9)		
May be	461 (30.1)	364 (32.1)	97 (24.4)			429 (31.8)	32 (17.7)			260 (30.0)	201 (30.2)		
May be not	24 (1.6)	18 (1.6)	6 (1.5)			18 (1.3)	6 (3.3)			12 (1.4)	12 (1.8)		
Impossible	4 (0.3)	3 (0.3)	1 (0.3)			3 (0.2)	1 (0.6)			3 (0.3)	1 (0.2)		

PTSD [senior 9 (3–15) vs. junior 7 (3–14), $P < 0.01$; male 11 (3–16) vs. female 7 (3–14), $P < 0.01$], depression [senior 1 (0–4) vs. junior 0 (0–2), $P < 0.01$; male 1 (0–5) vs. female 0 (0–2), $P < 0.01$], anxiety [senior 0 (0–3) vs. junior 0 (0–1), $P < 0.05$; male 0 (0–3) vs. female 0 (0–2), $P < 0.01$], and stress [senior 1 (0–5) vs. junior 0 (0–3), $P < 0.01$; male 1 (0–5) vs. female 0 (0–3), $P < 0.01$]. As compared with rural nursing students, urban nursing students also reported higher scores of PTSD [8 (3–15) vs. 7 (3–13), $P < 0.05$], anxiety [0 (0–2) vs. 0 (0–1), $P < 0.05$], stress [1 (0–4) vs. 0 (0–3), $P < 0.05$], and depression [0 (0–3) vs. rural 0 (0–2), $P = 0.072$]. Accordingly, as compared with junior, female, and rural nursing students, these senior, male, and urban nursing students had higher incidences of symptoms of PTSD (senior 50.9% vs. junior 42.3%, $P < 0.01$; male 54.7% vs. female 43.2%, $P < 0.01$; urban 48.9% vs. rural 41.1%, $P < 0.01$), depression (senior 5.5% vs. junior 2.0%, $P < 0.01$; male 6.1% vs. female 2.5%, $P < 0.01$; urban 4.2% vs. rural 2.0%, $P < 0.05$), anxiety (senior 5.5% vs. junior 1.9%, $P < 0.01$; male 6.6% vs. female 2.4%, $P < 0.01$; urban 4.1% vs. rural 2.0%, $P < 0.05$), and stress (senior 2.0% vs. junior 0.8%, $P < 0.05$; male 2.8% vs. female 0.9%, $P < 0.05$; urban 1.8% vs. rural 0.6%, $P < 0.05$). Furthermore, male nursing students had higher PSQI scores [3 (2–6) vs. 3 (2–5), $P < 0.05$] and rates of insomnia (31.5 vs. 23.3%, $P < 0.05$) when compared with female nursing

TABLE 2 | Scores of PTSD, depression, anxiety, stress, and insomnia.

Scales	Total	Educational status				Gender				Location			
	N = 1,532	Junior *N* = 1,135	Senior (interns) *N* = 397	*Z*	*P*	Female *N* = 1,351	Male *N* = 181	*Z*	*P*	Rural *N* = 866	Urban *N* = 666	*Z*	*P*
IES-R, PTSD	7 (3–14)	7 (3–14)	9 (3–15)	2.714	0.007	7 (3–14)	11 (3–16)	2.830	0.005	7 (3–13)	8 (3–15)	2.512	0.012
DASS, depression	0 (0–2)	0 (0–2)	1 (0–4)	4.151	<0.001	0 (0–2)	1 (0–5)	3.358	0.001	0 (0–2)	0 (0–3)	1.798	0.072
DASS, anxiety	0 (0–2)	0 (0–1)	0 (0–3)	2.591	0.010	0 (0–2)	0 (0–3)	3.613	<0.001	0 (0–1)	0 (0–2)	2.412	0.016
DASS, stress	1 (0–3)	0 (0–3)	1 (0–5)	2.871	0.004	0 (0–3)	1 (0–5)	3.350	0.001	0 (0–3)	1 (0–4)	2.102	0.036
PSQI, insomnia	3 (2–5)	3 (2–5)	3 (2–6)	0.553	0.581	3 (2–5)	3 (2–6)	2.050	0.040	3 (2–5)	3 (2–6)	1.402	0.161

PTSD, post-traumatic stress disorder; IES-R, impact of event scale–revised; DASS, depression, anxiety, and stress scale; PSQI, Pittsburgh sleep quality index.

TABLE 3 | Severity Classifications of PTSD, depression, anxiety, stress, and insomnia symptoms.

Variables	Total *N* = 1,532	Educational status		*Z*	*P*	Gender		*Z*	*P*	Location		*Z*	*P*
		Junior *N* = 1,135	Senior *N* = 397			Female *N* = 1,351	Male *N* = 181			Rural *N* = 866	Urban *N* = 666		
IES-R, PTSD				3.318	0.001			2.994	0.003			3.122	0.002
Normal	850 (55.5)	655 (57.7)	195 (49.1)			768 (56.8)	82 (45.3)			510 (58.9)	340 (51.1)		
Mild	636 (41.5)	455 (40.1)	181 (45.6)			545 (40.3)	91 (50.3)			334 (38.6)	302 (45.3)		
Moderate	41 (2.7)	24 (2.1)	17 (4.3)			34 (2.5)	7 (3.9)			21 (2.4)	20 (3.0)		
Severe	5 (0.3)	1 (0.1)	4 (1.0)			4 (0.3)	1 (0.6)			1 (0.1)	4 (0.6)		
DASS, depression				3.561	<0.001			2.651	0.008			2.577	0.010
Normal	1,487 (97.1)	1,112 (98.0)	375 (94.5)			1,317 (97.5)	170 (93.9)			849 (98.0)	638 (95.8)		
Mild	24 (1.6)	11 (1.0)	13 (3.3)			17 (1.3)	7 (3.9)			9 (1.0)	15 (2.3)		
Moderate	19 (1.2)	12 (1.1)	7 (1.8)			16 (1.2)	3 (1.7)			8 (0.9)	11 (1.7)		
Severe	2 (0.1)	0 (0.0)	2 (0.5)			1 (0.1)	1 (0.6)			0 (0.0)	2 (0.3)		
DASS, anxiety				3.719	<0.001			3.224	0.001			2.448	0.014
Normal	1,488 (97.1)	1,113 (98.1)	375 (94.5)			1,319 (97.6)	169 (93.4)			849 (98.0)	639 (95.9)		
Mild	26 (1.7)	15 (1.3)	11 (2.8)			19 (1.4)	7 (3.9)			12 (1.4)	14 (2.1)		
Moderate	15 (1.0)	6 (0.5)	9 (2.3)			11 (0.8)	4 (2.2)			5 (0.6)	10 (1.5)		
Severe	3 (0.2)	1 (0.1)	2 (0.5)			2 (0.1)	1 (0.6)			0 (0.0)	3 (0.5)		
DASS, stress				2.007	0.045			2.268	0.023			2.274	0.023
Normal	1,515 (98.9)	1,126 (99.2)	389 (98.0)			1,339 (99.1)	176 (97.2)			861 (99.4)	654 (98.2)		
Mild	13 (0.8)	8 (0.7)	5 (1.3)			10 (0.7)	3 (1.7)			5 (0.6)	8 (1.2)		
Moderate	3 (0.2)	1 (0.1)	2 (0.5)			2 (0.1)	1 (0.6)			0 (0.0)	3 (0.5)		
Severe	1 (0.1)	0 (0.0)	1 (0.3)			0 (0.0)	1 (0.6)			0 (0.0)	1 (0.2)		
PSQI, insomnia				1.222	0.222			2.614	0.009			1.482	0.138
Normal	1,160 (75.7)	868 (76.5)	292 (73.6)			1,036 (76.7)	124 (68.5)			668 (77.1)	492 (73.9)		
Mild	332 (21.7)	240 (21.1)	92 (23.2)			286 (21.2)	46 (25.4)			177 (20.4)	155 (23.3)		
Moderate	38 (2.5)	26 (2.3)	12 (3.0)			27 (2.0)	11 (6.1)			21 (2.4)	17 (2.6)		
Severe	2 (0.1)	1 (0.1)	1 (0.3)			2 (0.1)	0 (0.0)			0 (0.0)	2 (0.3)		

PTSD, post-traumatic stress disorder; IES-R, impact of event scale–revised; DASS, depression, anxiety, and stress scale; PSQI, Pittsburgh sleep quality index.

students. The detailed mental health outcomes are also shown in **Tables 2**, **3**.

Risk Factors for Mental Health of Nursing Students

The results of multivariable logistic regression analysis are presented in **Table 4**. As compared with junior nursing students, senior nursing students (interns) had a higher risk of PTSD (OR = 1.406; 95% CI, 1.116–1.771; $P = 0.004$), depression (OR = 2.790; 95% CI, 1.529–5.093; $P = 0.001$), and anxiety (OR = 2.950; 95% CI, 1.604–5.425; $P < 0.001$). As compared with female nursing students, male nursing students had higher risks of PTSD (OR = 1.631; 95% CI, 1.192–2.233; $P = 0.002$), depression (OR = 2.676; 95% CI, 1.318–5.431; $P = 0.006$), anxiety (OR = 3.144; 95% CI, 1.572–6.286; $P = 0.001$), stress (OR = 3.352; 95% CI, 1.158–9.702; $P = 0.026$), and insomnia (OR = 1.478; 95%

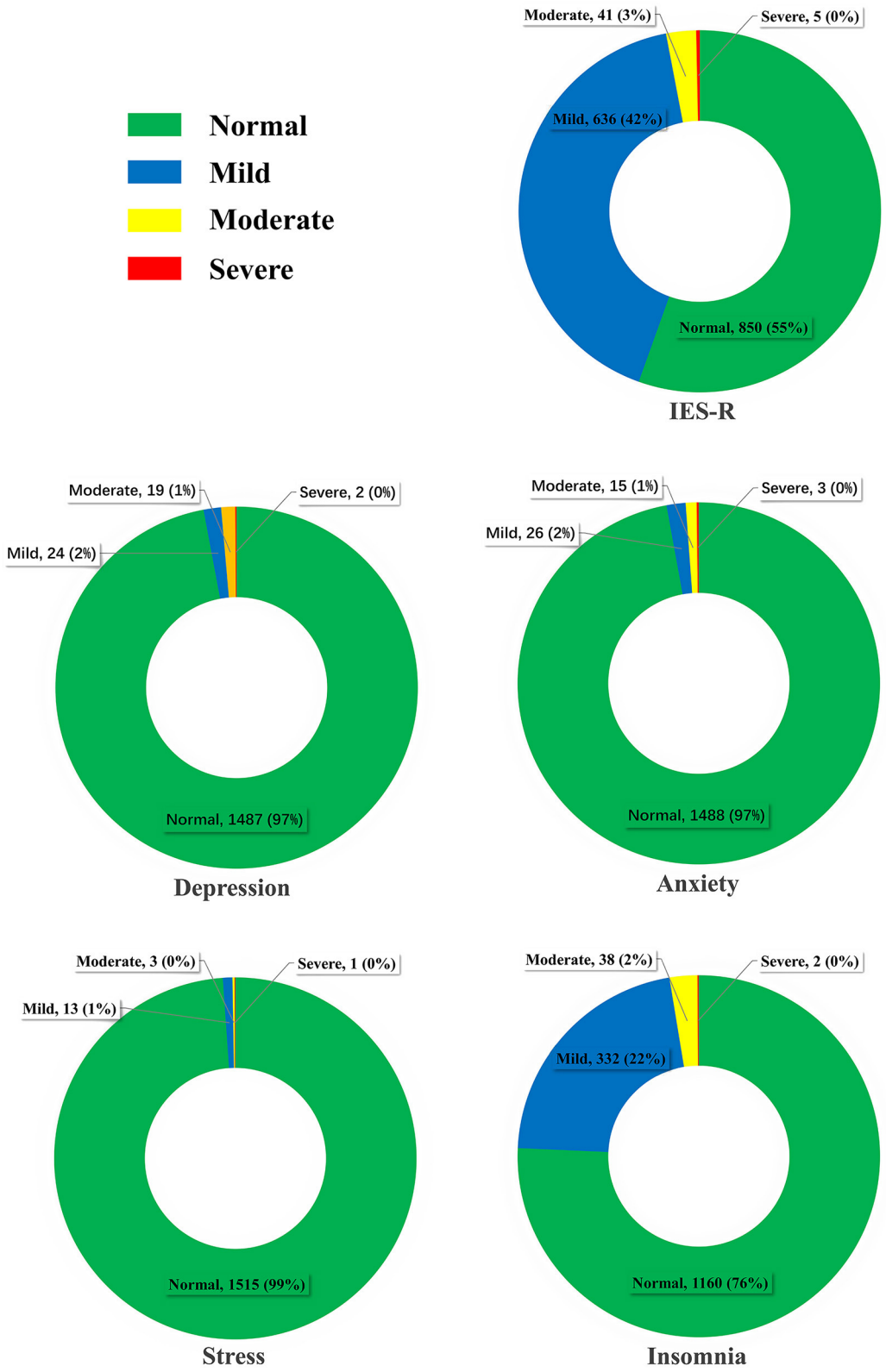

FIGURE 1 | Severity classifications of post-traumatic stress disorder, depression, anxiety, stress, and insomnia in nursing students.

TABLE 4 | Logistic regression analysis for PTSD, depression, anxiety, stress, and insomnia risk factors.

Variables	Abnormal/total cases (%)	Goodness of fit	B	SE	Wald	*P*	OR	95% CI
IES-R, PTSD	682/1,532 (44.5)	0.916						
Educational status								
Junior [reference]	480/1,135 (42.3)		–	–	–	–	1	–
Senior interns	202/397 (50.9)		0.341	0.118	8.352	0.004	1.406	1.116–1.771
Gender								
Female [reference]	583/1,351 (43.2)		–	–	–	–	1	–
Male	99/181 (54.7)		0.489	0.160	9.333	0.002	1.631	1.192–2.233
Location								
Rural [reference]	356/866 (41.1)		–	–	–	–	1	–
Urban	326/666 (48.9)		0.309	0.105	8.743	0.003	1.362	1.110–1.672
DASS, depression	45/1,532 (2.9)	0.069						
Educational status								
Junior [reference]	23/1,135 (2.0)		–	–	–	–	1	–
Senior (interns)	22/397 (5.5)		1.026	0.307	11.176	0.001	2.790	1.529–5.093
Gender								
Female [reference]	34/1,351 (2.5)		–	–	–	–	1	–
Male	11/181 (6.1)		0.984	0.361	7.424	0.006	2.676	1.318–5.431
Location								
Rural [reference]	17/866 (2.0)		–	–	–	–	1	–
Urban	28/666 (4.2)		0.738	0.315	5.498	0.019	2.091	1.129–3.874
DASS, anxiety	44/1,532 (2.9)	0.893						
Educational status								
Junior [reference]	22/1,135 (1.9)		–	–	–	–	1	–
Senior (interns)	22/397 (5.5)		1.082	0.311	12.116	<0.001	2.950	1.604–5.425
Gender								
Female [reference]	32/1,351 (2.4)		–	–	–	–	1	–
Male	12/181 (6.6)		1.145	0.354	10.498	0.001	3.144	1.572–6.286
Location								
Rural [reference]	17/866 (2.0)		–	–	–	–	1	–
Urban	27/666 (4.1)		0.698	0.317	4.837	0.028	2.010	1.079–3.743
DASS, stress	17/1,532 (1.1)	0.091						
Educational status								
Junior [reference]	9/1,135 (0.8)		–	–	–	–	1	–
Senior (interns)	8/397 (2.0)		0.904	0.493	3.355	0.067	2.468	0.939–6.490
Gender								
Female [reference]	12/1,351 (0.9)		–	–	–	–	1	–
Male	5/181 (2.8)		1.209	0.542	4.974	0.026	3.352	1.158–9.702
Location								
Rural [reference]	5/866 (0.6)		–	–	–	–	1	–
Urban	12/666 (1.8)		1.109	0.538	4.256	0.039	3.031	1.057–8.693
PSQI, insomnia	358/1,532 (23.4)	0.731						
Educational status								
Junior [reference]	259/1,135 (22.8)		–	–	–	–	1	–
Senior (interns)	99/397 (24.9)		0.114	0.136	0.695	0.404	1.120	0.858–1.464
Gender								
Female [reference]	304/1,351 (22.5)		–	–	–	–	1	–
Male	54/181 (29.8)		0.391	0.175	4.962	0.026	1.478	1.048–2.084
Location								
Rural [reference]	190/866 (21.9)		–	–	–	–	1	–
Urban	168/666 (25.2)		0.182	0.122	2.225	0.136	1.199	0.945–1.522

PTSD, post-traumatic stress disorder; IES-R, impact of event scale–revised; DASS, depression, anxiety, and stress scale; PSQI, Pittsburgh sleep quality index.

CI, 1.048–2.084; $P = 0.026$). As compared with rural nursing students, urban nursing students had higher risks of PTSD (OR = 1.362; 95% CI, 1.110–1.672; $P = 0.003$), depression (OR = 2.091; 95% CI, 1.129–3.874; $P = 0.019$), anxiety (OR = 2.010; 95% CI, 1.079–3.743; $P = 0.028$), and stress (OR = 3.031; 95% CI, 1.057–8.693; $P = 0.039$).

DISCUSSION

In this study, we conducted a survey to evaluate the mental health condition of college nursing students amid the COVID-19 pandemic. Measurement scales including IES-R, DASS-21, and PSQI were used to assess the symptoms of PTSD, depression, anxiety and stress, and insomnia, respectively. We found that among the college nursing students, 44.5% presented with symptoms of PTSD, 2.9% with depression, 2.9% with anxiety, 1.1% with stress, and 22.8% presented with symptoms of insomnia. Fortunately, few nursing students experienced severe symptoms of PTSD (0.3%), depression (0.1%), anxiety (0.2%), stress (0.1%), and insomnia (0.1%). Additionally, as compared with junior, female, and rural nursing students, senior (interns), male, and urban nursing students had higher occurrence rates of PTSD, depression, anxiety, and stress, and male nursing students had a higher rate of insomnia. Surprisingly, the results showed that an overwhelming majority of students had a positive attitude (98.2%) about becoming frontline nurses against COVID-19 despite the high risk of contagion.

At present, there is still no definitive treatment for COVID-19, we do not know how long this will last, and the future remains unpredictable. The psychological impact of the COVID-19 pandemic is extensive and profound, as it has led to psychological symptoms such as fear, irritability, uncertainty, PTSD, depression, anxiety, stress, and insomnia among people all over the world. Lockdowns, economic losses, and the lack of masks and alcohol-based disinfectants further aggravated feelings of social isolation, loneliness, and the above negative psychological symptoms and even gave rise to delirium, self-harm, and suicide (Ettman et al., 2020; Twenge and Joiner, 2020). A large-scale online survey showed that the rates of mental health symptoms among the general Chinese population from February 28 to March 11, 2020 showed that 27.9% had symptoms of depression, 31.6% had symptoms of anxiety, 29.2% had symptoms of insomnia, and 24.4% experienced acute stress (Shi et al., 2020). Another large web-based survey conducted in the United States from June 24 to 30, 2020 indicated that 26.3, 24.3, and 25.5% of the adult respondents presented with symptoms of PTSD, depression, and anxiety, respectively, and 10.7% respondents (8.9% females and 12.6% males) had seriously considered suicide in the previous 30 days (Czeisler et al., 2020).

Previous studies have indicated that healthcare workers had high levels of stress, depression, and anxiety. Furthermore, healthcare workers, especially nurses who were directly exposed to COVID-19 due to circumstances such as serving in isolation wards or emergency departments had higher levels of adverse psychiatric outcomes (Azoulay et al., 2020; Lai et al., 2020; Si et al., 2020). For instance, a survey regarding the mental health of healthcare workers in China revealed that the rates of PTSD, depression, anxiety, and insomnia were 71.5, 50.4, 44.6, and 34.0%, respectively, among all the participants, whereas these values were 74.5, 53.5, 47.1, and 38.2% among nurses, respectively (Lai et al., 2020). These findings were more severe than the results of this study.

Some recent studies revealed that students also experienced adverse mental symptoms after the COVID-19 outbreak, and the mental effects of COVID-19 may differ among countries and areas due to discrepancies in the COVID-19 infection and anti-epidemic conditions. First, a cross-sectional study regarding the psychological effects of the COVID-19 outbreak and lockdown among students (76.8%) and workers (23.2%) in a university in Spain which was severely affected by the COVID-19 pandemic showed that 87.5, 48.1, 35.2, and 40.3% of the respondents presented with symptoms of PTSD, depression, anxiety, and stress, respectively, with students having higher scores of depression, anxiety, and stress (Odriozola-Gonzalez et al., 2020). Next, a survey conducted in Texas A&M University, USA which was also severely affected by the COVID-19 pandemic showed that 80.6 and 71.8% of respondents reported symptoms of depression and anxiety, respectively (Wang X. et al., 2020). Furthermore, a survey about the impact of the COVID-19 pandemic on the mental health of home-quarantined students in Bangladesh showed that 69.3, 46.9, 33.3, and 28.5% of respondents reported having symptoms of PTSD, depression, anxiety, and stress, respectively (Khan et al., 2020). Finally, a large cross-sectional survey conducted among college students in Guangdong Province, China which aimed to assess the psychological impact of the COVID-19 outbreak showed that 50.9% respondents had abnormal IES scores, 0.5% reported poor mental health, and 3.2% reported poor sleep quality (Li X. et al., 2020).

As for nursing students, a recently published survey conducted from March 8 to 24, 2020 in China showed that the prevalence of anxiety, depression, and PTSD were 34.97, 40.22, and 14.97%, respectively (Li et al., 2021). Additionally, a multicenter cross-sectional study conducted from April 30 to May 14, 2020 in three European countries (Spain, Greece, and Albania) indicated that 67.5% nursing students experienced mild to severe depression, and the rates of depression differed among countries (Spain, 86%; Greece, 59.5% and Albania, 58.9%) (Patelarou et al., 2021). In this study, although the incidence rates of anxiety and depression were lower than that of the above studies, about half (44.5%) of the respondents reported symptoms of PTSD, whereas about a quarter (22.8%) reported symptoms of insomnia. Therefore, the psychological impact of the COVID-19 pandemic on nursing students is considerable, and special psychological guidance, support, and interventions should be implemented to assure their mental health.

Based on the above studies, we could conclude that the incidences of mental symptoms might be greater in areas with a high risk of COVID-19 or during high-risk periods. However, these results may be influenced by the use of different scales to evaluate the same symptoms. For example, depression was assessed using the Patient Health Questionnaire 9 (PHQ-9) in the above two studies; however, we used the DASS-21 to assess depression in this study.

In this study, senior and urban nursing students indicated higher levels of mental symptoms. Senior nursing students

(interns) had started working under their clinical practice which required them to come into contact with all kinds of patients. As they would become clinical staff nurses soon, their feelings about the COVID-19 contagion might be more intuitive and deeper than junior nursing students which may have caused them to experience more symptoms of PTSD, depression, anxiety, and stress, even though all of them were required by the education department to study at home. In addition, their worries regarding their clinical skills and further education or employment may contribute to their higher levels of mental symptoms. Due to the dense population and convenient transportation in urban areas (about 2 h from Wuhan city to Zhengzhou city by high-speed train), the spread of COVID-19 was more severe in urban areas compared with rural areas, which may have resulted in the higher incidence of mental symptoms among urban nursing students.

Unexpectedly, compared with female nursing students, male nursing students reported higher incidences of symptoms of PTSD, depression, anxiety, and stress in this study, which was different from previous studies about healthcare workers (Lai et al., 2020). Possible reasons for this inconsistency are listed as follows. First, the respondents in this study were far from the areas with a high-risk of COVID-19 and were relatively safe at home. Second, male nursing students paid more attention to the COVID-19 outbreak (always, 50.8 vs. 40.0% among females). Finally, male nursing students had higher rates of insomnia (31.5 vs. 23.3%).

As more severe mental symptoms of PTSD, depression, anxiety, and stress were found in senior, urban, and male nursing students, governments, schools, and teachers should pay more attention to students with these risk factors. More frontline or online mental health counseling and support should be provided for these students to promote their mental health. First, senior nursing students should be educated more regarding COVID-19 prevention and treatment, and governments and schools should guarantee their chances of clinical practice and employment. Second, as for junior nursing students, it is important to educate them regarding COVID-19, and strengthening their professional identity, ideals, and faith may help prevent them from experiencing more severe psychological symptoms. Third, there are fewer male nursing students in China, and even though it is easier for them to get jobs compared with female nursing students, they had poor professional feelings of self-identity, responsibility, honor, and pride; thus, they may require special attention and more relevant education. Furthermore, nursing students from urban cities which had a higher risk of COVID-19 infection require more education regarding the prevention and control of COVID-19 infection, such as maintaining social distancing, wearing masks, and hand hygiene, and the government should provide them with timely, updated, and accurate official information regarding COVID-19.

CONCLUSION

In this study, a considerable number of nursing students reported having symptoms of PTSD and insomnia, whereas few nursing students reported mental symptoms of depression, anxiety, and stress. Furthermore, senior, male, and urban nursing students may be at risk for more severe mental symptoms. As nursing students are an important reserve force against the COVID-19 pandemic, special psychological interventions should be implemented to assure their mental health.

LIMITATIONS

There were several limitations in our study. First, this study had an online cross-sectional design. Second, we only investigated the nursing students from one college in Henan Province, China, so the findings may differ among other colleges, areas, or populations such as students belonging to other disciplines. Furthermore, as fewer respondents reported symptoms of depression, anxiety, and stress, the sample may have been insufficient for the subgroup analysis. Finally, we did not assess the effects of psychiatric and physical disorders of respondents, which might affect the results. Based on the above limitations, further studies regarding the mental health of nursing students should be conducted in the future.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

FH, JG, and FW conceived and designed the experiments. JG wrote the original draft. JG, FW, and SG performed data collection, analysis, and interpretation. FH reviewed and edited the manuscript. All authors contributed to this study and approved the final version of the manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.699558/full#supplementary-material

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Early COVID-19 Government Communication Is Associated With Reduced Interest in the QAnon Conspiracy Theory

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Does inadequate risk communication during uncertain times trigger the rise of conspiratorial ideas? We hypothesize that, where government COVID-19 risk communication started early, as measured by the number of days between the start of the communication campaign and the first case in the country, citizens are less likely to turn to conspiratorial explanations for the pandemic, which typically assign blame to powerful actors with secret interests. In Study 1a, we find strong support for our hypothesis in a global sample of 111 countries, using daily Google search volumes for QAnon as a measure of interest in QAnon, which is a conspiracy theory contending, among other things, that COVID-19 is a conspiracy orchestrated by powerful actors and aimed at repressing civil liberties. The effect is robust to a variety of sensitivity checks. In Study 1b, we show that the effect is not explainable by pre-pandemic cross-country differences in QAnon interest, nor by 'secular' rising interest in QAnon amid the pandemic. A one-standard deviation (26.2 days) increase in communication lateness is associated with a 26% increase in QAnon interest. In pre-registered Study 2, we find limited support for the proposition that early communication reduces self-reported pandemic-related conspiratorial ideation in a sample of respondents from 51 countries. Overall, our results provide evidence that interest in extreme ideas, like QAnon, are highly responsive to government risk communication, while less extreme forms of conspiracism are perhaps less so.

Keywords: conspiracy theories, QAnon, COVID-19, coronavirus, government risk communication, blame allocation

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INTRODUCTION

The rapid spread of the highly contagious and deadly COVID-19 virus, since its emergence in December 2019, has led to a global pandemic—a state of affairs not seen since the 1918 Spanish Flu (see Ashton, 2020 for a comparison).[1] Governments around the world communicated

[1]For a historical overview on pandemics and their societal relevance, see Snowden (2019). For a detailed look at the Spanish Flu, see Barry (2004).

with the public about the virus with varying degrees of swiftness: the data from Hale et al. (2021), which we delve into in Study 1, show that there is substantial heterogeneity in how quickly governments began communicating with the public about COVID-19. In this paper, we ask whether the swiftness of government risk communication can explain the spread of COVID-19-related conspiracy theories, which typically seek to assign blame for the pandemic to powerful actors with secret agendas.

Our main hypothesis is that, where government risk communication is slow, there are opportunities for people to 'fill in the blanks' with conspiratorial ideas which attempt to rationalize the situation at hand, namely, the pandemic. The COVID-19 pandemic is an ideal breeding ground for the spread of false narratives: a sudden environment of extreme angst, frustration, and fear materialized, which in the minds of many people could not have been foreseen, and thus requires an extraordinary explanation. As a matter of fact, apart from the virus itself, a hallmark feature of the COVID-19 pandemic has been the proliferation of conspiracy theories on social media, a pattern which began early on during the pandemic (Van Bavel et al., 2020a). More generally, as shown by the folklorist Jon D. Lee (2014) in his book *An Epidemic of Rumors*, pandemics and epidemics, from AIDS to H1N1 and SARS, commonly give rise to rumours and conspiratorial narratives. Thus, we hypothesize that false narratives spread where governments do not communicate swiftly with the public about the virus.

We test our hypothesis using Google search data as a proxy for interest in the QAnon conspiracy theory in Study 1 and find strong support for our hypothesis. Our motivation for studying QAnon is that it is an integral part of what Rosenblum and Muirhead (2020, p. 35) define as the 'new conspiracism', which is an 'active assault on democracy'. QAnon is an extreme conspiratorial movement which blames a supposed secret cabal of left-leaning politicians for many real or perceived ills, including the pandemic. QAnon's spread is of current policy concern, as the group has been designated a terror threat by the FBI as early as 2019.[2] Central to QAnon lore is the dangerous belief that the pandemic is a hoax,[3] which makes QAnon a phenomenon deserving of empirical investigation. Importantly, the human cost of becoming embroiled in QAnon is also staggering, as evidenced by the stories of individuals 'losing' loved ones to the cult-like nature of QAnon,[4] which motivates us to study QAnon in Study 1. We also test our hypothesis using self-reported conspiratorial beliefs in a sample of approximately 40,000 respondents from 51 countries from the International Collaboration on Moral and Social Psychology (Van Bavel et al., 2020b), in the pre-registered Study 2. Our hypothesis finds limited support in Study 2, which suggests that not all conspiratorial ideas respond equally largely to government (in)action. Our results provide ample caution about the responsiveness of interest in extreme ideas, such as QAnon, to government risk communication.

Our work contributes to a well-established area of investigation in psychology and across the social sciences, which is the study of conspiracy theories (for overviews, see Lewandowsky and Cook, 2020; van der Linden et al., 2021) and of false beliefs more generally (O'Connor and Weatherall, 2019). The phenomena of scapegoating and conspiracy theories ensuing from pandemics have a long history, dating back at least to the plague of Cyprian in Roman times (Retief and Cilliers, 2000). Conspiracy theories and false narratives, more generally, tend to circulate more in times of uncertainty or complexity as a way of trying to make sense of what is going on in the world around us. These usually relate to clandestine government plans, elaborate murder plots, or paranoia about powerful groups, thinking they are sinister or have 'hidden agendas', and persist even when there is no decisive evidence for them (Lewandowsky and Cook, 2020). People 'fill in the gaps' with their own explanations as a way of relieving feeling of anxiety and stress (Douglas et al., 2017)—even going as far as assigning blame or responsibility to certain individuals or groups to fulfil their epistemic need for an explanation, with the scapegoating of Jews during the Black Death being a salient example. We thus contribute to a nascent literature analysing interest and beliefs in conspiracy theories in relation to the COVID-19 pandemic (see, for example, Cassese et al., 2020; Enders et al., 2020; Imhoff and Lamberty, 2020; Miller, 2020; Sternisko et al., 2020; Stoica and Umbreș, 2020; Uscinski et al., 2020; Chan et al., 2021; Šrol et al., 2021).

Our work also contributes to a strand of research in the crisis and risk communication literature, which emphasizes the benefits of communicating early (see, e.g., Heath and O'Hair, 2009; Coombs and Holladay, 2011). In mock criminal trials, Dolnik et al. (2003) show that revealing damaging information about oneself (a strategy known as 'stealing thunder') without waiting for others to reveal it first is beneficial to the party revealing the information. In an organizational context, Arpan and Roskos-Ewoldsen (2005) show that stealing thunder results in higher credibility ratings for the disclosing organization. Williams and Treadaway (1992) argue that the Exxon corporation's slow communication response to the grounding of the Exxon Valdez oil tanker in Alaska played a driving role in the failure of Exxon's communication strategy. In the context of health communication, Covello (2003, p. 5) specifically defines as best practice to 'demonstrate respect for persons affected by risk management decisions by involving them early, before important decisions are made'. Thus, in the case of the COVID-19 virus outbreak, our findings complement the extant risk communication literature by showing that early communication about the virus has a chilling effect on the diffusion of conspiratorial narratives people turn towards, to ease their feelings from the uncertainty of the virus' nature and spread. To the best of our knowledge, this paper is the first to quantitatively explore crisis communication during COVID-19 (see Malecki et al., 2021 for a discussion).

[2]The Hill, "FBI memo warns QAnon poses potential terror threat: report."
[3]The New Daily, 'The coronavirus 'hoax': Conspiracy peddlers infecting Australians at alarming rate'.
[4]The Guardian, 'The QAnon orphans: people who have lost loved ones to conspiracy theories'.

STUDY 1A

Data

QAnon

The origins of QAnon can be traced back to 28 October 2017, when a user of the internet forum 4chan began claiming that he or she was a high-ranking political insider working to inform the public about Donald Trump's battle against a so-called criminal deep state (Gallagher et al., 2020, p. 3). The username of the person posting this claim was Q, which is the highest level of security clearance in the United States, thus appearing to corroborate Q's claim that they are a high-ranking insider.[5] Q's identity remains unknown, and it is unclear whether multiple people have posted on 4chan while claiming to be Q. As Gallagher et al. (2020, p. 3) put it, 'The QAnon theory now connects antivaccine, anti-5G conspiracies, antisemitic and antimigrant tropes, and several bizarre theories that the world is in the thrall of a group of paedophile elites set on global domination in part aided by ritualistic child sacrifice'. As disjointed as QAnon might sound, there is no doubt it has captured the attention of many around the world and is far from limited to the United States (Gallagher et al., 2020), where it has been designated a domestic terror threat.

We use daily country-level Google search volumes to measure interest in QAnon from 1 January to 24 May 2020. We use the latter as our cut-off date because it is the day before George Floyd was murdered by Minneapolis police. Floyd's murder gave rise to large popular protests, leading at least some QAnon followers to conclude that the protests were staged by a 'deep state' to harm Donald Trump's re-election chances (Gallagher et al., 2020).

Using Google searches as a proxy for interest in QAnon follows in the footsteps of Stephens-Davidowitz (2014), who shows that racial animus, as proxied by search terms for the n-word, cost Barack Obama about 4 percentage points of the national popular vote. While we cannot know for certain that searches for QAnon reflect belief in QAnon, Madestam et al. (2013) provide evidence that Google searches are correlated with actual political behaviour. They document rising interest in the Tea Party between 2009 and 2011, as measured by Google searches, which accompanied increased attendance at Tea Party rallies. In **Supplementary Figure S1**, we also provide evidence that Google searches for Jo Jorgensen, the Libertarian Party candidate to the US presidency, predict votes for Jo Jorgensen at the state level, such that Google searches are indicative of political behaviour.[6] A major advantage of using Google searches as a proxy for interest in QAnon is that Google searches do not suffer from social desirability bias (Stephens-Davidowitz, 2014). This is particularly true for sensitive questions, as is the case for conspiratorial ideas.

Google search volumes for a given topic are measured as a share of all Google searches for a given country and date, and range from 0 (date with the least interest) to 100 (date with the most interest). For example, Google searches for the weather in the United States (**Supplementary Figure S2**) are approximately constant for the first 2 months of 2021 and peak markedly on February 15, which was around the start of winter storm Viola.[7] Because Google search volumes for QAnon are *relative* to other searches, higher numbers do not mean that people are at home because of the pandemic searching for more of everything. Instead, higher searches for QAnon specifically mean that searches for QAnon are becoming more frequent relative to all other searches. Since each country has data ranging from 0 to 100, and we are interested in cross-country comparisons, we adjust the original data to reflect cross-sectional differences in search volumes between countries. We adjust by using cross-sectional search intensity from Google trends, which ranks countries from most searches (100) to least (0), for a given time period. Austria is the country which sees the most searches for QAnon and receives a score of 100. We thus leave Austria's time-series data unchanged. The United States has a cross-sectional score of 83, meaning that its searches for QAnon are 83% as large as Austria's; we therefore multiply all daily search volumes for the United States by 0.83, in order to make them comparable with Austria's. We perform this adjustment for all countries in the data set.

Late Campaign

For a given country, we measure the timeliness of government COVID-19 communication as the number of days between the date of the first case of COVID-19 in the country and the date on which government officials began communicating with the public about COVID-19. Both of these variables are drawn from the Oxford COVID-19 Government Response Tracker (OxCGRT; Hale et al., 2021) data set, the main source of information on governmental responses to the pandemic, from which we also draw several control variables as detailed below. The OxCGRT data set records the first case of COVID-19 in New Zealand on 28 February 2020; the earliest government communication began on 22 January 2020, thus giving New Zealand a value of value for *Late Campaign* = −37, as their government began communicating 37 days before the first case. Alternatively, we also define another version of *Late Campaign* relative to the first death in the country, rather than relative to the first case. **Supplementary Tables S1 and S2** in the Supplementary Material provide descriptive statistics and definitions and sources, respectively, for all variables used in this paper.

[5]International Business Times, 'What is The Storm? Conspiracy theory that mysterious White House official QAnon is leaking secrets'.

[6]We focus on Jo Jorgensen in this validation exercise as she is the only minor party candidate to be present on the ballot in all states. Google searches for Jorgensen explain as much as 25% of her vote share. Note that we would not expect this pattern to hold for major parties: for example, in Democrat stronghold California, citizens (even politically active ones) are unlikely to spend much time searching for Democratic Party-related topics on the internet.

[7]Weather.com, 'Winter Storm Viola Smashed Records in the South and Brought Snow, Ice Into Northeast'.

Sample Composition and Country-Level Descriptive Statistics

Our main two variables described above are available for 111 countries and territories. The full list of countries included in either Study 1 or 2 is provided in **Supplementary Table S3**, along with country-level summary statistics for key variables of interest.

Methods

We estimate the following regression model:

$$QAnon_{it} = \alpha_0 + \alpha_1 Late\ Campaign_i + \alpha_2 QAnon_{i,t-1} + \mathbf{X}_{it}\gamma + \epsilon_{it} \quad (1)$$

where the dependent variable, *QAnon*, measures the volume of Google searches for the QAnon topic of QAnon in country *i* on day *t*, α_0 is a constant term, *Late Campaign* is the number of days elapsed between the start date of government COVID-19 communication campaigns and the first case of the virus (or first death from the virus) in the country, **X** is a vector of country-level control variables, and ε is an error term. Larger values of *Late Campaign* denote a later campaign, which we hypothesize to lead to larger interest in QAnon. Because search volumes for QAnon tend to be correlated from one day to the next in a given country, we control for the first lag of the dependent variable in all regressions. This is a conservative choice, since the coefficient of *Late Campaign* will reflect differences in search volumes between countries that cannot be explained by past search volumes. Our standard errors are heteroskedasticity and autocorrelation consistent, and are clustered over countries. Our results are robust to alternate estimation methods and clustering strategies (**Supplementary Figure S3**).

Results

Figure 1 displays a binned scatterplot of the basic relationship in the data. The mean interest in QAnon increases as *Late Campaign* increases; this is true both when *Late Campaign* is defined relative to the first case of COVID-19 in the country (left-hand side panel) or when it is defined relative to the first death (right-hand side panel).

Table 1 presents the main regression results. The top panel of the table, Panel A, presents results using the first case of COVID-19 as a reference point against which government communication campaign starts are measured, while Panel B uses the first death as the reference point. Model 1 presents the baseline estimates: a one-day increase in communication lateness is associated with a statistically significant 0.008–0.01 increase in searches for QAnon. The mean of the dependent variable is 2.05 approximately; the estimated effect therefore represents an increase in the order of 0.4–0.5% from the mean. Another quantity of interest is the effect of a one-standard deviation (26.2 days) increase in communication lateness, which is associated with a 11–13% increase in searches for QAnon. The effects we estimate are therefore sizable. Since our models treat the first lag of *QAnon* as an exogenous variable, our estimates are also conservative and should be understood as a lower bound.

Model 2 builds up from Model 1, with the added inclusion of a vector of continent fixed effects, which play a crucial role in this setting. Continent dummies allow us to rule out the possibility that the results are driven by varying propensities to search for QAnon across geographic regions. It is entirely plausible that European Google users may have googled QAnon more than Asian users; if European countries also tend to have later communication campaigns, then our results from Model 1 would be confounded in the absence of continent dummies. Our estimates from Model 2 survive the inclusion of continent dummies, and if anything, increase slightly in size. Importantly, the coefficient from Model 2 has a within-continent interpretation: we find that, when comparing two countries within the same continent, the country with the earlier government communication has significantly less search activity for QAnon.

Model 3 controls for a full vector of day dummies, which allows us to control for global fluctuations in searches for QAnon. For example, QAnon may have been featured in a prominent news story and thus searched for on some days more than others, owing to reasons orthogonal to government communication; day dummies allow us to rule out that such patterns could be driving our results. Importantly, the inclusion of day dummies will flexibly account for the rising global popularity of QAnon, since the coefficient of each day dummy is the difference in searches for QAnon between the relevant day and the baseline day. Thus, QAnon's rising global popularity will be reflected in higher coefficients for later day dummies, without constraining the daily step change to be linear. In Model 4, we control for both day fixed effects and continent fixed effects; the results are unchanged. Model 4 is the most demanding specification and is therefore our starting point for other specifications, from this point forward.

Sensitivity

Covariates

We consider an extensive set of factors which might correlate with both searches for QAnon and government's ability or willingness to implement a quick communication campaign. In **Figure 2**, we report the coefficients of *Late Campaign* conditional on day fixed effects, continent fixed effects and seven sets of covariates. First, we control for 14 variables taken from the International Country Risk Guide (PRS, 2018), which capture the quality of the institutional environment. These variables are expert ratings on the quality of the local bureaucracy, corruption and government stability, among others (see **Supplementary Table S2** for variable definitions). Second, we rule out that differences in economic development are driving the results, by controlling for the natural logarithm of *per capita* Gross Domestic Product. Third, we control for democracy, as measured in the Polity project (Marshall et al., 2013), which ranges from −10 (full autocracy) to +10 (full democracy). Fourth, we include an index of human capital from the Penn World Tables (Feenstra et al., 2015), since education might impinge on both search behaviour and

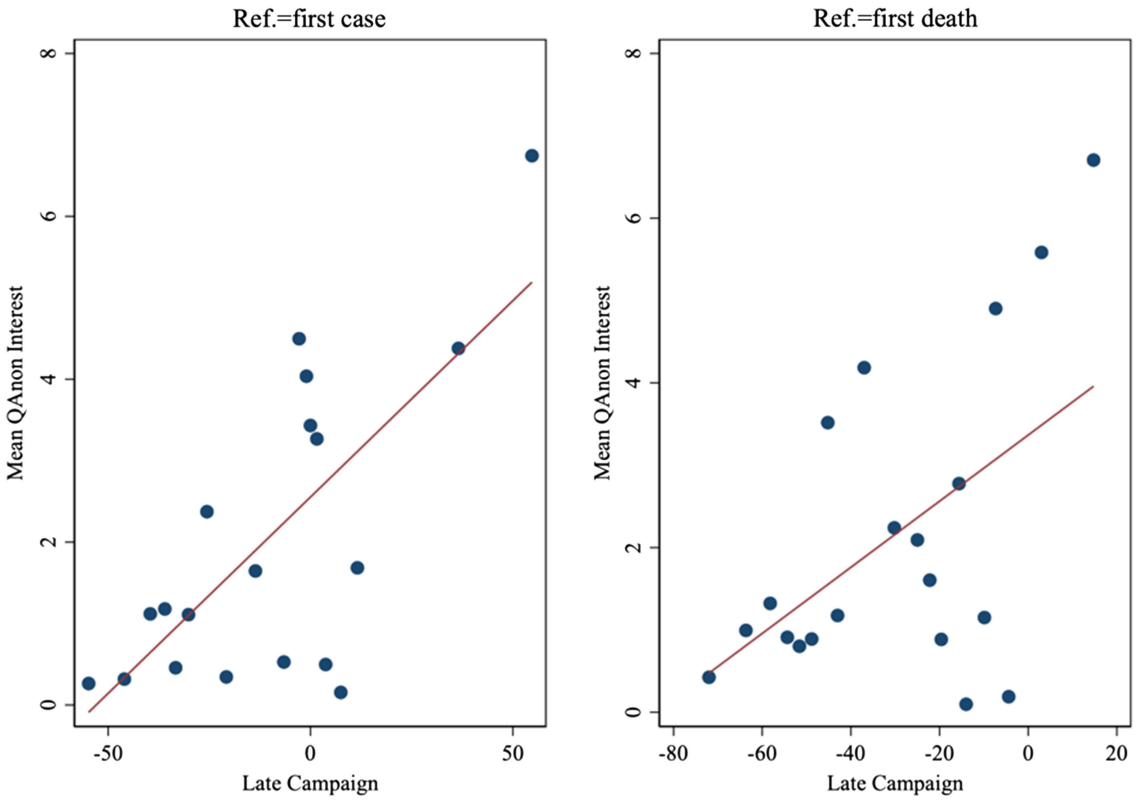

FIGURE 1 | Binned scatterplot of interest in QAnon and *Late Campaign*.

TABLE 1 | Main results from Study 1.

	(1)	(2)	(3)	(4)
A. *Late Campaign* relative to first COVID-19 case in country				
Late Campaign	0.0102***	0.0129***	0.0105***	0.0134***
	[0.0037]	[0.0041]	[0.0039]	[0.0043]
Continent FE		Yes		Yes
Day FE			Yes	Yes
Observations	15,969	15,969	15,969	15,969
Within R2	0.352	0.352	0.368	0.369
Overall R2	0.644	0.647	0.650	0.654
B. *Late Campaign* relative to first COVID-19 death in country				
Late Campaign	0.0083**	0.0101**	0.0085**	0.0105**
	[0.0038]	[0.0041]	[0.0039]	[0.0042]
Continent FE		Yes		Yes
Day FE			Yes	Yes
Observations	15,393	15,393	15,393	15,393
Within R2	0.354	0.354	0.371	0.371
Overall R2	0.644	0.647	0.651	0.654

*Dependent variable = Google search queries for the QAnon topic. Late Campaign is the number of days between the start of government COVID-19 communication campaigns and the first COVID-19 case (Panel A) or death (Panel B) in the country. All specifications include a constant term. Standard errors in brackets are clustered over countries and are consistent for autocorrelation and heteroskedasticity. ***, ** and * denote significance at the 1, 5 and 10% levels, respectively.*

government policy. Fifth, we control for differences in national culture using Schwartz's (2006) seven cultural value orientations. Sixth, we control for an extensive set of COVID-19-related restrictions; seventh and finally, we account for the incidence of COVID-19 by controlling for the natural logarithm of *per capita* COVID-19 cases. Our estimates for *Late Campaign* remain large and statistically significant, and exhibit little variation in response to the inclusion of controls.[8]

Outliers

We check whether extreme values of *QAnon* are driving our results by excluding the observations with the 5% largest values of *QAnon*. The results, displayed in the third model from the bottom in **Figure 2**, show that *Late Campaign* decreases slightly in magnitude but remains significant. Wald tests for the equality of coefficients across models (dropping the top 5% of *QAnon* values *vs.* keeping all observations) fail to reject the null that coefficients are identical across models ($p = 0.07$ and $p = 0.12$, relative to first case or first death, respectively).

Early vs. Late Campaigns

It is possible that public opinion reacts differently to early messaging (*Late Campaign* ≤ 0) than it does to late messaging (*Late Campaign* > 0). In the former case, the government is

[8]Where a control variable is missing for a particular observation, we impute the missing control as the average of the non-missing values in the relevant cell. For example, we replace the missing value for Schwartz's egalitarianism value in Kenya by the average egalitarianism of African countries.

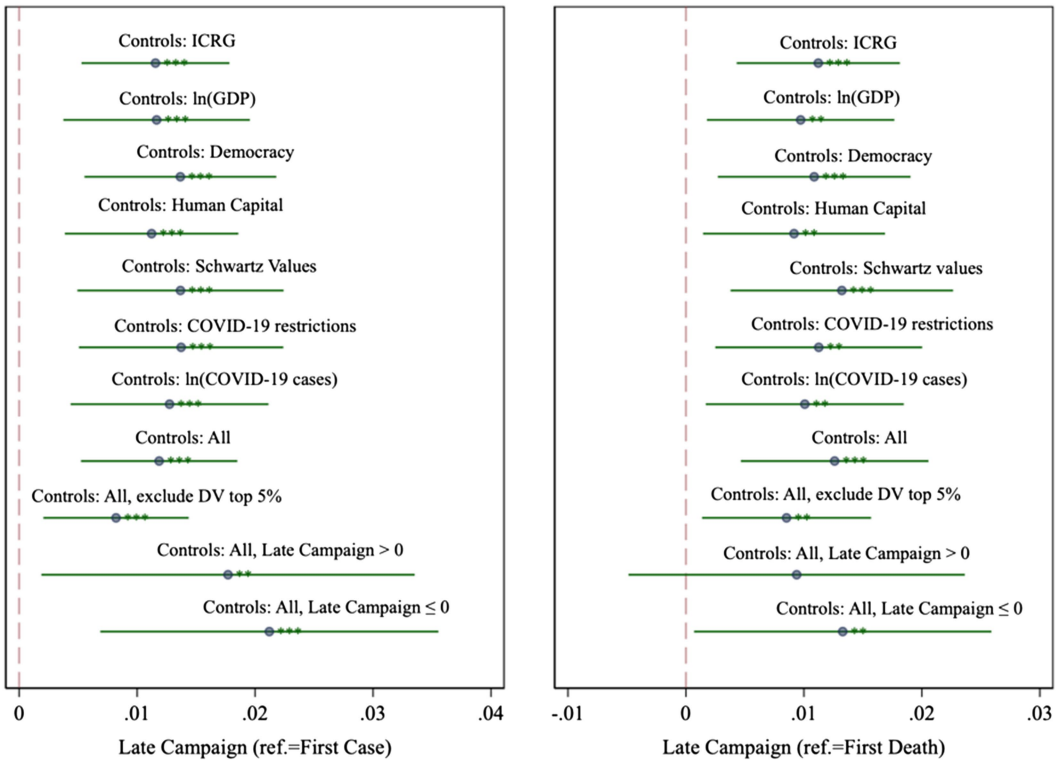

FIGURE 2 | Sensitivity analysis. ***, ** and * denote significance at the 1, 5 and 10% levels. Significance levels are reported on the confidence interval spikes.

communicating prior to the outbreak, with varying degrees of earliness; in the latter case, an outbreak has occurred, and the government is delaying communication. In the last two models of **Figure 2**, we disaggregate the analysis into those countries for which *Late Campaign* ≤ 0 and those for which *Late Campaign* > 0. Interestingly, in the right-hand side panel of **Figure 2**, where communication timeliness is measured relative to the first death, *Late Campaign* is insignificant when we restrict *Late Campaign* to be positive, but significant when we restrict it to be negative. This offers some indications that communicating well ahead of time (before the outbreak) may be the most effective strategy. We do interpret this difference with some caution, however, since Wald tests fail to reject the null of equality of the *Late Campaign* coefficients across the early-messaging and late-messaging periods ($p = 0.74$ and $p = 0.42$, relative to first case or first death of COVID-19 in the country, respectively).

Bottom-Censoring of the Dependent Variable

Google reports a search volume of 0 in a given time and place if the fraction of searches is below a certain threshold, such that the dependent variable is bottom-censored at 0. In **Supplementary Figure S3**, we report results using Tobit estimators, which take into account the censored nature of the dependent variable. Tobit coefficients of *Late Campaign* are larger than their OLS counterparts.

Alternate Error Structures

In **Supplementary Figure S3**, we report 95% confidence intervals for *Late Campaign* estimated with different clustering strategies, namely, clustering over days and double-clustering over countries and dates. The point estimates for *Late Campaign* remain statistically different from zero.

Placebo Analysis

If late-campaigning countries have some unobserved features that make them more likely to be high-QAnon-interest, it is possible that our results reflect the effect of some variable other than *Late Campaign*. To check whether our estimates may be affected by such unobserved factors that are correlated with *Late Campaign*, we conduct a placebo analysis. Specifically, we generate random values for *Late Campaign* and estimate their effect on QAnon, while conditioning on the full set of control variables. The rationale for the test is that, if *Late Campaign* is picking up the effect of another variable, then *Late Campaign* should perform no better than its placebo counterpart. We repeat the placebo-randomization 500 times, to obtain a distribution for the placebo *Late Campaign*. As **Supplementary Figure S4** shows, the coefficient of actual *Late Campaign* lies beyond the 98.5th and 98th percentile of the placebo distributions, relative to the first case and first death, respectively. These estimates strongly suggest that *Late Campaign* predicts *QAnon* above and beyond the placebo, offering reassurance that our previous estimates are in fact

detecting the effects of *Late Campaign* and not those of another variable.

Model Dependence

We consider whether our results are model-dependent by examining whether the patterns we document above are driven by idiosyncratic combinations of observations and control variables. Our starting point is the most demanding specification from **Table 1** (Model 4), which includes day and continent fixed effects. For each variant of *Late Campaign* (defined relative to the earliest COVID-19 case or death), we run 500 iterations of our regression equation, including either (i) all control variables, and a randomly selected 50% of all observations, or (ii) all observations, and a randomly selected 50% of all control variables. We collect the resulting 2,000 test statistics for Late Campaign and plot them against their percentile rank in **Figure 2**. Overall, 92% of the t-statistics are above the rule of thumb critical value of 1.96 (shown by the dashed horizontal line), indicating that our results are not model-dependent.

STUDY 1B

Introduction

In Study 1a, we establish a correlation between government communication lateness and Google searches for QAnon. Our estimates suggest that a one-standard deviation increase in lateness is correlated with an approximately 12% increase in searches for QAnon. These results hold up to extensive scrutiny, as evidenced by **Figures 2, 3**. However, we cannot rule out that the observed pattern reflects pre-existing differences between countries. If late-communication countries had higher levels of QAnon searches prior to the pandemic, then it is possible that Study 1a is over-stating the importance of early communication.

Methods

We estimate variants of Equation (2):

$$QAnon_{it} = \beta_0 + \beta_1 Post_{it} + \beta_2 LC_i + \beta_3 \left(Post_{it} * LC_i\right) + \mathbf{X}_{it}\rho + \mu_{it} \quad (2)$$

where *LC* is shorthand notation for *Late Campaign*, and *Post* is a dummy variable set equal to 1 from date *t*, for a given country, if either (i) government officials have started communicating about COVID-19, or (ii) the country has reported its first case of COVID-19. *Post* is thus equal to 1 from the day the virus is brought to the public's attention, either *via* government communication or *via* the first local case. As such, *Post* accounts for differences in searches for QAnon across the pre- and during-pandemic periods, which allows us to rule out that any effect we see in Study 1a is driven by increased interest in QAnon due to the pandemic more generally, rather than to government communication timeliness. The coefficient of interest in Equation (2) is the coefficient of *Post * LC*, β_3, which captures differences in QAnon searches associated with communication timeliness in the post period, above and beyond: (i) secular trends captured by *Post* and, crucially (ii) pre-existing cross-country differences in QAnon searches that are associated with unobserved correlates of *Late Campaign*.

In Equation (2), the coefficient of *LC* is interpreted as the pre-pandemic correlation between QAnon searches and government communication. If countries with late government communication had higher QAnon searches to begin with, in the pre-pandemic period, then *LC* will account for those differences. The coefficient of *Post * LC* therefore informs us about the correlation between government communication and QAnon searches net of pre-existing differences and secular trends.

Main Results

Figure 4 presents the results of estimating Equation (2) with either no covariates or the full set of covariates from **Figure 2**. The coefficient of *Post * LC* is large and significant throughout, indicating that our previous results were not driven by pre-existing differences in interest in QAnon or by increased interest in QAnon once the virus becomes known to the public. The mean of the dependent variable in the post period is approximately 2.6, and the coefficient of *Post * LC* is approximately 0.01. Thus, in the post period, having ruled out pre-existing differences in QAnon interest, the effect of a one-standard deviation (26.2 days) increase in *Late Campaign* is a 26.2 * ((0.01 + 2.6) /2.6) = 26% approximately increase in interest in QAnon, which is sizable.

Regional Heterogeneity

Does the pattern we document in the data differ across world regions? To explore this question, we estimate separate models for each continent and report the 95% confidence interval of *Post * LC* in **Figure 5**. The four panels of **Figure 5** present results with and without control variables and separately for *LC* as defined relative to the first case of COVID-19 in the country (on the left-hand side) or relative to the first death (on the right-hand side). We find evidence of a heterogeneous relationship: while *Post * LC* is insignificant in Africa, the estimates are generally positive for other continents. In particular, the estimates are larger for the Americas, Oceania (which cannot be precisely estimated), and Europe, and positive but insignificant in Asia. One noteworthy limitation of this analysis is that the number of degrees of freedom is necessarily reduced when we split the sample across continents;[9] still, it is interesting to note that there is some degree of regional heterogeneity at play.

STUDY 2

Background

Do the results presented in Study 1 apply exclusively to the QAnon conspiracy theory, or do they extend to other

[9]Owing to this continent-wise split, the cluster-robust statistics we use in the remainder of Study 1 are no longer valid, as we now have too few clusters in each regression. We thus calculate 95% CIs using Roodman et al.'s (2019) wild bootstrap procedure, which are cluster-robust even with a small number of clusters.

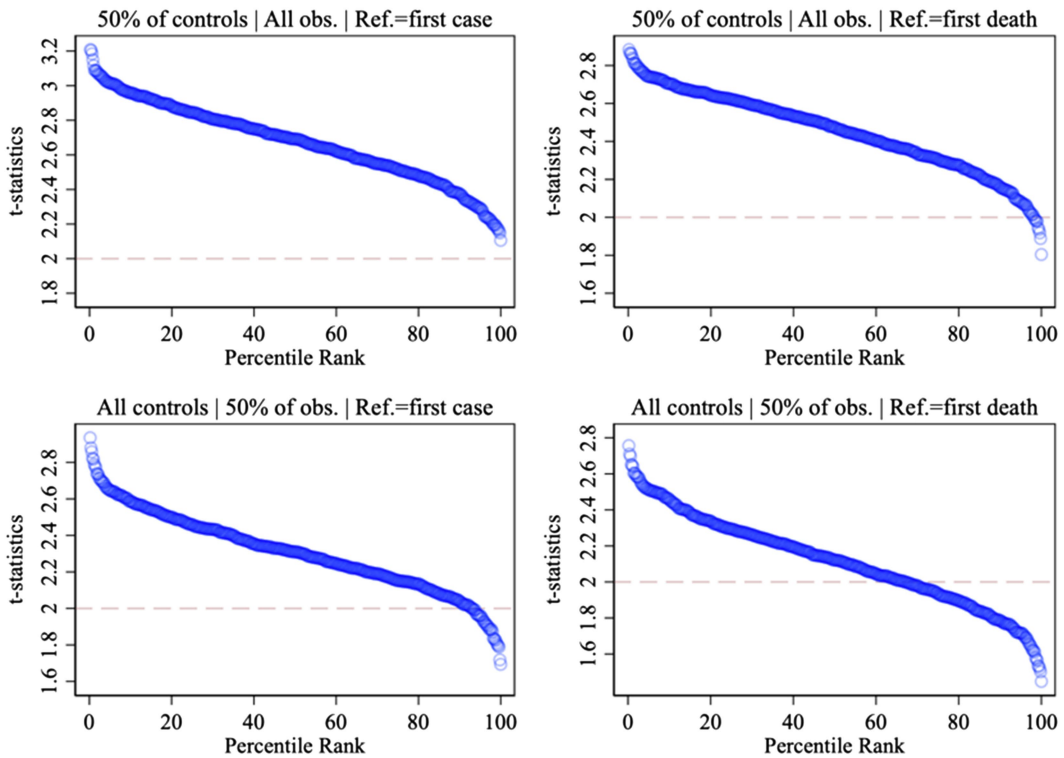

FIGURE 3 | Model dependence: 2,000 test statistics and percentile ranks.

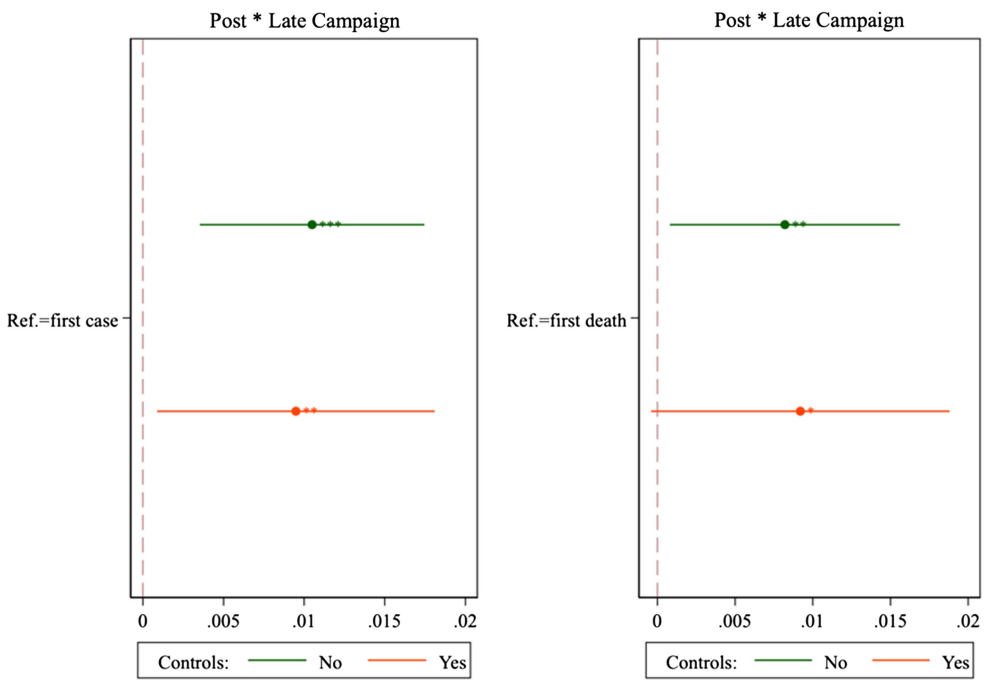

FIGURE 4 | Coefficients and 95% CIs of *Post * LC* from Equation (2).

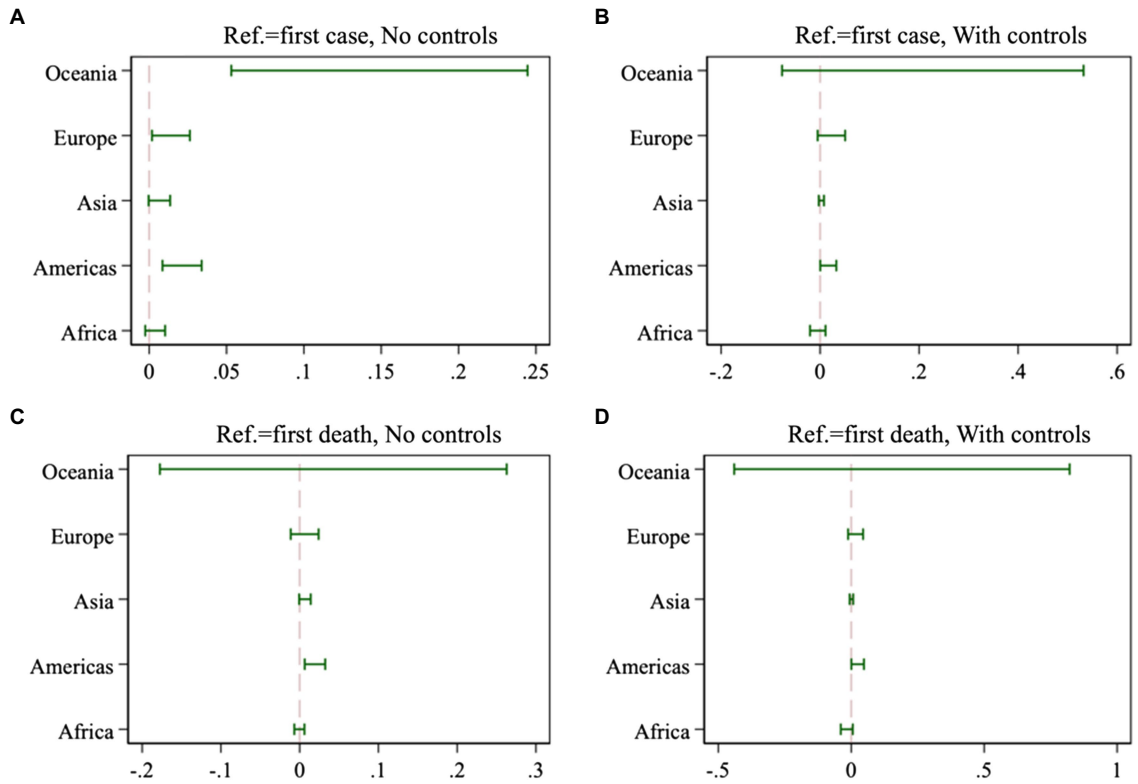

FIGURE 5 | Coefficients of *Post * LC* from continent-specific regressions.

COVID-19-related conspiracy theories? To answer this question, we use data from the International Collaboration on the Social and Moral Psychology (ICSMP) of COVID-19 study (Van Bavel et al., 2020b). We pre-registered our analysis on the Open Science Framework at[10], which was necessary in order to obtain the data.

Materials and Methods

The ICSMP study surveyed 44,000 respondents from 67 countries on their attitudes and behavioural intentions related to the COVID-19 pandemic. The study is a large-scale collaboration involving research teams around the world; further details on the project, including a complete codebook, are available at[11]. Each team was asked to collect age and gender-representative data from their own country/territory. The original survey was created in English and translated as appropriate by local research teams, using the forward-backward translation method. Ethics approval was obtained from the University of Kent (approval ID number: 202015872211976468). The data we use in this study are well-balanced on sex (52.4% female) and smooth with respect to age, with no conspicuously missing age brackets (**Supplementary Figure S5**). A greater proportion of younger respondents is found in Africa and Asia, where fertility is relatively high. Shorter life expectancies in Africa are also visible in the data. Country-level descriptive information is available in the Supplementary of Van Bavel et al. (2020b).

The list of countries included in Study 3, along with the number of respondents per country, can be found in Supplementary Table S3. We follow our pre-analysis plan with two departures. First, in our pre-registration, we indicated that we would drop from the data set those respondents who gave the same number answer on two specified pairs of questions from the moral identity block of the survey, thus indicating that the respondent was not reading the question before answering. We also did not foresee that respondents could hold genuinely middle-of-the-road opinions, leading them to answer the pair of questions with 5 out of 10. This pattern is borne out in the data (**Supplementary Figures S6, S7** and accompanying notes); we therefore keep those respondents who responded with 5 out of 10 on our flat-line detection questions, but exclude others as per our pre-registration. Second, following a recommendation from an anonymous reviewer, we exclude countries with fewer than 100 respondents. The results exactly following our pre-registration (exercising neither of the above departures) are shown in **Supplementary Table S4**.

Keeping in line with our pre-registration, we consider two dependent variables from the ICSMP, which we refer to as the 'Authoritarian' and 'Financial' conspiracy types in **Table 2** below. *Authoritarian* is the degree of agreement, from 0 to 10, with the statement: 'The coronavirus (COVID-19) is a conspiracy to take away citizen's rights for good and establish

[10]https://osf.io/kqnvg
[11]https://icsmp-covid19.netlify.app/about.html

TABLE 2 | Main results from Study 2.

	(1)	(2)	(3)	(4)
	Authoritarian	**Financial**	**Authoritarian**	**Financial**
A. *Late Campaign* relative to first COVID-19 case in country				
Late Campaign	−0.0110	−0.0138*	0.0048	0.0135**
	[0.0080]	[0.0074]	[0.0055]	[0.0053]
Observations	39,069	39,066	38,528	38,525
R-squared	0.0073	0.0121	0.1361	0.1524
N. Countries	49	49	49	49
Continent FE			Yes	Yes
Country Controls			Yes	Yes
Demographics			Yes	Yes
B. *Late Campaign* relative to first COVID-19 death in country				
Late Campaign	−0.0075	−0.0076	−0.0019	0.0088
	[0.0085]	[0.0079]	[0.0060]	[0.0058]
Observations	39,069	39,066	38,528	38,525
R-squared	0.0026	0.0028	0.1360	0.1514
N. Countries	49	49	49	49
Continent FE			Yes	Yes
Country Controls			Yes	Yes
Demographics			Yes	Yes

*Late Campaign is the number of days between the start of government COVID-19 communication campaigns and the first COVID-19 case (Panel A) or death (Panel B) in the country. FE = fixed effects. Demographics: age (continuous), gender (categorical) and marital status, has children (binary) and employment status (categorical). All specifications include a constant term. ** and * denote significance at the 5, and 10% levels.*

an authoritarian government'. *Financial* is the degree of agreement with the statement 'The coronavirus (COVID-19) is a hoax invented by interest groups for financial gains'.

Results

Table 2 presents the main results of Study 2. In Models 1 and 2, we estimate unconditional correlations between *Late Campaign* and either *Financial* or *Authoritarian*. The coefficients are statistically indistinguishable from zero, with the exception of Panel A Model 2, which is weakly significant ($p = 0.071$). In Models 3 and 4, we control for differences between individual respondents as well as differences between countries by including continent fixed effects, the full set of country variables from Study 1, as well as respondent-level demographic[12] variables (see **Supplementary Table S2** and notes to **Table 2** below). Once we rule out these confounders, there is tentative evidence that late communication provides a fertile breeding ground for conspiracism: the sign of *Late Campaign* is positive in three out of four cases and highly significant in one case ($p = 0.015$, Panel A Model 4).

Comparison of Results Across Studies

Is the pattern we observe in Study 2 idiosyncratic to the group of countries sampled in the ICSMP? In **Supplementary Table S5**, we report results from the full Study 1a specification for all countries which appear in both studies. The results show that the Study 1a patterns hold when the sample is restricted to be the same as in Study 2.

LIMITATIONS

While Google searches (Study 1) present the clear advantages of being measured in near real-time, available across a wide range of geographies, and not subject to desirability biases, a noteworthy limitation of Google data is that they do not necessarily reflect being 'taken in' by the QAnon conspiracy theory. We do however have evidence from previous work (Madestam et al., 2013; Stephens-Davidowitz, 2014) and from **Supplementary Figure S1** that Google searches correlate with actual political behaviour, such that our results are unlikely to reflect mere fleeting curiosity. Relatedly, it is also possible that the differences in the results across the two studies are driven by differences in measurement. A potential limitation is that the outcome variables used across studies are internet searches and self-reports, which present clear differences in measurement, and might thus hinder comparability across studies.

Another limitation of this paper is that we do not study other elements of government risk communication besides timeliness. One would expect that other facets of risk communication, including accuracy and consistency, also matter for the diffusion of false narratives: there are anecdotal reports, for example, of the public feeling misled by early calls for not using face masks (which were ostensibly directed at preventing mask hoarding) which were later reversed to recommended or even compulsory mask policies.[13] We believe this is a fruitful area for future data collection efforts, as we know of no data set that takes stock of other facets of government risk communication beyond timeliness. Another potentially productive research agenda, going forward, would be to explore the dynamics of conspiratorial beliefs and government communication as contextual elements change. We leave these questions open for future research.

CONCLUSION

In general, the capacity for belief is a core and dominant force in humans. As Fuentes (2019) points out, '[b]eliefs permeate our neurobiologies, bodies, ecologies and societies. They mediate the whole of human existence' (p. 65). But beliefs are not always a good thing. There are also dangers inherent in such a capacity. Misleading beliefs about the world can threaten societies' fabrics. In the long term, societal functioning depends on beliefs that are consistent with available evidence. However, an overload of information can result in a failure to properly process available information. As Herbert Simon (1983, p. 22) points out, we all 'have modest computational abilities in comparison with the complexity of the entire world that surrounds' us. Thus, it

[12]Data for employment status are missing for Spain. We impute them *via* a multinomial logit regression of employment status for all other countries on the full set of other demographic variables and country fixed effects.

[13]Financial Times, 'French public feels lied to as lockdown fatigue grows'.

is worth exploring which mechanisms help society better respond, either to available evidence or to the spread of false beliefs. Investigating such mechanisms is particularly important in times of crises (such as pandemics) which can trigger prolonged uncertainty, feelings of fear and a sense of needing reassurance to cope with the challenging situation, often through assigning blame to others for the occurrence of the crisis. Although interest in conspiracy theories is different from actual belief, showing higher levels of interest can be a warning sign against exercising a sensible approach when drawing inferences from available facts.

In this paper, we have investigated the link between timely risk communication and the assignment of blame for the pandemic, as reflected by interest or belief in conspiratorial narratives. Our results indicate that a key mechanism in reducing the spread of interest in the QAnon conspiracy theory is the timely provision of risk communication regarding the emergency faced. In Study 1a, we showed that the earlier governments communicate about the virus, relative to the first instance of the virus in a given country, the lower the public's interest in the destructive QAnon conspiracy theory – as measured by Google searches for QAnon in a sample of 111 countries and territories. In Study 1b, we showed that the results of Study 1a cannot be explained away by either of two crucial factors: (i) rising interest in QAnon in the COVID-19 era and (ii) pre-pandemic cross-country differences in interest in QAnon. Instead, interest in QAnon appears to rise specifically in response to late government risk communication about the virus, with a degree of regional heterogeneity, as effects were overall larger in the Americas, Oceania and Europe. These results should serve as a caution for policymakers in future developments with the COVID-19 pandemic and, in other crises, as they may arise: the late communication of risk can foster the rise of extreme ideas. We believe this is an important result, especially in a world where misinformation is rife.

In the pre-registered Study 2, we found only limited evidence of a relationship between government communication timeliness and self-reported beliefs in other conspiracies around the COVID-19 pandemic. Specifically, we did not find evidence that respondents in countries with later government communication think that COVID-19 is a conspiracy to establish an authoritarian government or a hoax perpetrated by interest groups for financial gains. Once we account for observable differences between countries and individual respondents, we do find evidence of higher conspiracy beliefs for the latter outcome, but not for the former. The overall picture emerging from Study 2 is thus mixed, with only limited indication that self-reported conspiracy beliefs respond to the timeliness of communication. Overall, we believe it is reassuring to observe that not all conspiratorial ideas respond equally to government (in)action.

DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/restrictions: Part of the data used for this article is proprietary (the International Country Risk Guide). We are happy to share our replication data with users who have access to the ICRG. Requests to access these datasets should be directed to PRS Group.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

HC: conceptualization, formal analysis, and writing – review and editing. SR: conceptualization, writing – original draft, and writing – review and editing. AS: conceptualization, validation, formal analysis, and writing – original draft. BT: conceptualization, methodology, and writing – review and editing. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2021.681975/full#supplementary-material

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Willingness to Vaccinate Against COVID-19: The Role of Health Locus of Control and Conspiracy Theories

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Understanding the predictors of the willingness to get vaccinated against COVID-19 may aid in the resolution of current and future pandemics. We investigate how the readiness to believe conspiracy theories and the three dimensions of health locus of control (HLOC) affect the attitude toward vaccination. A cross-sectional study was conducted based on the data from an online survey of a sample of Czech university students (n = 866) collected in January 2021, using the multivariate linear regression models and moderation analysis. The results found that 60% of Czech students wanted to get vaccinated against COVID-19. In addition, 40% of the variance of willingness to get vaccinated was explained by the belief in the COVID-19-related conspiracy theories and the powerful others dimension of HLOC. One-sixth of the variance of the willingness to get vaccinated was explained by HLOC, cognitive reflection, and digital health literacy [eHealth Literacy Scale (EHEALS)]. HLOC and conspiracy mentality (CM) and its predictors are valid predictors of a hesitancy to get vaccinated against COVID-19. The campaigns promoting vaccination should target the groups specifically vulnerable to the conspiracy theories and lacking HLOC related to powerful others.

Keywords: COVID-19, pandemics, vaccination, willingness to get vaccinated, conspiracy theories, health locus of control, conspiracy mentality

INTRODUCTION

The vaccination campaign against COVID-19 was launched in December 2020 in the Czech Republic, with only half of the population willing to get vaccinated a month later (National Pandemic Alarm, 2021). Vaccination plays a major role in stopping the pandemics, while the cognitive, emotional, and social processes shape public compliance with protective measures, such as vaccination. The WHO (2020) highlights the importance of addressing the "infodemic" as a part of the pandemic response and scientists point to the importance of taking into consideration the social and behavioral factors (Van Bavel et al., 2020) and research that can "inform contextualized campaigns and information-sharing that will ultimately result in increased confidence in

and uptake of available vaccines" (Machingaidze and Wiysonge, 2021, p. 1339). Such research needs to investigate how individuals gather and interpret information about and the reason for or against the vaccines, as the primary motivation to get vaccinated is related to the perceived costs and benefits for personal well-being (Solís Arce et al., 2021). Further, studying the predictors of vaccination intentions is important for understanding the reasons and beliefs behind vaccine refusal rather than blaming those who refuse them (refer to Williams, 2021). The intention to get vaccinated against COVID-19 (VAC) is, among other predictors, associated with the beliefs in the COVID-19-related conspiracy theories and about how human health is determined by *health locus of control* (HLOC), which are examined by the present study.

Health locus of control consists of three relatively independent dimensions: *internal* (the belief that health is determined by the internal factors and personal effort) and two external ones: the *powerful others dimension* summarizing the belief that health is determined by other persons, especially the medical personnel and family members, and last, *the chance dimension*, or the belief that health depends on chance, God, or destiny (Wallston et al., 1978). *Internal* dimension tends to be positively related to the health behavior, medication adherence, and self-reported health status and *chance* dimension to psychological distress and lack of adherence (Wallston, 2004; Grotz et al., 2011; Náfrádi et al., 2017; West et al., 2018). The role of the *powerful others* dimension is more complex, as it places health control in the hands of medical professionals and other people may yield different outcomes (Grotz et al., 2011; Náfrádi et al., 2017; West et al., 2018). Interaction of two dimensions or interaction of an HLOC dimension with another construct may play a crucial role (Wallston, 2004; O'Hea et al., 2005). With respect to vaccination, the *chance* dimension correlated with the vaccination intentions negatively (Chapman and Coups, 1999) and *powerful others* (Zhang et al., 2012; Kan et al., 2018) and *internal* HLOC (HLOC_I) (Tinsley and Holtgrave, 1989; Chapman and Coups, 1999) positively, although Kan et al. (2018) found opposite associations for the *chance* and *internal* HLOC, and the associations were not confirmed by Nexøe et al. (1999). In a recent model of the attitudes of parents toward child vaccination, the *internal* and *powerful others* HLOC is linked with pro-vaccination and *chance* HLOC is linked with the anti-vaccination attitudes (Aharon et al., 2018). Recently, the negative link between the *chance* of HLOC and the willingness to get vaccinated against COVID-19 was confirmed (Olagoke et al., 2021).

The intentions to vaccinate may be negatively affected by the conspiracy theories (Jolley and Douglas, 2014). In the case of COVID-19, a lack of willingness to get vaccinated was associated with the COVID-19-related conspiracy beliefs (Romer and Jamieson, 2020) and a gradual decrease in the vaccination intentions throughout 2020 was linked with the COVID-19-related misinformation (Robinson et al., 2021). Conspiracy theories are "attempts to explain the ultimate causes of significant social and political events and circumstances with claims of secret plots by two or more powerful actors" (Douglas et al., 2019, p. 4). The conspiracy claims, such as that COVID-19 is a hoax, or that it was spread intentionally, reduce compliance with protective measures and restrictions (Bierwiaczonek et al., 2020; Imhoff and Lamberty, 2020; Pummerer et al., 2021; as shown in Douglas, 2021 for an overview). Conspiracy mentality (CM) is studied as the individual predisposition to believe in conspiracy theories because beliefs in conspiracy theories from various domains are intercorrelated, even if the beliefs contradict each other (Wood et al., 2012; Imhoff and Bruder, 2013). CM is related to the external locus of control (Abalakina-Paap et al., 1999) and the belief in COVID-19-related conspiracy theories (Imhoff and Lamberty, 2020), and in those who perceive low support for the vaccination in their social environment, it predicts low vaccination intentions (Winter et al., 2021). CM is itself predicted by *dissociation* (Charlton, 2014) and *cognitive reflection*—the ability to reflect upon whether the result of an intuitive cognitive process is correct (Stoica and Umbreș, 2020). The COVID-19-related conspiracy theories are also associated with low *digital health literacy* (EHEALS) (Naeem and Boulos, 2021; Pickles et al., 2021), which is "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem" (WHO, 2013, p. 61).

In our previous study on the same sample, we have shown that the COVID-19-related conspiracy theories were indeed predicted by digital health literacy, dissociation tendencies, and cognitive reflection and that the effect of the latter two was mediated by CM (Pisl et al., 2021). The present study further extends these results with respect to the vaccination intentions, studying the effects of HLOC and conspiracy theories and their predictors on the willingness to get vaccinated against COVID-19. Based on the model of Aharon et al. (2018), we hypothesize that the *internal* and *powerful others* HLOC is linked with higher and *chance* HLOC with the lower willingness of the university students of Czech to get vaccinated against COVID-19. With respect to the conspiracy theories, we examine how these conspiracy theories and their predictors influence the willingness to get vaccinated against COVID-19 in three steps. In the first model, we will test the effects of HLOC and belief in the COVID-19-related conspiracy theories on VAC. In the second model, we will test the effects of HLOC and the predictors of COVID-19-related conspiracy theories on VAC, expecting VAC to be related to the low CM and high digital health literacy. Further, we expect the effect of *internal* HLOC to interact with the CM and digital health literacy, indicating that the positive effect of *internal* HLOC on vaccination is higher in those who are well-informed and less susceptible to the conspiracy theories. In the third model, we will test the effects of HLOC, digital health literacy, and predictors of CM on VAC, expecting VAC to be related to low dissociation and high cognitive reflection.

MATERIALS AND METHODS

Materials

Health locus of control was measured by the Multidimensional HLOC scale (MHLOC), version A (Wallston et al., 1978), a short instrument with acceptable reliability (Cronbach's alpha usually

hovers in the range 0.65–0.70) (Wallston, 2004), consisting of 18 items measuring three separate and only slightly intercorrelated dimensions: the belief that it is the subject who has control over their health (*internal* HLOC, HLOC_I), the belief that health of an individual is controlled by others (e.g., health professionals and family; *powerful others* HLOC, HLOC_P), and the belief that health is controlled by *chance* (HLOC_C). The answers were recorded on the 6-point Likert scales that were later converted to numbers ranging from 1 to 6 (6 meaning highest agreement), yielding three summary scores ranging from 6 to 36.

The vaccination intention (VAC) was measured by a single question: "How likely is it that you are going to get vaccinated against COVID-19" with 11 options ranging from 0 to 100%.

The measures of other variables were described previously by Pisl et al. (2021). **Experience with dissociation** was measured by the Dissociative Experience Scale (DES) (Ptáček and Bob, 2009), **CM** by the CM Questionnaire (CMQ) (Bruder et al., 2013), **cognitive reflection** by the cognitive reflection test (CRT) (Frederick, 2005), and digital health literacy (EHEALS) by the eHealth Literacy Scale (eHEALS) (Norman and Skinner, 2006). **The belief in two COVID-19-related conspiracy theories**, namely, that COVID-19 is a hoax, and that COVID-19 was created intentionally by humans, was measured by two scales, each consisting of three items, adopted from Imhoff and Lamberty (2020). The three items in the HOAX subscale are: "The virus is intentionally presented as dangerous in order to mislead the public," "Experts intentionally mislead us for their benefit, even though the virus is not worse than a flu," and "We should believe experts when they say that the virus is dangerous" (reverse-coded). The three items used in the CREATED subscale are: "Corona was intentionally brought into the world to reduce the population," "Dark forces want to use the virus to rule the world," and "I think it's nonsense that the virus was created in a laboratory" (reverse-coded). The Czech translation of the original English scales was confirmed by a back translation.

Participants and Data Collection

The convenience sample consisted of 866 students (mean age 23.58 years; 621 women) of medicine, law, and pedagogy at the universities located in Pilsen, Czech Republic. Out of the original 914 responses, seven participants were excluded as they did not belong to the studied population and 40 submissions were excluded as duplicates (for details, refer to Pisl et al., 2021). The participants were delivered a link to an online questionnaire presented *via* Google Forms from their lecturers, consisting of the above-described scales. To avoid any possible effects of priming or self-stylization with respect to the COVID-19-related beliefs that might possibly influence the responses to the DES and CMQ, the questions regarding COVID-19 were placed at the end of the questionnaire, and coronavirus was not mentioned in the introduction of the aims of the research. The study was approved by the Ethics Committee of the University Hospital and Faculty of Medicine in Pilsen (No. 49/2021), Czech.

Settings

Data were collected between January 8 and January 21, 2021, during the second pandemic peak in the Czech Republic, shortly after vaccines were introduced and before they were made available to the general population. The first dose of the vaccine was given to a politician on December 27, 2020, and between then and January 21, 2021, 175,999 inhabitants, or 1.7% of the population received at least one dose (Mathieu et al., 2021). As of January 21, 2021, 15,445 persons died of coronavirus in the country of 10 million, according to government statistics (MZCR, 2021), with a mean of 164 daily deaths during the data collection period. According to a longitudinal panel survey with a sample representative of the Czech population above 15 years old, 78.4% of people of Czechs knew someone who was or had been ill with COVID-19 (National Pandemic Alarm, 2021). The pandemic-related concerns were rising since the previous November, together with the increasing perceived personal impact of the restrictions and dropping trust in the government (National Pandemic Alarm, 2021). The students were attending their lectures online and the national state of emergency was, except for 2 weeks before Christmas, in effect since October 2020, together with a night curfew, a general stay-at-home order, and the closure of many industries, such as hospitality, entertainment, and sport.

Statistical Analysis

The scores for each scale were calculated as the sums of all items for scales of HLOC and CRT and as means for DES, CM, EHEALS, and (converting the reverse-scored questions) CC_HOAX, and CC_CREATED. In CRT, the inputs not containing any answer were interpreted as lack of effort rather than lack of ability to solve the puzzle and labeled as the missing values rather than the incorrect answers. A forced entry multiple linear regression analysis was used to evaluate the effect of the independent variables on the vaccination intentions in three different models, using the function "lm()" with its predefined parameters. For testing the interactions, moderation analysis was used as described by Wu and Zumbo (2008). The analysis was conducted in R 3.6.3, using the packages tidyverse (Wickham et al., 2019), psych (Revelle, 2020), and QuantPsyc (Fletcher, 2012); the figures were created using sjPlot (Lüdecke, 2021).

RESULTS

Descriptive Statistics

In the sample of 866 university students, 65.70% reported the probability that they would get vaccinated against COVID-19 as higher than 50%; the mean reported probability was 67.48%. Further descriptive values are depicted in **Table 1**. As shown in **Table 2**, all the scales used had at least acceptable reliability, especially taking into consideration the low number of items of some scales, and intercorrelations found elsewhere (refer to, for instance, Wallston, 2004).

Model 1

A multiple regression model using belief in COVID-19-related conspiracies and three dimensions of HLOC as predictors explained 40.21% of the variance of willingness to get vaccinated [$R^2 = 0.40$, $F(5,860) = 115.70$, $p < 0.001$]. VAC was most strongly predicted by the belief that COVID-19 is a hoax ($\beta = -0.67$,

$p < 0.001$), followed by the belief that COVID-19 was created ($\beta = -0.16$, $p < 0.001$), and *powerful others* HLOC ($\beta = 0.16$, $p < 0.001$), while the other two dimensions of HLOC had no effect (both the values of $p > 0.3$). The results summarized in **Table 3** and visualized in **Figure 1A** support our hypothesis about VAC being predicted by the belief in the COVID-19-related conspiracy theories and reveal that when conspiracy theories about COVID-19 are taken into account, VAC is predicted by *powerful others*, but not internal or chance HLOC.

Model 2

A multiple regression model using CM, digital health literacy, and three dimensions of HLOC as predictors explained 17.23% of the variance of willingness to get vaccinated [$R^2 = 0.17$, $F(5,860) = 35.81$, $p < 0.001$]. VAC was most strongly predicted by *powerful others* HLOC ($\beta = 0.32$, $p < 0.001$), followed by CM ($\beta = -0.22$, $p < 0.001$), digital health literacy ($\beta = 0.11$, $p < 0.001$), *internal* ($\beta = -0.08$, $p < 0.05$), and *chance* ($\beta = -0.08$, $p < 0.05$) HLOC. The results summarized in **Table 3** and visualized in **Figure 1B** support our hypotheses about VAC being related to the CM and digital health literacy. Further, the results reveal that when CM and digital health literacy are taken into account, VAC is linked to low *internal* HLOC (contrary to our expectations), high *powerful others* HLOC, and low *chance* HLOC.

The moderation analysis was used to test whether the HLOC_I effect on the vaccination intentions may be moderated by the CM or digital health literacy (EHEALS). To test this, the HLOC_I and VAC scores were centered and scaled, and a regression model predicting CM (or EHEALS, respectively) based on the HLOC_I and VAC was compared with the same model containing the product of HLOC_I and VAC. The results of ANOVA revealed that the models did not differ significantly, indicating that there was no significant moderation effect of either EHEALS [$F(1,862) = 1.85$, $p = 0.17$] or CM [$F(1,862) = 1.63$, $p = 0.20$] on the link between HLOC_I on VAC. Therefore, our hypothesis that the effect of HLOC_I on vaccination intentions (VAC) may be moderated by CM and/or EHEALS is not supported by the data.

Model 3

A multiple regression model using experience with dissociation, cognitive reflection, digital health literacy, and three dimensions of HLOC as predictors explained 15.53% of the variance of the willingness to get vaccinated [$R^2 = 0.16$, $F(5,860) = 25.58$,

TABLE 1 | Descriptive statistics.

	n	Min	Max	Mean	Med	Standard deviation	Standard Error	Skew	Kurtosis
DES	866	0	78.21	17.58	14.11	13.1	0.45	1.24	1.53
CM	866	2	100	56.04	58	20.21	0.69	−0.15	−0.47
HOAX	866	0	100	23.60	16.67	24.22	0.82	0.95	0
CREATED	866	0	100	29.77	26.67	21.76	0.74	0.66	−0.11
EHEALS	866	1	5	3.85	4	0.82	0.03	−0.66	0.07
CRT	842	0	3	1.51	2	1.19	0.04	−0.05	−1.52
HLOC_I	866	11	36	25.04	25	4.27	0.15	−0.24	0.15
HLOC_C	866	6	34	16.19	16	4.93	0.17	0.4	0.18
HLOC_P	866	6	34	19.60	20	4.65	0.16	−0.15	−0.09
VAC	866	0	100	67.48	80	33.63	1.14	−0.73	−0.89

DES, Dissociation Experience Scale; CM, conspiracy mentality; HOAX, a conspiracy theory that COVID-19 is a hoax; CREATED, a conspiracy theory that COVID-19 is human-made; EHEALS, digital health literacy; CRT, cognitive reflection test; HLOC_I, HLOC_C, and HLOC_P, dimensions of health locus of control: internal, chance, and powerful others; VAC, willingness to get vaccinated.

TABLE 2 | Correlation matrix.

	Cronbach's alpha (Number of items)	DES	CM	HOAX	CREATED	EHEALS	CRT	HLOC_I	HLOC_C	HLOC_P
DES	0.93 (28)									
CM	0.82 (5)	0.33								
HOAX	0.88 (3)	0.15	0.30							
CREATED	0.67 (3)	0.17	0.42	0.46						
EHEALS	0.92 (8)	−0.08	−0.06	−0.14	−0.11					
CRT	0.73 (3)	−0.16	−0.19	−0.21	−0.25	0.05				
HLOC_I	0.67 (6)	0.02	0.05	0.05	−0.02	0.23	0.02			
HLOC_C	0.69 (6)	0.17	0.09	0.10	0.13	−0.06	−0.09	−0.10		
HLOC_P	0.66 (6)	0.02	−0.04	−0.26	−0.14	0.04	0.06	0.08	0.23	
VAC	NA (1)	−0.09	−0.25	−0.60	−0.41	0.12	0.20	−0.04	−0.04	0.30

DES, Dissociation Experience Scale; CM, conspiracy mentality; HOAX, a conspiracy theory that COVID-19 is a hoax; CREATED, a conspiracy theory that COVID-19 is human-made; EHEALS, digital health literacy; CRT, cognitive reflection test; HLOC_I, HLOC_C, and HLOC_P, dimensions of health locus of control: internal, chance, and powerful others; VAC, willingness to get vaccinated.

TABLE 3 | The multivariate linear regression predicting the vaccination intentions (Models 1–3).

	MODEL 1				MODEL 2				MODEL 3			
Predictors	***Estimates***	***Beta***	***t***	***p***	***Estimates***	***Beta***	***t***	***p***	***Estimates***	***Beta***	***t***	***p***
(Intercept)	73.15	−0.00	10.47	**<0.001**	50.24	−0.00	5.46	**<0.001**	29.81	0.00	3.26	**0.001**
CC_HOAX	−0.67	−0.48	−15.52	**<0.001**								
CC_CREATED	−0.25	−0.16	−5.45	**<0.001**								
HLOC_I	−0.20	−0.03	−0.97	0.332	−0.61	−0.08	−2.41	**0.016**	−0.77	−0.10	−2.97	**0.003**
HLOC_C	0.02	0.00	0.10	0.919	−0.56	−0.08	−2.54	**0.011**	−0.66	−0.10	−2.91	**0.004**
HLOC_P	1.14	0.16	5.51	**<0.001**	2.33	0.32	10.02	**<0.001**	2.31	0.32	9.74	**<0.001**
CM					−0.37	−0.22	−7.14	**<0.001**				
EHEALS					4.38	0.11	3.36	**0.001**	4.51	0.11	3.36	**0.001**
DES									−0.10	−0.04	−1.19	0.236
CRT									4.62	0.16	5.07	**<0.001**
Observations	866				866				842			
R^2/R^2 adjusted	0.402/0.399				0.172/0.168				0.155/0.149			

Estimates, beta, unstandardized and standardized regression coefficient; HOAX, a conspiracy theory that COVID-19 is a hoax; CREATED, a conspiracy theory that COVID-19 is human-made; HLOC_I, HLOC_C, and HLOC_P, dimensions of health locus of control: internal, chance, and powerful others; CM, conspiracy mentality; EHEALS, digital health literacy; DES, Dissociation Experience Scale; CRT, cognitive reflection test; VAC, willingness to get vaccinated; p-values < 0.05 in bold.

$p < 0.001$]. VAC was most strongly predicted by *powerful others* HLOC ($\beta = 0.32$, $p < 0.001$), followed by cognitive reflection ($\beta = 0.22$, $p < 0.001$), digital health literacy ($\beta = 0.11$, $p < 0.001$), *internal* ($\beta = -0.10$, $p < 0.01$), and *chance* ($\beta = -0.10$, $p < 0.01$) HLOC, while the effect of dissociation was not significant ($p = 0.23$). The results summarized in **Table 3** and visualized in **Figure 1C** confirm the hypothesized effect of cognitive reflection on VAC but not the effect of dissociation on VAC. Further, they reveal that when dissociation and cognitive reflection are taken into account, VAC is linked to high *powerful others* HLOC, low *chance* HLOC, and low *internal* HLOC.

The results indicate that a one SD increase of *powerful others* dimension of HLOC was linked to an additional 10.76% of the subjectively estimated probability that the individual was going to get vaccinated against COVID-19. Similarly, a one SD increase in cognitive reflection and digital health literacy was linked to an additional 5.38% (CRT) and 3.70% (EHEALS) of the subjectively estimated probability that the individual was going to get vaccinated, and a decrease of one SD in *internal* or *chance* dimensions of HLOC was linked to an additional 3.36% of the subjectively estimated probability of getting vaccinated.

DISCUSSION

The presented data support the hypotheses that the willingness to get vaccinated against COVID-19 is reduced by the belief in COVID-19-related conspiracy theories and its predictors: CM, low digital health literacy, and low cognitive reflection. Experience with dissociation had no effect on the willingness to get vaccinated. The vaccination intentions were strongly positively related to the *powerful others* dimension of HLOC and negatively to *chance* HLOC. Contrary to our expectations, *internal* HLOC also reduced the vaccination intentions and the effect of *internal* HLOC was not moderated by CM or digital health literacy.

The result showed that 66% of Czech university students participating in our study were willing to get vaccinated. Our result is consistent with the previous findings that 60–79% of the population was going to get vaccinated worldwide in the summer of 2020 and that the willingness to get vaccinated against COVID-19 was decreasing through the year 2020, with Eastern Europe (represented by Poland) showing the lowest vaccination intentions (Robinson et al., 2021). Considering the national representative survey with 50.3–50.4% of Czechs planning vaccination against COVID-19 (National Pandemic Alarm, 2021), our university student sample was showing above-average vaccination intentions, suggesting that the positive effect of higher education on the willingness to get vaccinated (Schwarzinger et al., 2021) was stronger than the negative effect of younger age (Neumann-Böhme et al., 2020; Robinson et al., 2021). It may also support the findings of some studies that the relationship between the vaccination intentions and age may be "U"-shaped rather than linear, with the middle-aged being least willing to get vaccinated (Kourlaba et al., 2021; Schwarzinger et al., 2021).

The vaccination intentions were predicted by COVID-19-related conspiracy theories. Further, they were predicted by digital health literacy, CM, and cognitive reflection. This is consistent with the previous research revealing a positive link between the vaccination intentions and cognitive reflection as a proxy of analytical cognitive style (Murphy et al., 2021). The observed effect of cognitive reflection on the vaccination intentions also mimics the results of an experimental study showing that promoting rational decision-making increases the intentions to wear a face mask (Capraro and Barcelo, 2021), indicating that our observations may be used to inspire interventions. Health literacy was also found to be predictive of higher vaccination intake under the conditions of a high risk of getting sick and complications in the short-term (Lorini et al., 2018)—conditions which are certainly satisfied with respect to the current pandemic. The experience with dissociation was

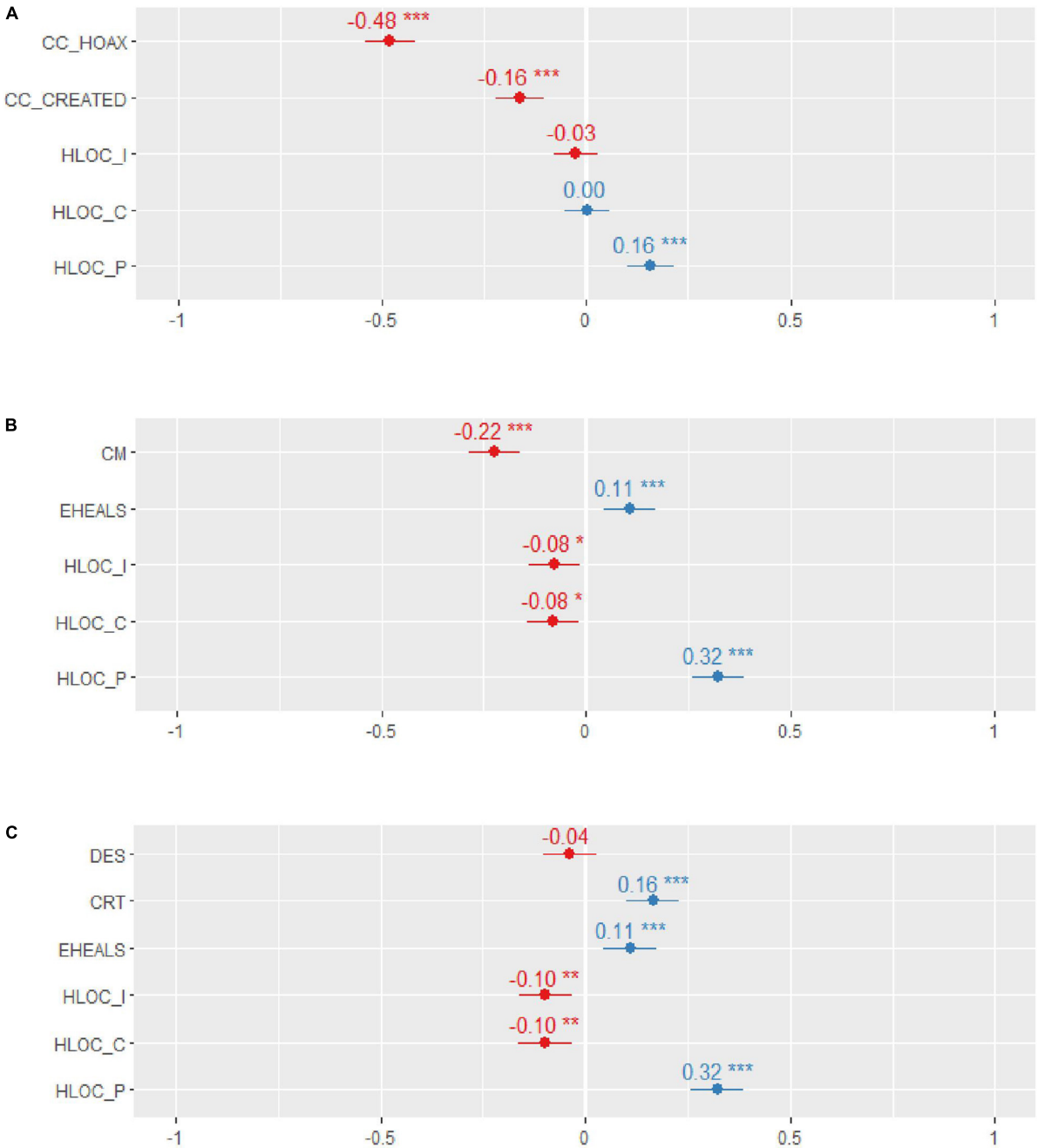

FIGURE 1 | The effects of predictors on the willingness to get vaccinated. Beta coefficients of variables predicting willingness to get vaccinated in the linear regression model 1 **(A)**, 2 **(B)**, and 3 **(C)**. CC_HOAX, a conspiracy theory that COVID-19 is a hoax; CC_CREATED, a conspiracy theory that COVID-19 is human-made; CM, conspiracy mentality; EHEALS, digital health literacy; DES, Dissociation Experience Scale; CRT, cognitive reflection test; HLOC_I, HLOC_C, and HLOC_P, internal, chance, and powerful others dimension of health locus of control. *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$.

not predictive of vaccination intention, even though it was predictive of CM (Pisl et al., 2021) which, in turn, predicted lower vaccination intentions. Given that the effect of paranormal thinking on belief in conspiracy theories is reduced by education (Douglas et al., 2016), the expected negative effect of dissociation experience on the vaccination intentions might possibly be present in the general population, although it was not reflected in our highly educated sample of university students. Alternatively, it is possible that while dissociation increases belief in the conspiracy theories, its effect does not translate into the changes in attitude toward vaccination.

The *powerful others* dimension of HLOC was strongly positively related to the intention of getting vaccinated, while the two other dimensions of HLOC (*internal* and *chance*) were

related to vaccination weakly and negatively. A recent study found the same pattern of the effects of HLOC on the vaccine intentions in British, but not in an Irish representative sample of the general adult population (Murphy et al., 2021). Our data are also consistent with the previous findings that *powerful others* HLOC is positively related to pro-vaccination attitudes in parents (Tinsley and Holtgrave, 1989; Aharon et al., 2018) and nurses (Zhang et al., 2012; Kan et al., 2018), even though no effect of HLOC was found with respect to influenza vaccination in the elderly (Nexøe et al., 1999). Given that *powerful others* HLOC correlates with trust in the physicians (Brincks et al., 2010) and concerns related to side-effects and safety of vaccines are the top reasons for vaccine hesitation and refusal (Neumann-Böhme et al., 2020), the link between HLOC and willingness to get vaccinated may be mediated by trust in the medical professionals.

The *chance* HLOC was negatively related to the intention to get vaccinated in the latter two models, which is again consistent with the attitudes of parents toward vaccination (Aharon et al., 2018) as well as recent findings that the *chance* HLOC partly mediates the negative relationship between the religiosity and vaccination intentions (Olagoke et al., 2021). The absence of effect of *chance* HLOC in the first model, when two particular conspiracy theories were included, might reflect the correlation between the conspiracy beliefs and external HLOC in general (Abalakina-Paap et al., 1999).

The *internal* dimension of HLOC predicted the lower vaccination intentions in the latter two models. This is contrary to the model based on the attitudes of parents toward vaccination (Aharon et al., 2018) but consistent with the recent findings from Great Britain and Ireland (Murphy et al., 2021). The patients with higher *internal* HLOC might be more prone to follow their judgment rather than the advice of the professional community, as vaccine hesitancy may be an act of self-empowerment (Velan, 2016). In such cases, we would expect the link between the *internal* HLOC and vaccination intentions to be moderated by digital health literacy and/or CM, as it would be those individuals who lack health literacy and/or are prone to conspiracy thinking, for whom high *internal* HLOC would result in vaccine hesitancy. However, such moderation was not found in our data. Noticing that the findings of negative associations between *internal* HLOC and the willingness to get vaccinated come from highly informed samples, considering the medialization of COVID-19 in our study and in Murphy et al. (2021) and the medical background of the sample of Kan et al. (2018), we propose that *internal* HLOC may increase the vaccination intentions in the less-informed populations (perhaps increasing their awareness of the benefits or the mere existence of the vaccine) and decrease it in more informed ones (perhaps increasing the safety or efficacy concerns).

Our results may serve as a warning that promoting *internal* HLOC with respect to COVID-19 might come with an adverse effect on the willingness to get vaccinated. This is relevant, because the *internal* HLOC was previously found to be related to higher information seeking and lower depression, anxiety, and stress symptoms during the pandemic, and promoting it was suggested to reduce the psychiatric burden of COVID-19 (Sigurvinsdottir et al., 2020). This might be especially relevant for younger populations, as *internal* HLOC tends to decrease with age, together with a decreasing capacity to influence the health outcomes of an individual (Bailis et al., 2010). With respect to this age-specific pattern, the negative effect of *internal* HLOC on the willingness to get vaccinated might reflect overestimating the ability of an individual to cope with COVID-19 or reducing complacency in terms of the Confidence, Complacency, and Convenience Model of Vaccine Hesitancy (WHO, 2014). Such explanations would fit the finding that considering COVID-19 harmless is the third most popular reason for refusing vaccination in Europe (after concerns about vaccine side-effects and safety; Neumann-Böhme et al., 2020).

Altogether, 40% of the variance of vaccination intentions are explained by the belief in the COVID-19-related conspiracy theories and *powerful others* HLOC. Our final model then explained 16% of the variance of vaccination intentions based on cognitive reflection, digital health literacy, and HLOC. HLOC (the *powerful others* dimension in particular) was found to have the largest effect on the vaccination intentions, followed by the cognitive reflection, EHEALS, and the other two dimensions of HLOC. The effect of dissociation experience was not confirmed.

Recommendations

Reducing proneness to believing in the conspiracy theories by increasing analytical thinking and digital health literacy may increase the willingness to comply with the recommendations to get vaccinated in general. In the short-term, disproving the COVID-19-related conspiracy theories may have a positive effect on the willingness to get vaccinated against COVID-19. Furthermore, the positive link between *powerful others* HLOC and the willingness to get vaccinated suggests that the campaigns promoting vaccinations should target especially those not connecting their health with other persons. Because the persuasiveness of health-related promotion campaigns is increased when matching the prevailing HLOC of an audience (Williams-Piehota et al., 2004), the promotional messages should be created to appeal to audiences deriving their health from internal decisions ("Vaccination – your gift to yourself!") or chance and destiny ("Destined to get vaccinated!"), rather than to those connecting their health with *powerful others* ("Scientists and doctors say: get vaccinated!"). Furthermore, the attempts to promote vaccination against COVID-19 should target those with intuitive rather than analytical cognitive style has given the lower vaccination intentions in those with low cognitive reflection.

Further Research

Possible mediators of the effect of *powerful others* HLOC on the vaccination intentions should be examined. To find ways to increase the intentions to get vaccinated, it would be beneficial to learn whether the effect of HLOC, which is relatively stable and developed in childhood (Lau, 1982), on the vaccination intentions may be mediated by something readier to change, such as the trust in health professionals. The effect of *internal* HLOC on the vaccination intentions and other health attitudes remains elusive and should be studied, especially with relation to how well subjects are informed about the scrutinized subject.

Limitations

The timing of the data collection in the weeks after the vaccination campaign was started limits the generalization of the absolute numbers. The immediate effect of pandemics on individual lives may strengthen the political and epistemic predictors of the conspiratorial explanations at the expense of the psychological ones (Hartman et al., 2020), which may have affected the attitudes toward vaccination. Further, the weekly number of persons met for at least 5 min in person was reduced to 17–18 in the respective period according to data on a representative Czech sample between 18 and 34 years of age (compared with up to 29.5 when the restrictions were loosened in summer 2020; Zivot behem pandemie, 2021). This might have affected our estimate of the relative importance of personal predictors and social factors with respect to the vaccination intentions. For instance, the personal willingness to get vaccinated is positively associated with the estimated vaccination intentions of peers and society (Agranov et al., 2021; Graupensperger et al., 2021). With peer interactions taking place online and offline (Luo et al., 2021), the effects of restricting personal contacts on social factors are complex, limiting the generalization of our findings beyond the end of the pandemic restrictions. Besides the restrictions, social processes tend to be affected by the experience of a disastrous event such as a pandemic (Sullivan, 2014; Townshend et al., 2015), which might have, again, affected the conspiracy beliefs as well as the willingness to comply with the recommendations to get vaccinated in a manner specific for a given time and place. Further, the survey answers of the participants about willingness to vaccinate might differ from their actual decision. For example, in a study of Dutch healthcare professionals, only 73.9% of those reporting high intention to get vaccinated against influenza in a survey were vaccinated a month later (compared with 1.3% of those with no intention; Lehmann et al., 2014).

The sample of university students may have influenced the effects of the scrutinized factors on the beliefs in conspiracy theories, *via* the above-mentioned effects of age and education on the willingness to get vaccinated and by the heterogeneity related to different fields of their studies. Also, our sample included predominantly (72%) female participants and women who have lower vaccination intentions and acceptance than men across the countries (Wang et al., 2021; Zintel et al., 2021), with the effect of gender being partly mediated by perceived behavioral control in the British and German samples (Sieverding et al., 2021). Because perceived behavioral control is conceptually related to HLOC, this might have affected the observed effects, although the link between both the constructs is weak, with HLOC explaining only 4% of the variance in the perceived behavioral control (Armitage, 2003). Only two COVID-19-related conspiracy theories were used for the analysis, limiting its generalizability to the whole scope of conspiracy beliefs about coronavirus.

CONCLUSION

In the study, two-thirds of our sample of Czech university students were willing to get vaccinated in January 2021, outpacing the national average of 50% of the population. About 40% of the variance of the willingness to get vaccinated was explained by *powerful others* HLOC and two conspiracy beliefs, indicating that a substantial part of vaccine refusal is a consequence of individual beliefs and characteristics rather than a moral decision one can be blamed for. One-sixth of the variance of vaccination intentions was explained by cognitive reflection, digital health literacy, and—especially—HLOC, showing that the psychological variables are relevant for the willingness to get vaccinated against COVID-19. The understanding of the predictors of vaccination intentions should be reflected in the campaigns promoting vaccination against COVID-19.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of the University Hospital and the Faculty of Medicine, Charles University in Pilsen (49/2021, 4th February 2021). The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

JVe, JVo, and VP: conceptualization. VP, JVe, and EC: methodology. VP and EC: formal analysis. VP, JVe, and GK: investigation. JVe, GK, KC, and VP: resources. VP: writing—original draft preparation. JVo, JVe, EC, GK, KC, and VP: writing—review and editing. JVe: supervision, project administration, and funding acquisition. All authors contributed to the article and approved the submitted version.

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Investigating the Relationships Between Public Health Literacy and Public Trust in Physicians in China's Control of COVID-19: A Cross-Sectional Study

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Objective: Public trust in physicians and public health literacy (HL) are important factors that ensure the effectiveness of health-care delivery, particularly that provided during the SARS-CoV-2 pandemic. This study investigates HL as a predictor of public trust in physicians in China's ongoing efforts to control COVID-19.

Methods: Data were gathered in February 2020 during the peak of the disease in China. Based on Nutbeam's conceptualization of HL, we measure HL vis-à-vis COVID-19 by using a six-item scale that includes two items each for functional, interactive, and critical HL. Trust in physicians was measured by assessing physicians' capability to diagnose COVID-19. A rank-sum test and ordinal logit regression modeling were used to analyze the data.

Results: Two key findings: (a) trust in physician handling of treatment for COVID-19 is reported by about 74% of respondents; and (b) five of the six HL measures are positive predictors of public trust in physician treatment of the disease, with functional HL1 having the highest level of such association (coefficient 0.285, odds ratio 1.33%, $p < 0.01$).

Conclusions: Improving public HL is important for better public-physician relationships, as well as for nations' efforts to contain the pandemic, serving as a possible behavioral, non-clinical antidote to COVID-19. Being confronted with the unprecedented virus, humans need trust. Health education and risk communication can improve public compliance with physicians' requirements and build a solid foundation for collective responses.

Keywords: China, COVID-19, health literacy, trust in physicians, agency theory

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INTRODUCTION

The urgency and the forthrightness with which a clinical response to the onslaught of COVID-19 was implemented was totemic of the resolve of the worldwide community of interests to ensure global public health. Even so, in the industrialized West, particularly, public protests have been launched, based on the rationales of individual liberty and of freedom of choice, to undermine and defy government measures to control the raging

pandemic (1–4). Concerns have also been expressed over the safety and efficacy of some vaccines that are being marketed as critical to protecting the public from COVID-19 (5). From an institutional perspective, one word looms large in the current global response to the public-health impact of SARS-CoV-2: trust (6–10). A burgeoning issue in that context is that China and the rest of the world are confronting a profound crisis of trust in patient-physician relationships (11–15). That mistrust is exacerbated by the evolving COVID-19 pandemic, for which there is a global race to develop and distribute therapeutics and vaccines to protect public health. That race is underscored, particularly in China, by a parallel public-health need: more interventions that target the general public, aiming to improve health literacy and to promote related behavior change (16, 17). In essence, the severity of mistrust in patient-physician relationships and the concerning levels of health literacy could foment discord whenever people are demonstrably anxious about the virus and about their inconveniences from their responses to it. Public response to such a public-health crisis can further undermine efforts by public-health practitioners to control the viral infection and the spread of the disease. It is, therefore, important that public trust in physicians and the health literacy of the public be investigated as essential factors in accessing COVID-19 health-care services and in complying with their health recommendations. The objective of this study, then, is to explore the relationships between HL and public trust in physicians in China vis-à-vis efforts to control SARS-CoV-2 and to treat patients infected with it. In addition to the goal of having better control of the pandemic, the strained public-physician relationships in China merit more attention in part because violence against physicians threatens the country's health-care system. There has been a significant increase in violence against physicians in China (18). Therefore, this study presents suggestions to promote better public-physician relationships.

Trust has been defined as an optimistic relationship between the trustee and the truster (19). Public trust in physicians represents the public's optimistic attitude toward physicians, with the expectation that they will be competent to treat their diseases. Public trust in physicians is a form of professional trust due to their professional competence in medical services (20). The public has a different level of trust in physicians, and we intend to explore the varying degrees of such trust within the context of controlling COVID-19 in China and its relationship with public-health literacy.

Research demonstrates that public trust in medical professionals in China has declined in recent years (21, 22). Various explanations of this troubling trend have been proffered. They include the overarching issue of "inaccessible and unaffordable health care" (*kan bing nan, kan bing gui*) (23); the minuscule patient-physician communication (24); the financial incentives doctors and hospital administrators receive to promote unnecessary health-care services (25); and the experiences of individual patients, such as their satisfaction with previous medical treatment (21). Hsiao argues that patients' limited HL, particularly regarding medical risk, is a major reason for China's medical-related violence (26). Even though patient education has been suggested as a plausible response to combatting this malaise, no study has demonstrated its effectiveness in enhancing public trust in physicians in China (27, 28). This concerning pattern of low trust has been found in other countries as well. In the United States, for example, the introduction of the efficiency-oriented managed-care system has negatively altered patient-physician relationships, and public trust in physicians declined from a high level in the "golden age of doctoring" to a comparatively low-level today (29, 30). This concern over trust is also apparent in Germany (31). In a cross-sectional study, Germans reported significantly less confidence in health-care providers' professional expertise than the British public has in physicians in England, Wales, and the Netherlands (31).

HL is defined as "the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways that promote and maintain good health" (32) (p. 10). Earlier studies limited the definition to clinical settings, whereas recent research included settings outside hospitals (33), that is, extended to society as a whole. It is critical, then, that research specific to governments' management of COVID-19 be undertaken to ensure, at the microlevel, patient compliance and, at the macrolevel, public safety. It is that lacuna in the extant literature that this work seeks to fill.

Research to date presents conflicting arguments on the potential relationships between them, with findings on both positive and negative associations (34–38). Some researchers have found that higher levels of HL enable patients to be more aware of their own health conditions and to participate in higher-level conversations with physicians, which has led to a deeper sense of trust and better patient-physician relationships (34, 35). In China, cognition- and affect-based trust had a direct positive effect on patient compliance, but internet-health-information seeking had a non-significant impact on patient trust in physicians (39). The authors concluded that seeking internet treatment-related information can improve patient compliance. On the contrary, other studies indicated that high HL, particularly after the emergence of online information, enabled patients to become more knowledgeable and thus more critical of treatments prescribed by their doctors (36, 37). Young, highly educated patients who frequently access online information are regarded as the most critical group and thus are more likely to question doctors' authority rather than be compliant and taciturn (38).

In addition to the two preceding scenarios, there is also the possibility of no association. In other words, it is impossible to find statistical significance between these two variables. For example, self-perceived risk of cardiovascular events was associated with patient follow-up rates; that is, the number of patients who showed up for their clinic appointment suggesting their compliance with physician requests, while patient health literacy did not significantly affect follow-up rates (40). Research

Abbreviations: HL, Health Literacy; UEBMI, Urban Employee Basic Medical Insurance; URBMI, Urban Resident Basic Medical Insurance; NCMS, New Cooperative Medical Scheme; TOFHLA, Test of Functional Health Literacy in Adults; ALLS, Adult Literacy and Life Skills Survey.

findings with regard to the relationship between HL and public trust in physicians are largely dependent on the ethnography of the research. For example, for the positive perceptions literature, hospitals providing inpatient services are a special setting with long-term health-care service (35), and veterans have a greater need to seek multiple medical services (34). Improved HL under these circumstances contributes to a sense of trust because both patients and physicians have more chances to interact with each other, which ultimately reduces misunderstandings between them.

Agency theory and Nutbeam's model of HL guided the development of our framework for investigating the possible association between public trust in physicians and HL. Agency theory enables researchers to understand physician-patient relationships (38, 41). According to the theory, control problems arise from the possibilities of preference discrepancy and information asymmetry between principals and agents (38). In encounters between patients (principals) and physicians (agents), physicians, armed with professional knowledge and experience, prevail in their relationships with patients. Patients, as principals, face their first control problem in their attempts to align physician preferences with those of principals. Skeptics of physician trustworthiness report evidence in physician self-interested behavior, such as the oversupply of services at patients' cost (42). The second control problem arises from information asymmetry, and patients are incapable of monitoring their physicians effectively because of a lack of knowledge. The complexity of medical knowledge and its potential importance for medical treatment make the information gap a very salient issue in the patient-physician relationships. These control disadvantages and patients' perceived vulnerabilities to the threat of diseases nudge them to cede their control over this relationship, making trust a key factor in that relationship (19). However, the proliferation of health-education programs and developments in internet use have resulted in the narrowing of the information gap among some patients (43). The previous physician-dominated relationship evolved into a patient-empowered relationship (38).

Similarly, the definition of HL has also been evolving. Nutbeam identified two approaches to HL: (a) health literacy as a risk factor that needs to be managed, and (b) health literacy as an asset to be built (44). Nutbeam posits that the risk-factor approach in the literature narrows the scope of HL to personal health, mainly occurring in clinical contexts. HL, in this approach, provides individuals with functional knowledge of health care limited to individual literacy and numeracy skills. In the asset approach, individual HL progresses from functional HL to interactive HL and critical HL, providing more empowerment in different healthcare decisions. Interactive HL refers to the capability to apply health information in everyday life and different circumstances; critical HL refers to the capability of analyzing information critically and utilizing that information to exert more control in personal, community, and even social health-care decisions (44) (p. 2075). Nutbeam combines functional HL, interactive HL, and critical HL into a new model of HL for wider application.

Against the preceding backdrop, the purpose of this study is to explore the relationships between HL and public trust in physicians in China vis-à-vis efforts to control SARS-CoV-2. In this study, we hypothesize that public HL will be a positive predictor of public trust in Chinese physicians' control of COVID-19. There are two rationales for this hypothesis. First, the increasing threat of the unprecedented virus has shifted the center of the patient-physician relationship back to the physician side. The literature on patient psychology demonstrates the high level of reliance on physicians for treating severe disease (19, 45). Improving patient knowledge is not likely to challenge physician authority in this circumstance. Second, the control of the pandemic is different from normal health-care services since physicians' opportunistic behavior has been eliminated. The following sections present details on differences between China's control of COVID-19 and normal health care in terms of public trust in physicians. To test the hypothesis, we used a scale of patients' trust in physician knowledge and capability to diagnose and to treat COVID-19 as the dependent variable. For the main independent variable, we used a scale of public HL that includes separate subscales for functional, interactive, and critical HL. A detailed explanation of the measures of the variables is presented in the methods section.

Main Hypothesis: There will be a significant positive correlation between the level of trust in physicians and an individual's HL level.

BACKGROUND: PUBLIC TRUST IN PHYSICIANS DURING THE COVID-19 PANDEMIC IN CHINA

As previously noted, public trust in physicians is not high in China; however, during the management of COVID-19, control measures significantly improved public-physician relationships (46), an outcome that had not occurred since the control of the SARS epidemic in 2003 (47). Public trust in physicians is a dynamic phenomenon, and it varies when certain issues change public attitudes. During COVID-19 in 2020 and the SARS epidemic in 2003, the public witnessed the great sacrifice of medical professionals; that enhanced their trust in physicians.

Post-pandemic, that burgeoning public trust will eventually retreat to pre-pandemic lows. However, these fluctuations in trust have raised serious questions about factors that may be responsible for them. This section includes a delineation of the reasons for an upsweep in public trust of physicians in the COVID-19 pandemic vs. normal circumstances. Using previous models of public trust in physicians or in health-care systems (31, 48), the influences on public trust were divided into three categories: the social conditions, the physician side influences, and the public side influences. The following section was based on those classifications.

Societal Developments

The health-care system and social media have a significant effect on the public's relationship with the medical community.

According to cross-national studies, countries with insurance-based funding for health care have lower public trust in physicians than those with tax-based funding (31). The former type aligns health-care services with commercial transactions and arouses patient consumerist feelings about medical encounters (31). Currently, China has three basic insurance systems: Urban Employee Basic Medical Insurance (UEBMI), Urban Resident Basic Medical Insurance (URBMI), and New Cooperative Medical Scheme (NCMS), which cover more than 98% of the population (49). However, the out-of-pocket payments are exorbitant for many services (50), particularly for low-income patients. Their complaints about unnecessary tests and prescriptions are a reflection of their dim view of the representatives of the health care system—physicians (25). After the COVID-19 outbreak, China's central government decided to foot the bill for all treatment (51), which has done much to allay the public's suspicions regarding physicians' financial motivations.

Meanwhile, the media has contributed to the deterioration of the relationship between physicians and the public (52). China's media comprise both traditional mainstream outlets and new online channels. The idealistic ways in which physicians are portrayed by the mainstream outlets create unrealistically high expectations of them in public. They are depicted as demigods, and these perfect moral images are in direct contrast to the reality that they are just normal people with professional skills (53). In addition, the media also depicted an overly optimistic image of available medical services (52), which causes the public to underestimate the complicated nature and extreme health risks in the real world. Some health-education programs frequently promote the ease of treating severe diseases with simplistic advice from medical experts, especially those in traditional Chinese medicine (54). Unrealistic expectations of physicians are one of many reasons behind this distrust since outrage and indignation are born out of the disillusion of hope (19). Additionally, abundant online information (i.e., Weibo and WeChat, Chinese versions of Facebook and Twitter, respectively) is replete with patients' personal stories of mistreatment that cast doctors in a negative light. Previous studies have documented that net citizens who rely upon online news report a lower level of trust in physicians (55). Therefore, both traditional and online sources are in dire need of stories that portray health-care professionals and medical services in a balanced and realistic way. However, the current dichotomy of good vs. evil in the media only strengthens people's negative perceptions.

Following the outbreak of COVID-19, there has been an increase in the number of positive online comments on health-care professionals (46). Inarguably, their sacrifices in treating COVID patients have earned them praise. Interestingly, positive images have been extended from the traditional media outlets to online sources to the point where negative stories of physicians were hardly ever found on the internet during this period (46). Also, news reports about the disease are unlike those of the pre-pandemic era because the media strives to educate the public about the virulence of the disease and about a new virus that should not be underestimated. People also understand that, even though there are few therapeutic drugs for treating symptoms of the disease, it is plausible that its severity is related to individual immunity (56). Media reports have conveyed a clear public message: that physicians may not have a firm handle on the present health crisis, in contrast to their omnipotent image depicted in pre-pandemic times.

Developments Among Physicians

The characteristics of physicians are also critical to understanding the public's flaccid trust in them. Research shows that patient-physician relationships are also dependent on doctors' technical knowledge and communication skills (19). Previous studies have suggested that physicians use their discretionary power to create a provider-induced oversupply of health-care services (42), which could lead to patient complaints about unnecessary tests and prescription drugs (57). Chinese physicians have also been reported to have poor communication skills (24). Burdened with heavy workloads, they only allot a few minutes to each patient, exacerbating complaints about their negative professional attitudes.

In the current pandemic, physicians' initiative has been weakened. Because of the overwhelming influx of patients, the pandemic control group in the central government prepared standard procedures to treat patients; that action undermined physicians' standard responsibilities in treating patients with mild symptoms. The Ministry of Health issued seven versions of guidelines on the COVID-19 treatment regimen (58). When treating patients with severe symptoms, physicians were encouraged to make more collective decisions instead of individual ones (59). Further, the treatment of COVID-19 patients was no longer influenced by financial incentives to the degree that the government was making all patient payments. In addition, because of working under several layers of protective gear, it was impossible for them to convey any facial expressions to their patients, and their conversations with patients are also limited because of the concern for self-protection.

Developments in the Public

Studies indicate that socioeconomic features also influence people's trust in physicians (21, 60, 61). One's age, gender, and socioeconomic class influence one's personal perceptions of doctors, even after controlling for previous experience with them. In addition, people's social trust and their satisfaction with life in general also correlate with their trust in physicians (21, 62). Even though changes in individual traits have been minimal since the outbreak of COVID-19, the public's HL has vastly improved. A cross-sectional study indicates that residents in China have a high level of knowledge about COVID-19 (63), in sharp contrast to their counterparts in countries such as India and the United States (64, 65).

Under normal circumstances, the general public has been criticized for its low level of HL, including having unrealistic expectations of medical treatment and lacking the ability to effectively communicate with physicians during medical encounters (24). During the COVID-19 pandemic, improving personal HL became both an individual and national goal. Previous studies on distrust of physicians were based on the agency theory framework, which highlights the incongruence of

preferences and the information asymmetry between patients and physicians (38). The unprecedented nature of COVID has tested the limits of physician knowledge, so people must search for information from alternative sources. Meanwhile, the government waged a nationwide campaign to inspire people to become informed about how to protect themselves from the virus.

Nonetheless, the degree of HL varies widely among the public because of individual differences. In order to assess HL during the COVID-19 pandemic, we combined the public's general HL with their cognitive and critical knowledge of the disease. We adapted Nutbeam's classification to the particular context of COVID-19 and included the following elements of HL with regard to COVID-19: having general health knowledge of the virus, having self-protective measures (functional HL), having the critical skill to process online information on COVID-19 (critical HL), and having the ability to apply specific health information to one's daily life (interactive HL) (57). These dimensions are discussed in the next section.

In sum, the outbreak presents a unique setting for studying public trust in physicians in China. It can be viewed as a natural social experiment in which factors in health-care services have been controlled, allowing us to focus on factors in the public sphere. Without the compounding influences of health insurance systems and of physicians' use of their discretionary power, previously overlooked influences have become prominent, making HL an even more critical factor in the patient-physician relationship.

Previous studies on the relationship between this essential factor and public trust have yielded inconsistent results. HL could be seen as a double-edged sword: infringing on physicians' professional authority while empowering patients and thus pulling the patient-physician relationship in opposite directions. During the COVID-19 pandemic, the positive influences from patients' high HL upon this relationship outweighed negative outcomes from high HL. A comparison of influences underlying public trust before the COVID-19 outbreak demonstrates that public trust is a dynamic phenomenon, varying in accordance with individual characteristics in a unique setting. Therefore, in this study, we focus on individual health literacy.

This social experiment, which mimics a longitudinal study, allowed us to infer that this positive connection is also valid for the cross-sectional study of individuals during the COVID-19 outbreak. In this study, the main hypothesis was that there is a positive correlation between the level of trust in physicians and an individual's HL level, which was then tested with empirical evidence.

MATERIALS AND METHODS

Sampling

A cross-sectional online survey was conducted at the peak of the pandemic from 31 January to 4 February 2020. Because of the pandemic, an online survey is more appropriate and safer than face-to-face surveys. The Institutional Review Board of a major East Coast university in China approved the data-gathering protocol. We used SoJump as a participant-recruitment tool (http://www.sojump.com). SoJump is one of the largest online survey providers in China, with more than 2.6 million registered respondents with different sociodemographic characteristics. The site invited 1,717 randomly selected registered users to participate in an online survey. A total of 1,692 respondents (98.5%) completed the questionnaire. The company used the internal records of registered users to identify potential participants who met three research criteria: (a) have their residence in mainland China, (b) have basic reading and writing skills to complete the survey, and (c) are at least 16 years old. After the final screening, the sample has 1,568 respondents.

Consent to participate was strictly voluntary; no respondent was coerced. Nonetheless, we acknowledge the potential limitations of the sampling and data collection methods used in this study. Specifically, the respondents range from 16 to 74 yr old ($M = 32$, $SD = 10$). Education levels ranged from uneducated (0) to those having a Ph.D. or postdoctoral degree (9), with most participants having some degree of a college education. The average monthly household income was between 8001 RMB-10,000 RMB. The survey options included no income (1), 1000 RMB and below (2), 1001 RMB to 3000 RMB (3), 3001 RMB to 5000 RMB (4), 5001 RMB to 8000 RMB (5), 8001 RMB to 10000 RMB (6), 10001 RMB to 15000 RMB (7), 15001 RMB to 20000 RMB (8), 200001 RMB to 50000 RMB (9), and more than 50000 RMB (10). We combine some categories in education and income level, and **Table 1** shows the main features of the sample.

Our survey population could not represent the whole population in China. Our research design is still valid because our main objective is to focus on whether the connection between these two variables is positive or negative. The high proportion of some categories, such as high education levels, will not affect our findings.

Data Analysis

STATA 14.0 was used to conduct a three-pronged analysis of the data (Stata Corporation, College Station, TX). First, a simple descriptive analysis of the variables was performed. Second, a rank-sum test was used to identify (significant) differences between the levels of control variables and trust in physicians. Third, the measure of trust in physicians was based on a five-point, Likert-type scale of 1 to 5. In other words, these choices are not independent of each other; rather, they are ordinal-level measures. Ordinal logistic regression modeling is used to analyze the relationship between HL and patient trust in physicians.

Measures

The complexity of the relationships between public trust and public HL lies in the multidimensional nature of both concepts. In extant studies, the predominant classifications include the value dimension and the technical competence dimension, otherwise known as fiduciary and competence trust of physicians (20, 66). Value trust refers to physicians' fiduciary responsibility to patients, while competence trust refers to their technical skills (20, 66). As discussed in section 2, during the COVID-19 pandemic in China, physicians' value trust was unprecedently high because of their dedication to controlling the spread of the virus and the strong pro-doctor propaganda on traditional

TABLE 1 | Socioeconomic characteristics of respondents.

	Proportion (%)	*M*	*SD*
Age (real age)		31.02	9
16–30	828	24.62	3.77
31–45	625	35.44	3.89
46–60	98	51.35	4.11
61–67	17	62.94	1.75
Gender			
Male (0)	49.68	–	–
Female (1)	50.32	–	–

Income (RMB)	**Proportion (%)**			
Income level (scale 1–10)	**Primary school or below**	**Junior high school**	**High school**	**University or above**
No income	1 (3.03%)	0 (0%)	6 (18.18%)	26 (78.79%)
Less than 1,000	0 (0%)	1 (5%)	3 (15%)	16 (80%)
1,001–3,000	0 (0%)	2 (2.67%)	15 (20%)	58 (77.33%)
3,001–5,000	0 (0%)	2 (1.28%)	24 (15.39%)	130 (83.33%)
5,001–8,000	0 (0%)	7 (2.69%)	24 (9.23%)	229 (88.08%)
8,001–10,000	0 (0%)	3 (1.32%)	12 (5.26%)	213 (93.42%)
10,001–15,000	0 (0%)	2 (0.60%)	8 (2.41%)	322 (96.99%)
15,001–20,000	0 (0%)	0 (0%)	4 (1.62%)	243 (98.38%)
20,001–50,000	0 (0%)	0 (0%)	1 (0.52%)	193 (99.48%)
More than 50,001	0 (0%)	0 (0%)	0 (0%)	23 (100%)

Data source: Data from the survey were collected during the peak of COVID-19 in China.

and online media. Meanwhile, the responses to treating COVID patients have eliminated the potential incentives for physicians to maximize their financial interests because all treatments have been free for patients. Under normal circumstances, public trust in physicians comprises two parts: value trust and competence trust. In the special setting of China's control of COVID-19, this trust has been more about competence trust because of a series of control responses.

Even so, people are still concerned about treatment in light of variations in the technical skills of physicians. During the administration of this survey (February 2020), COVID-19 was still comparatively new to physicians and the public. Confronted with an unprecedented virus, physicians were caught flat-footed. Thus, it was expected that the public would have varying levels of trust toward physicians treating COVID-19. Our measures focused exclusively on physicians' technical competence, particularly as it related to their treating COVID-19.

This study measured respondents' trust in physicians on a single statement ("Because physicians cannot diagnose COVID-19, they are likely to misdiagnose patients because of this lack of knowledge"). The answer is a five-point Likert scale from "strongly disagree" (assigning a value of 5) to "strongly agree" (assigning a value of 1). Previous studies adopted different scales for measuring trust in physicians. Some studies adopted a multi-item scale to measure trust, whereas others also employed a one-item scale to measure trust (21). We used that single- question format because it is the top concern for individuals during the outbreak of COVID-19. Identifying the unprecedented disease from other normal pneumonia is critical to the right treatment, which constructs the most important part of individual evaluation of doctors' medical competence. The measure was reverse-coded so that greater trust was assigned higher values. Previously scholars employed the reverse measure of distrust to calculate the trust level or vice versa (20, 66).

Researchers worldwide have developed HL measures, including the Test of Functional HL in Adults (TOFHLA) in the United States and the Australian Adult Literacy and Life Skills Survey (ALLS) (34). There is no gold standard for assessing HL under normal circumstances (67, 68), and, understandably, there is no agreement on measures to be used during the COVID-19 pandemic. Dumenci and other scholars argued that standard HL measures were more appropriate for primary care services, and for critical diseases, such as cancer, they emphasize that scholars need to develop particular measures (69). We built our measures based on two concerns. The first concern is to build upon previous literature on HL because the structure of health literacy conceptualization should be similar across different diseases. The second concern is to build our measures to reflect the critical elements of health knowledge with regard to COVID-19. We used Nutbeam's model of HL (44, 70), and then divided it into three subscales: health knowledge, self-motivation, and information-processing skills. These categories correspond to functional, interactive, and critical HL under Nutbeam's model of HL. We list two questions for each subscales, and thus, we measure HL using the six-item scale, including two items for functional, interactive, and critical HL, respectively. The questions are listed in **Table A1** in the **Appendix**. Different from comprehensive measures of HL in general, these six questions cover important aspects of HL on COVID-19.

Based on previous research, we also include three important control variables, social trust in general, life satisfaction, and usage of internet news (70, 71). These variables have been used to examine the patient-physician relationship in China. This study explores the validity of the control variables during this pandemic. The measurements for social trust and life satisfaction are listed in **Table A1** in the **Appendix**.

High levels of individual life satisfaction are likely to lead to high levels of trust because optimistic attitudes colors the individual perception of others, including physicians (57). Based on the cross-section analysis, Wang and colleagues find that interpersonal trust is an important predictor for both value trust and competence trust in physicians (72). Also, we measured the frequency of using we-media (i.e., Weibo or WeChat) for news on COVID-19 to measure the extent of reliance on Internet news. We-media refers to the information platform that allows users to receive and send information without the content being screened for accuracy. Demographic characteristics and socioeconomic status were also identified, based on evidence that they are significantly associated with the trust level in physicians in China (21, 71, 72). **Table 1** presents the socioeconomic characteristics of respondents.

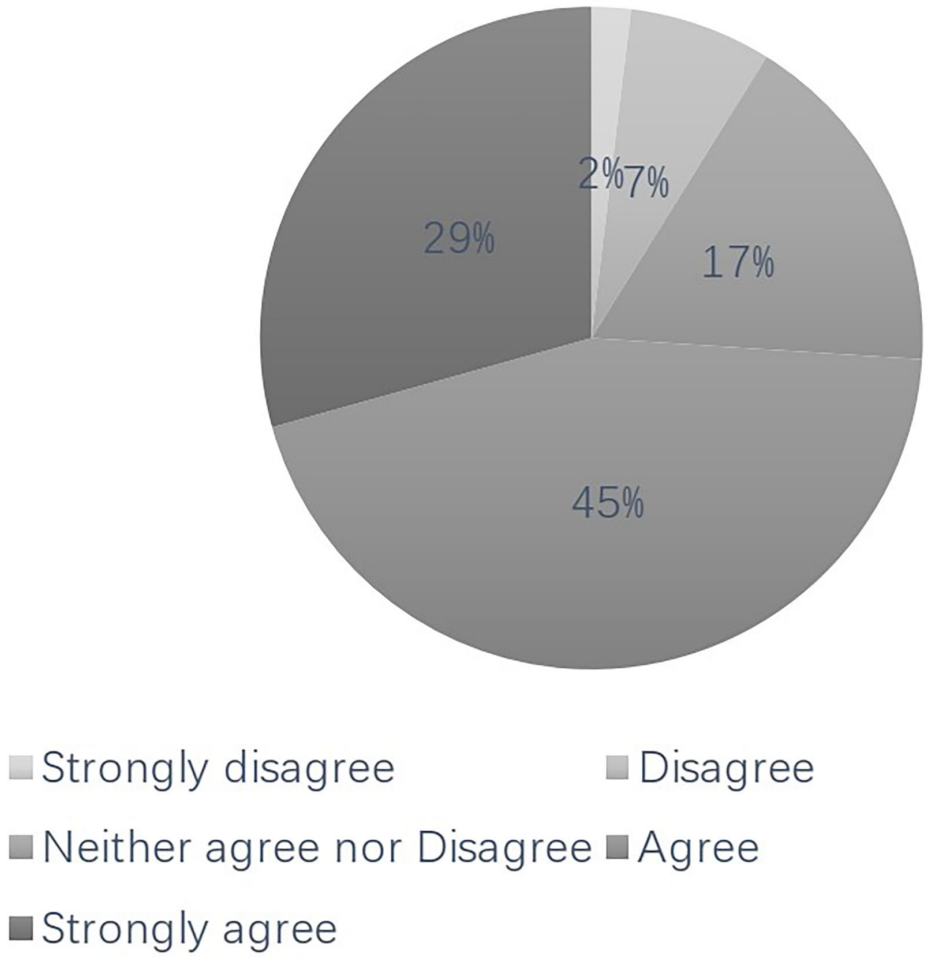

FIGURE 1 | Proportional distribution of respondents based on their trust in physician (%). The distribution of the respondents is clockwise organized from "strongly disagree" to "strongly agree".

TABLE 2 | Descriptive statistics for HL and controlling variables.

Variables	Percentage(%)					*M*	*SD*
	Strongly Disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**		
Functional HL1[†]	0.89	5.61	9.69	59.57	24.24	4.006	0.803
Functional HL2[#]	0.19	0.26	2.1	16.58	80.87	4.777	0.504
Interactive HL1[#]	1.02	4.15	16.58	48.41	29.85	4.019	0.85
Interactive HL2	0.19	0.7	8.1	59.95	31.06	4.21	0.627
Critical HL1[†]	1.98	9.82	16.01	55.99	16.2	3.746	0.91
Critical HL2[†]	1.53	8.35	14.29	44.84	30.99	3.954	0.961
We-media usage [#]	9.95	24.68	27.04	25.57	12.76	3.065	1.186
Life satisfaction	5.42	16.26	26.21	38.08	14.03	3.39	1.082
Social trust	1.21	6.7	20.41	60.01	11.67	3.742	0.795

Data source: Data from the survey were collected during the peak of COVID-19 in China. [†] *Reverse scored. All measurements of these variables are listed in the* ***Appendix***, ***Table A1***. [#]*Functional HL2 measurement includes five options, ranging from "no knowledge" (scored as 1) to "full knowledge" (scored as 5). Interactive HL1 measurement includes five options, ranging from "very low capability" (scored as 1) to "very high capability" (scored as 5). We-media usage measurement includes five options, ranging from "never" (scored as 1) to "very often" (scored as 5).*

RESULTS

Analysis of Differences in Public Trust in Physicians and in Health Literacy

Figure 1 shows the specific distribution of public trust in physicians during the COVID-19 pandemic. **Table 2** shows the distribution of HL, social trust, life satisfaction, and we-media usage. Since HL is discussed in relation to COVID-19, the measures yielded in this study differ significantly from standard measures that appear in the existing literature. Furthermore, public trust in physicians examined in this study refers exclusively to the competence of physicians to treat COVID-19 rather than the trust in the existing literature, which includes trust in their personal values or personal responsibilities. It can be seen from **Figure 1** that 74% of respondents reported having trust or strong trust in China's physicians, a figure higher than those reported by Zhao and Zhang (21). According to their article, 64.2% of respondents were found to have trust or strong trust in physicians; the mean score of trust in physicians in China was 3.53 in 2016.

With regard to functional health literacy (HL), a reverse-coded measure, 83.8% of respondents (including those who chose "agree" and "strongly agree") had been educated about how to take preventive measures (functional HL1), and 97.45% of the respondents (including those who chose "much knowledge" and "full knowledge") had been taught that COVID-19 could be transmitted from person-to-person (functional HL2). As for interactive HL (interactive HL1), only 5.17% of respondents (including those with "low capability" and "very low capability") were unable to follow their physician's advice from their latest medical appointment, and 0.89% (including those who "disagree" and "strongly disagree") did not plan to take any preventive measures (interactive HL2).

The critical HL item was reverse coded. 72.19% of respondents (including those who chose "agree" and "strongly agree") read the information carefully (critical HL1), and 75.83% of respondents (those who selected "agree" and "strongly agree") carefully analyzed the points of view behind the information (critical HL2). Our findings were consistent with other similar studies on Chinese HL as it relates to COVID-19. For example, Zhong and colleagues found the public's knowledge about COVID-19 to be quite high in China (73), as the correct answer rates were 70.2–98.6%. The results show that public HL during the COVID-19 remains at a high level in China.

The Association Among Trust in Physicians and the Control Variables

A rank-sum test was used to compare the differences of control variables and the results, listed in **Table 3**. In order to save space for this table, we combine some categories when we perform rank-sum tests. For example, all respondents are divided into two groups based on their ages. The proportion of the first group (aging 16–41) among all respondents is 88.52%, 11.48% for the second group (aging 42–67). The rank-sum and *P* values are shown in **Table 3**. There were no significant associations between trust in physicians and sociodemographic characteristics ($p > 0.05$ for age, gender, income, and education). As for the other control variables, we-media usage and high social trust were found to have no significant correlation with trust in physicians ($p > 0.05$). Confidence in medical staff was associated with life satisfaction ($p < 0.01$) and social trust ($p < 0.1$). In other words, those who were satisfied with their current life circumstances and trusted others more maintained a higher level of trust in physicians.

TABLE 3 | Association between trust in physicians and control variables.

Parameters	Category	Proportion among all respondents (%)	Rank Sum	*p*
Age†	16∼41	88.52	606,489	0.130
	42∼67	11.48	66,892	
Gender	Female	49.68	342,732	0.442
	Male	50.32	330,648	
Monthly household income ‡	<10,000 RMB	49.23	326,867	0.182
	≥10,000 RMB	50.77	346,504	
Education level§	Primary school	0.06	0	0.239
	Junior high school	1.08	4,665	
	High school	6.19	37,270	
	University or higher	92.67	631,445	
We-media usage	Never	9.95	62,226	0.148
	Seldom	24.68	165,650	
	A couple of times	27.04	178,981	
	Multiple times	25.57	179,052	
	Very often	12.76	87,471	
Life satisfaction	Strongly disagree	5.42	28,316	0.002***
	Disagree	16.26	105,793	
	Neither agree nor disagree	26.21	156,153	
	Agree	38.07	267,141	
	Strongly agree	14.03	115,979	
Social trust for others	Strongly disagree	1.21	7,336	0.056*
	Disagree	6.7	33,452	
	Neither agree nor disagree	20.41	119,559	
	Agree	60.01	425,334	
	Strongly agree	11.67	87,701	

† *To save space on the table, respondent ages were categorized into two groups for the rank-sum test.* ‡ *Respondents' monthly household income are categorized into two groups for rank-sum analysis.* § *To save space on the table, we divided the respondents' education levels into four groups for the rank-sum test.* ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

Ordinal Logistic Analyses Results

Finally, an ordinal logistic model was developed to analyze the data. Before modeling, we conducted collinearity diagnoses. Through the Collin test, the values of VIF and Tolerance can be observed. Each VIF value is less than 5, and the Tolerance values are greater than 0.1, indicating that there is no collinearity

among the variables; that is, the results of the key model are reliable. The result of the Collin test is reported in **Table A2** in the **Appendix**. Results of the ordinal logistic model in **Table 4** are from Model 1 and provide substantial support for the hypothesis that HL has a positive relationship with trust in physicians. Thus, it is clear that functional HL significantly improves public trust in physicians (functional HL 1 coefficient 0.302, the odds ratio between the reference group and the compare group is 1.353%, $p < 0.01$; functional HL 2 coefficient 0.158, the odds ratio between the reference group and the compare group is 1.171%, $p < 0.1$). In addition, the effect of interactive HL on the public's trust in physicians is significant (interactive HL 1 coefficient 0.209, the odds ratio between the reference group and the compare group is 1.232%, $p < 0.1$; interactive HL 2 coefficient 0.237, the odds ratio between the reference group and the compare group is 1.267 %, $p < 0.01$). Furthermore, critical HL also significantly improves public trust in physicians (critical HL 1 coefficient 0.148, the odds ratio between the reference group and the compare group is 1.160%, $p < 0.05$; critical HL 2 coefficient 0.202, the odds ratio between the reference group and the compare group is 1.224%, $p < 0.01$). In Model 2, in which we-media, life satisfaction, and social trust were added as control variables based on Model 1; the results continue to show that HL can promote public trust in physicians. Also, we-media exerts no influence on one's trust in physicians. However, life satisfaction (coefficient 0.106, the odds ratio between the reference group and the compare group is 1.112%, $p < 0.05$)and social trust (coefficient 0.141, the odds ratio between the reference group and the compare group is 1.151%, $p < 0.05$) have a significant influence on public trust in physicians. When controlling for socio-demographic variables according to Model 3, HL can still significantly affect public trust, with the exception of functional HL 2. Since this variable was found to be significant in both Models 1 and 2, it would not affect the overall influence of HL on trust in physicians. Among the six measures of HL, functional HL 1 was found to be the major predictor, according to Model 3 (coefficient 0.285, the odds ratio between the reference group and the compare group is 1.33%, $p < 0.01$). Hence, the main hypothesis in this study is supported.

Since we only use a single question to measure the trust in physicians, we add two additional measures to further test the relationship in order to ensure the robustness of the results. Variable One is based on the measure of the answer to the question "Do you agree that the hospital's diagnosis of COVID-19 is highly accurate" and Variable Two is "Do you think the professionalism of the scientists involved in the prevention and treatment of COVID-19 is convincing". There are five options, from "completely disagree" to "completely agree." We use these two measures as approximate measures of the public trust in physicians, one representing an aggregation of physicians and the other representing their professionalism. The results are similar to our findings in **Table 4**, and are reported in **Table A3** in the **Appendix**.

As for the sociodemographic variables tested in Model 3, the variable of age was shown to be negatively related to trust in physicians. Thus, the older one gets, the less one trusts physicians. Gender, income, and education have no significant effect on one's trust in physicians.

TABLE 4 | Ordinal logistic regression analysis of health literacy and trust in physicians.

	Trust in Physicians		
	Model 1	**Model 2**	**Model 3**
Functional HL 1	0.302 (0.063)***	0.288 (0.063)***	0.285 (0.064)***
Functional HL 2	0.158 (0.094)*	0.165 (0.094)*	0.138 (0.095)
Interactive HL1	0.209 (0.059)***	0.168 (0.060)***	0.160 (0.060)***
Interactive HL2	0.237 (0.083)***	0.197 (0.084)**	0.239 (0.085)***
Critical HL 2	0.148 (0.058)**	0.141 (0.059)**	0.121 (0.059)**
Critical HL 2	0.202 (0.055)***	0.196 (0.055)***	0.203 (0.055)***
We-media Usage		0.014 (0.040)	0.006 (0.040)
Life satisfaction		0.106 (0.046)**	0.126 (0.047)***
Social trust		0.141 (0.063)**	0.158 (0.063)**
Age			−0.023 (0.006)***
Gender			−0.051 (0.095)
Income			0.022 (0.027)
Education level			−0.023 (0.057)
N	1568	1568	1568

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$.

Our sample included more educated people than the general population in China, which would affect our results' generalization. The online survey is more popular among highly educated individuals because they are more capable of using mobile phones. Since there exists a possibility that the relationship between public trust in physicians and public HL (health literacy) may vary among the different populations, we divided the respondents into two subgroups, that is, the less educated and the more educated. The more educated subgroup includes respondents with high education and above. We compared the coefficients and significance of six measures of public HL in the modeling of trust in physicians between these two subgroups. We found that the relationship between trust in physicians and HL in the low-educated subgroup was not significant, while the relationship in the high-educated subgroup is almost significant. Five out of six measures of HL have significant positive relationships with trust in physicians; the coefficients of four out of six HL measures are larger than the counterparts in the lower educated subgroup. These results indicate that the selection bias would overestimate the regression estimates between pubic trust in physicians and public HL. The conclusions of the data in this article are more suitable for populations with higher education. We reported our results of these two modeling in **Table A4** in the **Appendix**.

DISCUSSION

Patient-physician relationship has never been more important in the background of the global pandemic. The information gap raised in the agency theory framework suggests that a growing need among patients for health information coexists with more self-awareness. In China's control of COVID−19, this trend upends the traditional balance of the patient-physician relationship. There is a discussion on the relationship between

patients' HL and their trust in physicians in normal times (57, 72). This study investigates public HL as a predictor of public trust in physicians in China's pandemic control of COVID-19. Based on agency theory and on Nutbeam's model of HL, we conclude that the uniqueness of the setting mediates the relationship between them. In the context of China's control of the pandemic, control regulations modified patient-physician relations and the impact of public HL on the trust in physicians.

Our results demonstrate significant positive relationships between HL and public trust in physicians, providing empirical evidence for the main hypothesis. In this study, trust in physicians was treated as a one-dimensional concept that was limited to physician competence. HL was viewed as a multifaceted concept that includes health knowledge, self-motivation, and information processing skills. During the COVID-19 pandemic, the positive connection between these two elements was revealed in a series of statistically significant correlations, shown in **Table 4**. Based on these results, a causal relationship with the vector from HL to public trust could not be determined. Among these three dimensions, functional knowledge to recognize the highly infectious nature of the virus might be based on following medical experts' suggestions in the media. With regard to communicative literacy, respondents with high awareness of their health problems and high willingness to adhere to previous advice from their doctors demonstrate prior compliance. Placing their trust in physicians' treating COVID-19 can be perceived as an extension of their ongoing confidence in their personal physicians. Better functional knowledge and communicative literacy have been already proven to have a strong correlation with a high-quality patient-physician relationship (24, 74).

The only exception to this dyadic interaction might be critical literacy because trust in physicians may not have a causal effect on one's critical literacy and online information processing skills; however, this component has been shown to have a possible negative relationship with public trust in previous studies (75, 76). The discrepancy between patients' perceptions of health issues based on online sources and doctors' perceptions weakens the traditional paternalistic position of physicians (38). However, some scholars argue that seeking quality online health information could improve patient trust in physicians because this information helps build interdependence between patients and physicians (76). During the COVID-19 pandemic, people also confronted "infodemic," a term used to describe the fake news common on online platforms (77). That makes having a high level of critical HL particularly important. People with low levels are more likely to be swayed by rumors and paranoia, placing them further away from science-oriented information. However, those with high critical literacy are more likely to trust the representatives of medical science, physicians. This study provides more evidence for the current academic debate on the relationship between HL and public trust in physicians. The positive role of HL in promoting better public-physician relationships has been confirmed during the COVID-19 pandemic based on the empirical analysis discussed above.

The division of value trust and competency trust within this unique setting has enabled us to reach a better understanding of their connections. China's control of the COVID-19 pandemic can be perceived as a large-scale social experiment in which the element of value trust is controlled by a series of governmental interventions, as discussed in Section 2. A possible explanation for the inconsistencies in previous studies of HL and public trust may be attributed to the multi-dimensional nature of these concepts. Our conclusion can be used to study the connection between individual HL and public trust in other settings, and the relevant research design can be utilized to examine the multi-dimensional nature of these concepts.

With regard to control variables, our results are mixed in comparison to those of existing studies. For example, our finding that social trust and satisfaction have positive impacts on individual trust in physicians is consistent with those of previous studies (57, 72). This generic trust strengthens personal contact with other people and social organizations, of which physicians are certainly an important part. In addition, individuals' satisfaction with their current lives might color their perception of others and cause them to have a more positive attitude toward them.

However, some of the results run counter to generally agreed-upon beliefs in previous studies. Existing studies on public trust reached a consensus that elderly people are more likely to have a high level of trust in physicians because of their multiple encounters with them (19). This long-term relationship is generally thought to build a positive reciprocal relationship. However, in COVID-19 settings, we found that age has a negative relationship with trust. Based on the current statistics on the demographic character of infected patients, older people are more likely to develop serious symptoms (78); therefore, they are more cautious about the possibility of malpractice. Thus, they are more vigilant about choosing physicians to treat COVID-19.

Another finding that is not aligned with previous research is the influence of people's use of the internet to receive news and information on the pandemic. Research has found that people who rely on the internet for news are more likely to have lower trust in physicians because there are inaccurate accounts on treatment (71). Our findings indicate that internet use does not significantly affect trust levels. During the COVID-19 pandemic, negative online news about physicians lessened to the degree that its impact upon public trust disappeared.

The COVID focus of this study does not diminish the validity of its findings, which may enhance our understanding of patient-physician relationships in other clinical settings in China and in other countries. As we note in Section 2, this pandemic unexpectedly provides a social experiment to observe China's health-care services. China's ongoing experience is a large-scale social experiment in which financial, media, physician discretion and other factors have been controlled. Better patient-physician relationships are based on more patient education. Studies find empirical support for agency theory in normal times (38), and our study demonstrates its validity in a global pandemic, an unusual period.

Our main research question is on the analysis of the relationship between public trust in physicians and public-health literacy in China's control of COVID-19. Even though this relationship is for a particular occasion, the findings from this special occasion provide a rare opportunity to explore this relationship in a straight and direct way. Current studies on

the relationship between public trust in physicians and public health literacy could hardly control macro-level influences such as the payment system of medical services. These influences could complicate the relationship, and scholars turn to certain research designs (cross-nation studies) to identify the possible influence (20). China's control of COVID-19 creates a de-facto social experiment, where many macro-level influences have been controlled. Thus, we could find a comparatively straightforward way to focus on individuals' properties only and explore the relationship between their trust in physicians and their health literacy.

However, the particular setting leads to a concern about the generalization of our findings, especially about the validity and reliability of the measurements of basic concepts. We try to make a balance between two considerations. The first is to keep our studies consistent with previous studies, including the selection of variables and their measurements. For example, we employed Nutbeams' structure of conceptualization of HL to design our measures of HL. The second is to take into account the specific situation in China's control of COVID-19, which is unprecedented. We identified critical elements of the public attitudes toward treating and protecting from COVID-19 and integrated them into our measurements. By combining these two considerations, we believe our findings could be expanded to understand the relationship between public trust in physicians and HL in normal times.

This finding can also be supported by the public's self-protection behavior in China, among which wearing facial masks is the most prominent one. In China, the highly-disciplined behavior is born out of two important conditions: their knowledge of the virus derived from all forms of media and their trust in physician counseling regarding the use of facial masks. In China, there is an agreement that wearing mask is the easiest way to protect oneself, eliminating all kinds of distorting "noises" that might undermine public compliance. Its authoritarian style of fighting the virus has resulted in a lot of controversies in the world (79). Among China's control strategies, hard-control measures, such as lockdown measures, are more inconvenient than other soft-control ones, such as wearing facial masks. Wearing facial masks is an important control strategy in China, but it does not mean that it is an infringement on individual freedoms, as viewed in some industrialized nations. Encumbered with an unusual enemy in the virus, the public should have more trust in their health-care professionals and in fellow citizens.

These findings have several implications for controlling the current pandemic worldwide, as well as for improving patient-physician relationships in China. The study suggests that having a high level of health literacy bolsters one's trust in physicians, particularly trust in physician competence, which is in itself likely to promote more compliance, as the control of the pandemic in China demonstrates. Martin emphasizes that high levels of trust in physicians is part of "societies' reserves of generalized trust" (20). Encumbered with an unprecedented health-care crisis, social trust has never been so important.

The tense public-physician relationship is among a series of strained social relationships, enabled by partisan politics (i.e., the United States) and international conflicts (i.e., W.H.O.). Yet, the importance of trust in physicians reminds us that solidarity in collective actions and individual responsibility are vital to fighting the virus. Groups need to set aside their ideological and political differences in the ongoing battle against a global scourge.

Based on our findings, we also have suggestions for improving the patient-physician relationship in China. The public needs to expand its HL and avoid solely relying on physicians–a dereliction of personal duties and responsibilities. This is not an easy task because it requires the accumulation of health information, the ability to apply it in one's daily life, and the acquisition of critical skills in distinguishing between accurate and inaccurate information. Physicians can direct patients to reliable sources of health information. China's media could also positively contribute by providing more programs on medical risks, thus offering people more reasonable expectations about health care.

Our study has several limitations. First, the sampling may not be adequately representative, given the high level of education among respondents. That may be an artifact of selection bias. That means the estimates of our study are more appropriate for the population with similar characteristics. We can improve our further understandings by two potential solutions. The first is to conduct more rigorously designed surveys targeting the general public, and the other is to focus on respondents with low education levels. Second, measures on respondents' HL level are designed for COVID-19 only and could hardly be expanded to other diseases. Third, public trust in physicians for treating COVID-19 may be different from a general trust as well as patients' trust in their personal physicians. Finally, future studies should include more in-depth, one-on-one discussions on mechanisms of improving HL.

CONCLUSION

This study demonstrates that public HL and trust during the breakout of COVID-19 are high. And we also find that public HL is a positive predictor of trust in physicians during this unusual period. This finding adds significant evidence to current discussions on the potential relationship between HI and public trust in physicians. As long as physicians' opportunistic behavior is mitigated, the level of patients' trust in physicians is positively associated with their HL. Besides, our finding has practical significance even though the uniqueness of China's COVID-control measures may not be replicated elsewhere. First, the global COVID pandemic is not likely to disappear in the near future. Following physician suggestions and taking action to ensure self-protection—e.g., getting vaccinated and wearing facial coverings—are key responses to slowing or stopping the spread of the virus. Second, in the context of a strained patient-physician relationship in China, improving patients' HL results in a higher level of trust in physician competence, which lends empirical support to using more health-education and risk-communication interventions. For both normal occasions and pandemic settings, health education and risk communication are indispensable to collective actions against diseases.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of Zhejiang University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

DC and ZG: conceptualization and methodology. DC and QZ: software. DC and ZS: formal analysis. DC, CP, and QZ: writing—original draft preparation. DC, QZ, CP, ZS, and ZG: writing—review and editing. QZ: visualization. DC: supervision, project administration, and funding acquisition. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2021.758529/full#supplementary-material

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Social and Cognitive Psychology Theories in Understanding COVID-19 as the Pandemic of Blame

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When faced with adverse circumstances, there may be a tendency for individuals, agencies, and governments to search for a target to assign blame. Our focus will be on the novel coronavirus (COVID-19) outbreak, where racial groups, political parties, countries, and minorities have been blamed for spreading, producing or creating the virus. Blame—here defined as attributing causality, responsibility, intent, or foresight to someone/something for a fault or wrong—has already begun to damage modern society and medical practice in the context of the COVID-19 outbreak. Evidence from past and current pandemics suggest that this tendency to seek blame affects international relations, promotes unwarranted devaluation of health professionals, and prompts a spike of racism and discrimination. By drawing on social and cognitive psychology theories, we provide a framework that helps to understand (1) the effect of blame in pandemics, (2) when people blame, whom they blame, and (3) how blame detrimentally affects the COVID-19 response. Ultimately, we provide a path to inform health messaging to reduce blaming tendencies, based on social psychological principles for health communication.

Keywords: COVID-19, blame, social identity, social cognition, pandemics and epidemics, social psychology, Path Model of Blame

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INTRODUCTION

Blame is a feature of individual, organizational, system and government responses to COVID-19 pandemic worldwide. Struggling to deal with an invisible, organic threat, many governments, agencies, and individuals have sought instead to assign undue responsibility of the spread of COVID-19 to groups and entire countries (e.g., China; Al-Jazeera, 2020), minority groups (Sarkar, 2020; Markowitz et al., 2021). The World Health Organization has suggested that the language used around pandemics is critical to limiting blame and stigma, but many world leaders have paid no heed to this advice, calling COVID-19 by regional language or variants by their location of origin (World Health Organisation [WHO], 2020). For example, former US president Donald Trump repeatedly called the virus the "China Virus" to blame China for the spread of COVID-19, even crossing out "COVID-19" on his script (Smith, 2020). Blame was also directed by agencies against governments; for example, the Brazilian Education minister blamed China for COVID-19 as a plan for "world domination" (Al-Jazeera, 2020). Assigning blame to specific groups and agencies (sometimes unduly) during COVID-19 appears to be common in many countries (Montiel et al., 2021), at multiple levels (e.g., Australia's blame game between media, state, federal, and local governments; see Hoffman et al., 2020). Recent research also suggests that the blame-game behavior may negatively affect compliance with public health directives (Stadler, 2003; Mahajan et al., 2008).

Blame can have wide ranging consequences, both directly on pandemic response and indirectly through influencing undesirable and unacceptable general social issues. Blame is, simply put, when one individual/group attributes responsibility, intent, foresight, or causality to another individual/group for an event (Malle et al., 2014). Historically, minority groups were blamed for pandemics with deadly consequences. Jewish communities were blamed for the Black Death pandemic in the 1300's. Consequently, thousands of Jewish people were killed (Zahler, 2009). Sexual health epidemics were blamed on other countries. Syphilis was called "the French disease" in Italy, and "the Italian disease" in France (Cassar, 2002). There exists a long history of blaming "others" for diseases in more recent times, such as the "Mexican Swine Flu" in 2009 (Cohn, 2012; Habicht et al., 2020).

This effect of blame has direct negative consequences on managing pandemics. Because blame can cause stigma, individuals from blamed groups may conceal or hide their illness (Dar et al., 2020; Singh and Subedi, 2020). Multiple studies have found blaming individuals or groups for HIV/AIDS leads to stigma, which led to weaker intentions to seek treatment, or conceal their illness (Stadler, 2003; Mahajan et al., 2008). In more recent news, in Iran, the stigma of having COVID-19 in the house was so great that if a case showed up at home, the head of the household could be blamed for failing to protect their family. As a result of this, patients hid their illness, and COVID-19 spread extremely quickly in Iran compared to its neighbors. This likely led to a severe undercounting of deaths (Asadi-Aliabadi et al., 2020; Rubin, 2020).

Research on COVID-19 and blame has highlighted some trends in how blame operates and spreads. An analysis of 1 million instances of Chinese online material (including Facebook texts and news), found information on these pages frequently spread information that blamed China or Wuhan residents for the spread of COVID-19 (Chang et al., 2020). Another multilingual text analysis of online platforms found that blaming specific agents for COVID-19 comprised of 15% of online texts, with most being false (Islam et al., 2020). Further experimental research on Americans found that conservatives were more likely than liberals to blame Democrats, Republicans, Chinese people, and the Chinese government for COVID-19's impact in the United States (Porumbescu et al., 2020). When exposed to the term "China-virus," all participants of the study became more likely to blame Chinese residents (Porumbescu et al., 2020). While these studies have shown that certain people are more likely to blame certain targets, and that blame can spread quickly, these studies say little on the mechanics of blame in COVID-19.

Surprisingly, at time of writing, little direct psychological research has been done on blame and COVID-19 beyond commentary; a cursory search on this topic revealed only four papers that sought to understand blame in COVID-19. This may be because psychological research on the factors of blame (both theoretical and empirical) has yet to be adopted by the wider medical and health community. Understanding the psychology of blame may help inform an agenda on reducing blame in COVID-19 and improve COVID-19 risk communication and the outbreak management response in present and future contexts. Here, we describe how blame has affected the pandemic response, leading to a discussion on the psychology of blame (when and who people blame), how blame works to weaken the response, and how we can reduce blame in COVID-19. We consolidate a socio-cognitive model of blame (Malle et al., 2014) and social identity research (Jetten et al., 2020) to inform a model of blame in COVID-19.

WHEN DO PEOPLE BLAME?

Attribution models (including blame) have been a mainstay of psychology and anthropology for decades (Heider, 1958; Kelley, 1973). Older Freudian perspectives on blame famously suggested it was a defense mechanism to shift responsibility onto others to protect one's ego (Freud, 1946). As such, Freud suggested that "blame projection" was an immature defense mechanism; later psychodynamic research suggested that certain people were more likely to employ blame projection when they were less trusting than others (Hochreich, 1975).

A more recent theory of blame (the Path Model of blame) suggests that blame is cognitive, social, and requires warrant (Malle et al., 2014). The model posits that blame comes in a private, cognitive form based on one's characteristics and social cognition, and a public social form where the blame is guided by a set of norms, and roles designed to regulate community and social relationships. This model suggests a first step, where the perceiver considers whether a particular agent or target caused an event or outcome that violated a social norm. Then, if there was clear intent, blame is allocated, but if there was no intent, responsibility and capacity to prevent the issue are considered (Malle et al., 2014). This model suggests blame is most likely to occur under these circumstances, but also elaborates on *what* events cause blame to extrapolate "when." The events have to be detectable as a norm violation. For example, aged care workers in Australia were blamed for spreading COVID-19 in aged care homes; this can easily be considered to be a norm violation (Team and Manderson, 2020). However, people may differ in terms of the intent attribution as a function of *which* norm is subjectively being violated, and differ in their views of responsibility and preventative capacity. Specifically, one person may blame just the infected person as they would believe the norm of individual responsibility. Another person may instead consider responsibility and capacity of others (e.g., aged care homes and the government) to prevent these things from occurring through providing proper training and protective materials in aged care homes. The social component in this model is particularly pertinent, therefore, in understanding blame in a pandemic (Malle et al., 2014).

BLAME AS A SOCIAL PHENOMENON: WHO IS BLAMED, AND WHAT FACTORS AFFECT BLAME?

Because blame targeting is largely a social phenomenon, understanding the social goals and norms that guide this behavior and cognition from an established framework will be requisite. The social identity approach is one such approach that has

detailed how norms are a function of intergroup dynamics (Abrams and Hogg, 1990). This approach posits that people join groups to feel good and special (i.e., as part of a drive for positive distinctiveness), and have a drive to maintain the positive distinctiveness of their group by ensuring their group is *better* than other groups (Tajfel, 1974a; Tajfel et al., 1979). This drive leads intergroup relations, and affects how groups interact with one another (Tajfel, 1974b). One particular intergroup context could potentially lead to greater blame: when one group, of a higher status than another, maintains higher status by blaming a lower status group for a given problem. Admission of failure may reduce the positive distinctiveness individuals normally would get from their group membership, and blame reduces this sensation as it redirects the responsibility away from their group to another. For example, if a person is a strong identifier with the Conservative party in the United Kingdom (i.e., a member of the party), and the Conservative leadership fails to secure enough protective equipment for healthcare workers, that violates the embedded norm of "Britain first" that the party espouses (see Reicher et al., 2005; Hansson, 2019 for a discussion on social identity and leadership). In this context, individuals can either acknowledge the failures of their party (weakening the positivity of their group), or allocate blame to another group, like the EU or China.

Overall, a novel socio-cognitive integrative framework of blame for when blame occurs and who is blamed can be created from this social and cognitive evidence. First, from a social perspective, the purpose of blame is a form of diffusion of responsibility in order to maintain one group's status relative to others and regulate the behavior of ingroup and outgroup members. This affects *who* is blamed. The cognitive component affects *when* blame is used as a regulation strategy; this is where individuals must consider warrant and the actual information used to make this assessment. The blamer must have information on the intent, causality, and preventability of the event that clearly can be used to justify the blame. In this integrative framework, social groups provide direction and drive, while cognition gives rationality behind blame (allowing for justification). In the previous example, because the Conservative party member is driven toward positive distinctiveness, they are driven to choose to blame another group, and the group they select must make their group look good by comparison (Krylova et al., 2017). This means that they may choose the EU, a group that has a strained relationship with the United Kingdom since Brexit. Their ability to rationalize blame would be dependent on their cognition; here, the conservative member might ascribe intent (e.g., "they chose to withhold supplies") or responsibility and capacity (e.g., "they knew this would happen, and they could have helped but didn't").

There are some situations where blame can be helpful, such as a retrospective tribunal examining where fault lies in order to improve systems or existing responses to emergent issues, such as COVID-19. For example, the EU has a commission that seeks to examine where the failures are COVID-19 containment and rectify them (EU Directorate-General for Communication, 2021). This is to say that blame is sometimes warranted; there is a strong case to be made for some leaders, political parties, groups, and individuals failing to protect the public from COVID related consequences. For example, there is evidence that the UK government's "Eat out to help out scheme," which gave cash for people to eat inside restaurants likely accelerated the second wave of COVID-19 cases (Fetzer, 2020) and blaming the government for this failure would likely be warranted. However, often blame takes the form of assigning responsibility or intent to individuals or groups that have no role in the problem, or assign blame too early for it to be of use. In some cases, governments can be blamed no matter what they do; for example, the Australian government was blamed for failures for repatriating flights from India when Delta arose in the country, but was also blamed for Delta coming to Australia after the ban was lifted (Gunia, 2021). As we are writing this in the middle of the pandemic and data on the key elements of blame (responsibility, evidence, foresight) is scant, we will not distinguish between due and undue blame here.

Because blame requires warrant (being able to provide evidence in the form of causality, intent, and preventability), and the social drive to maintain positive distinctiveness is so strong, creative solutions to creating warrant may be used instead (Greene et al., 2020). This means using moral grounds to establish blame, which can result in undue blame targeted against a group or individuals that have little to do with the issue or problem. Because morality is a function of one's social group (Ellemers et al., 2013; Parker and Janoff-Bulman, 2013), this means that the evidence used may not actually make sense to an outgroup member, which in turn may increase animosity. When the response to a crisis requires a co-ordinated response, blame can be toxic. For example, the former president Donald Trump's tendency to blame China for COVID-19 (which also occurred in the middle of a trade war) resulted in worse relations when Chinese manufacturing was essential to deliver medical equipment (Tan, 2020). Blame games within the United States on COVID-19 supplies also did not help with the response between federal and state agencies (Forester and McKibbon, 2020). The virtual G7 and G20 summits were an exercise in blame shifting as well; instead of a collaborative response, it devolved into an argument on who to blame, and the United States even blocked a statement on the leadership role of the World Health Organization as a result of this disagreement (Forman et al., 2020).

HOW BLAME REDUCES EFFECTIVE RESPONSES TO A PANDEMIC IN THE COMMUNITY

Blame can lead to divisions in the international community in a pandemic (e.g., the United States and China), but blame can lead to divisions within the community when a full community response is required (Jetten et al., 2020). When a minority group is blamed for a pandemic, the social identity approach would argue that this means the pandemic is no longer a problem of *we* but rather *them* (Tajfel, 1974b; Tajfel et al., 1979). When a pandemic, such as COVID-19, requires voluntary responses for the collective, this blame can be damaging for the willingness of the subgroups to engage with government services and directives. In India, for example, the population was directed by the government to quarantine in response to COVID-19. However, in response to an outbreak of COVID-19 that occurred due

to Islamic gatherings, MPs from the nationalist Hindu ruling party (the BJP), used this to blame Muslims as super-spreaders, calling it "corona terrorism" (Ellis-Petersen and Rhaman, 2020). Muslims in India were then ostracized, and ostensibly, may have concealed their symptoms rather than get help. Similarly, ethnoreligious minorities in the United Kingdom were blamed for the spread of COVID-19 by a member of the ruling party—and the prime minster, Boris Johnson, did not condemn these comments (Ellis-Petersen and Rhaman, 2020).

Post-COVID-19, blame can also lead to significant fractures in intergroup cooperation for future threats. It is evident that blaming China for the COVID-19 pandemic will have long standing consequences. China has already retaliated against Australia for blaming China for COVID-19's origins, by placing tariffs on Australian goods (British Broadcasting Corporation [BBC], 2020a). Tensions in India between Hindus and Muslims are already strained, and COVID-19 fractures may worsen these relations (Sarkar, 2020). Historical evidence suggests that pandemic blaming can even cause long lasting effects; for example, the cholera epidemics in early nineteenth century America and Europe led to several riots against doctors, hospital workers, and government workers, which contributed to distrust of the government for decades (Rosenberg, 2009). Blaming the Church for the Black Death in Europe may have helped hasten its downfall as well, as it has been argued the failure of the church to deal with the pandemic shook people's confidence in the clergy and the power of the church (Zentner, 2015). It is likely that blame in pandemics, such as in COVID-19, will have similarly severe consequences on intragroup and intergroup functioning.

HOW TO REDUCE BLAME IN A PANDEMIC

Blame in a pandemic is not necessarily an instinctive response, but rather a manufactured one that relies on social norms above all else; the level of blame appears to be dependent on the greater context in which pandemics occur (Cohn, 2012). In fact, in antiquity, many pandemics resulted in communities working together, rather than blame (Cohn, 2012)—but this largely only happened if the community had an effective response that maintained social structures (Habicht et al., 2020). As stated earlier, blame can help to reduce responsibility from one's own group to another, so combating blame while maintaining a positive social standing can be difficult.

There are two main ways that have been proposed to reduce blame. The first method comes from political science and law. A recent paper with seven studies and agent-based modeling suggested that the best thing to do to reduce blame is to focus on praising as many people as possible on success, and blame as narrowly as possible after failure (Schein et al., 2020). In the context of COVID-19, this would mean focusing as much as possible on the people who have done the *right* thing and the successes along the way, and blame should be used extremely rarely to met out judgment on very narrow targets (e.g., a failed health minister who violated social norms for their own gain). This method, in Path Based Model of blame, would work by changing *when* blame is used.

The other way to reduce blame in COVID-19 has been discussed (albeit indirectly) in a recent social identity analysis of COVID-19 (Jetten et al., 2020). Leaders and health professionals must ensure their messages on COVID-19 unite, rather than to divide by fostering a sense of "us" above all else. It may be politically expedient to blame particular groups, but ultimately it not only damages the response by causing those groups not to comply, but also potentially may lead to future problems in intragroup relations (Jetten et al., 2020). Theoretically, this will instill social norms that focus less on individual responsibility (i.e., "those bad rule breakers") and rather ones of shared, collective responsibility (i.e., "we're in this together"), changing *who* is blamed.

Overall, these streams of research suggest that the best way policy makers can act to reduce blame is through harnessing social identification for good: *protect us, because that's what we do*. Focusing on others may not be helpful. Instead, messaging about *us* doing the *right* thing is key. Recent evidence showed that social identification is a consistent predictor of health behaviors several months later, meaning harnessing this power of us is useful (Cárdenas et al., 2021). Another paper provides evidence that that family, community, and national identification has significant links with self-reported helping and physical distancing, and provides an example of good health messaging around these topics (Vignoles et al., 2021). Similarly, public health messages around protecting us are more powerful than protecting oneself (Wang and Lee, 2020; Gerber et al., 2021), as these messages can build trust between ethnic groups and governments (Razai et al., 2021).

Despite this evidence, there is little experimental research on the effects of blame messages on people's health behavior in the context of COVID-19. Most research focuses on messages designed to build community solidarity or correlational research on social identity and (Vignoles et al., 2021), but there is no experimental evidence on the effect of blame type messages weakening a response or intentions compared to non-blame messages. It is possible that a fine-tuned collective based blame messages on outgroups (using the Path Model of Blame Malle et al., 2014), coupled *with* messages on us as a contrast, may actually improve adherence to public health directives. One such example would be to say that *we* take care of each other, even though it's *them* that caused it, *we* can fix it. From a social identity approach, this is theoretically plausible; social identity content (who we are) is partially defined by what we are not, and harnessing this may be powerful (Haslam et al., 1992; Haslam and Turner, 1992, 1995; Parker and Janoff-Bulman, 2013). Doing so may be difficult to do without causing stigma, but at least assessing the impact of these messages is still useful as messages from various countries already blame others residents (Porumbescu et al., 2020). Future research should compare the effects of blame messages against a social identity approach. From a political science perspective (the theory of games), alternative approaches to understanding blame as a functional part to maintaining power may also add to understanding why leaders blame as well (Wagner, 1986). This is to say that we have

highlighted one approach to understanding blame, but there are others that might be worth considering.

CONCLUSION

It has become clear in the past year that public health officials are fighting two epidemics: an epidemic of COVID-19, and an epidemic of faulty/malice filled information (Islam et al., 2020). This dual burden that COVID-19 represents is likely to continue to affect society for the next decade. At the time of writing, vaccines are being rolled out across the United Kingdom and the world; however, intragroup distrust (as a consequence of being blamed) may impact the roll out. Early surveys suggested ethnic minorities and low income individuals in the United Kingdom will resist getting the vaccine, possibly due to a general distrust of the government (Bell et al., 2020; Dickerson et al., 2021; Razai et al., 2021), which also blamed them (British Broadcasting Corporation [BBC], 2020b). The gap between the rich and the poor is likely to grow as a result of COVID-19 (Adams-Prassl et al., 2020), and ethnoreligious tensions appear to have worsened in some countries (Ide, 2021). Blame in such an environment is especially toxic as it further separates people, when unity is needed against the COVID-19 threat and beyond (Jakovljevic et al., 2020).

Although we have detailed a theoretical account of COVID-19 and blame, precious little literature has attempted to understand how blame works against a theoretical model in COVID-19. This means there are key gaps in our knowledge. Perhaps most notably, there is little experimental evidence that manipulates the conditions of blame in COVID-19, suggesting more research is needed to examine the causality of blame in COVID-19. Understanding how blame functions in COVID-19 is crucial to ensure the recovery from the pandemic occurs evenly, and effectively. Pandemics can result in ethnic tensions when particular groups are blamed, and can even cause further health problems through distrust in systems. As blame can be damaging to a society already ravaged by COVID-19, we must seek to understand blame further through research in this context. In the meantime, avoiding blame as much as possible is critical to ensuring that a post-COVID-19 society is at least as healthy and harmonious as pre-pandemic levels.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

AB and VT conceptualized the contribution. AB produced the first draft. VT and CW reviewed the manuscript and provided the critical revision processes. All authors approved the submission of the final version of the manuscript.

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Impact of Refutational Two-Sided Messages on Attitudes Toward Novel Vaccines Against Emerging Infectious Diseases During the COVID-19 Pandemic

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Two-sided messages that include two perspectives (i.e., risks and benefits) are more effective than one-sided messages that convey only one perspective (usually only the benefits). Refutational two-sided messages are effective for communicating risks regarding vaccines. To examine the effectiveness of refutational two-sided messages in risk communication regarding novel vaccines against emerging infectious diseases, we conducted the randomized controlled study based on a 3 × 3 × 2 mixed design (Intervention 1: vaccines against subcutaneous influenza, "novel severe infectious disease," or intranasal influenza; intervention 2: one-sided, non-refutational two-sided, or refutational two-sided messages; two questionnaires) using a Japanese online panel. Participants completed questionnaires before and after receiving an attack message (negative information). We evaluated the impact of attack messages on the willingness to be vaccinated, and the anticipated regret of inaction (ARI). Among 1,184 participants, there was a significant difference in the willingness to be vaccinated among the message groups ($p < 0.01$). After receiving the attack message, willingness to be vaccinated decreased in the one-sided message group and increased in the non-refutational two-sided and refutational two-sided message groups. Additionally, ARI in the refutational two-sided message groups was significantly higher than in the one-sided groups ($p = 0.03$). In conclusion, two-sided messages are more effective than one-sided messages in terms of willingness to be vaccinated. Furthermore, the high ARI in the refutational two-sided message group indicated that refutational two-sided messages were more effective than one-sided messages for communicating the risks of vaccines, especially those against emerging infectious diseases.

Keywords: risk communication, vaccine hesitancy, refutational two-sided messages, inoculation theory, COVID-19, two-sided messages, anticipated regret

INTRODUCTION

The pace of vaccination against coronavirus disease 2019 (COVID-19) has been accelerating in many countries, to establish herd immunity. However, vaccine hesitancy among policy-makers and clinicians is a major obstacle to vaccination efforts (1). Japan is also facing this obstacle (2, 3). In Japan, the national program for human papillomavirus (HPV) vaccine was stopped because vaccine side effects caused controversies that led to a steep decline in vaccine coverage (<1% of Japanese population) and serious risks for unvaccinated women (4, 5). COVID-19 vaccine hesitancy may not be completely unreasonable considering the controversies surrounding vaccines such as the measles, mumps, and rubella vaccine or HPV vaccine (6).

Emphasis on the benefits of vaccines, without considering their side effects, is risky despite its short-term positive effects. This strategy may not work because people's attitudes toward the vaccine change if they encounter negative information regarding it (e.g., vaccine side effects). Additionally, the environment cannot be cleared of negative information regarding the vaccine (correct or incorrect) (7), and vaccines do have some risks for certain populations; people should have the right to decide whether they want to be vaccinated. The best strategy to gain the public's trust in a crisis like COVID-19 is to inform them of the positive and negative scientific evidence on vaccination.

The psychological inoculation theory states that beliefs called "cultural truisms" such as "the effects of penicillin have been of enormous benefit to mankind" are vulnerable to counterarguments (8). The mechanism of resistance to counterarguments can be explained using the analogy of medical inoculation. People will be motivated to defend their attitudes if they are already informed about possible arguments including mere forewarnings. People who have been informed of the possible arguments are likely to refute them and become resistant to negative information, a process called attitudinal inoculation. Therefore, people build immunity against future attacks.

Although this theory helps us understand the mechanism of resistance to persuasion, we must recognize that the mechanism is not identical between medical and psychological contexts. Compton pointed out that, in the medical context, the immune system is automatically motivated, while in the psychological (persuasion) context, cognitive affective systems are motivated by recognition of a threat (9).

The applicability of this theory to other fields has been explored (8, 10). In particular, its application to health-related issues (11), including vaccination (12), has been increasing.

Studies have demonstrated the superiority of two-sided messages related to vaccination over one-sided messages. One-sided messages present a single perspective, typically positive, whereas two-sided messages present arguments from both sides, i.e., both the risks and benefits. A two-sided message is more effective than a one-sided message because it increases the credibility of the message and functions as attitudinal inoculation, i.e., motivates people to "protect" their attitude. Refutational two-sided messages refute counterarguments and are more effective (13). Such messages have been used to tackle misinformation regarding the measles, mumps, and rubella vaccine (14).

For effective risk communication regarding the COVID-19 vaccine, the credibility of information on its safety and effectiveness is an important factor in the decision to get vaccinated, especially among those who are unsure about getting vaccinated (15). However, to the best of our knowledge, no study has evaluated whether refutational and non-refutational two-sided messages are effective in the case of vaccines for life-threatening diseases, such as COVID-19. The risks of vaccines should be communicated accurately because risk perception increases for unfamiliar interventions (16).

In the present study, we compared the effectiveness of refutational two-sided messages with one-sided and non-refutational two-sided messages, to understand how better to convince people regarding the benefits of COVID-19 vaccination.

MATERIALS AND METHODS

We conducted a randomized controlled study using a 3 × 3 × 2 mixed design (Intervention 1: vaccines against subcutaneous influenza, "novel severe infectious disease," or intranasal influenza; intervention 2: one-sided, non-refutational two-sided, or refutational two-sided messages; two questionnaires) (**Supplementary Figure 1**). The first two interventions were between-subjects variables, and the third was a within-subjects variable. The study participants were recruited in December 2020 using an online panel provided by the NTTCom Online Marketing Solutions Corporation (Tokyo, Japan). During the study period, COVID-19 vaccination had started in the USA, and there was a paucity of information regarding COVID-19 vaccine side effects in Japan. "Novel severe infectious disease" was a fictitious disease, and intranasal influenza vaccine had not been introduced in Japan.

We recruited 1,184 participants with approximately equal representation of sex and age groups. Informed consent was obtained online (**Supplementary Figure 1**). This study obtained ethical approval from the institutional review board of the National Institute of Infectious Diseases of Japan.

For Intervention 1, participants were asked to imagine that they received an explanation for one of the following vaccines: subcutaneous influenza vaccine, intranasal influenza vaccine, or "novel severe infectious disease" vaccine before vaccination. The participants were informed that the "novel severe infectious disease" was fictitious.

Irrespective of their assigned groups in Intervention 1, participants were randomly assigned to one of three experimental conditions: one-sided, non-refutational two-sided, or refutational two-sided messages. Participants in the one-sided message group were given positive information (i.e., general information and data on effectiveness) about the vaccine that they were assigned in Intervention 1. Positive information

Abbreviations: COVID-19, coronavirus disease 2019; HPV, human papillomavirus; PCV, pneumococcal conjugated vaccine; ARI, anticipated regret of inaction; ARA, anticipated regret of action; ANOVA, analysis of variance.

about the subcutaneous and intranasal influenza vaccines was adapted from the content on the websites of the US Centers for Disease Control and Prevention, the Japanese National Institute of Infectious Disease, and the Ministry of Health, Labour, and Welfare (17, 18). Positive information for the "novel severe infectious disease" was the same as that for the subcutaneous influenza vaccine, except for the different names of the infectious disease and the vaccine.

Participants in the non-refutational two-sided message group received the following message in addition to the positive information: "However, vaccine side effects occur in a certain proportion of recipients, estimated to be 15–30%." (counterarguments) Participants in the refutational two-sided message group received the following message in addition to the messages received by the non-refutational two-sided message group: "Although vaccine side effects may occur in a certain proportion of the recipients, most side effects are relatively mild and improve in a few days. To date, documented serious side effects have been very rare" (refutation). The type of refutation was "refutational-same," in the sense that both the counterargument and refutation deal with the side effects of vaccination (10). After reading the messages, all participants received an attack message (negative information) about the vaccine side effects. Information regarding the side effects of the subcutaneous and intranasal influenza vaccines was adapted from the content on the websites of the US Centers for Disease Control and Prevention and the Japanese Ministry of Health, Labour, and Welfare (17, 18). Information regarding the side effects of the vaccine against the "novel severe infectious disease" was the same as that for the subcutaneous influenza vaccine, except for the different names of the infectious disease, and the vaccine. We also added that there were no data from Japan regarding the serious side effects of the intranasal influenza and "novel severe infectious disease" vaccines.

Participants filled in questionnaires before and after receiving the attack message. Participants were asked to rate on Likert-type scales [range: 1 (not at all) to 5 (extremely)]: their willingness to be vaccinated, anxiety regarding vaccine side effects, anticipated regret if they did not get vaccinated and developed an infection (anticipated regret of action, ARA), and anticipated regret if they were vaccinated and suffered from vaccine side effects (anticipated regret of inaction, ARI).

We analyzed the data to evaluate the impact of the attack message on willingness to be vaccinated, especially against the "novel severe infectious disease." Differences among the groups were analyzed using three-way factorial analysis of variance (ANOVA) and Bonferroni correction. $P < 0.05$ were considered significant. All analyses were performed using SPSS Statistics software (version 25; IBM Corp., Armonk, NY, USA).

RESULTS

Study Participants

The average age of the participants was 46.3 years (SD = 13.6; **Table 1**). More than half had graduated from graduate schools or universities ($n = 652$; 54.7%; **Table 1**). Before Intervention 1, participants were asked to rate their interest in various real vaccines using Likert-type scales. The percentage of participants who were extremely interested in the vaccine along with the average score of interest was highest for the COVID-19 vaccine (36.4%; average score of interest: 3.83), followed by the subcutaneous influenza vaccine (19.9%; 3.17), and intranasal influenza vaccine (9.7%; 2.75; $p < 0.01$; **Table 1**). Regarding vaccine knowledge, the average knowledge scores were relatively low for unfamiliar vaccines, i.e., the COVID-19 and intranasal influenza vaccines, compared to the subcutaneous influenza vaccine (1.83, 2.61, 2,88, respectively; $p < 0.001$).

TABLE 1 | Characteristics and interest in the vaccines.

		All participants	
		***n* = 1,193**	**(%)**
Average age (years, ±SD)		46.3 (±13.6)	
Male		644	54.0
Education			
	High school/Junior college	519	43.5
	University	581	48.7
	Graduate school	71	6.0
Interest in the subcutaneous influenza vaccine			
	Extremely	238	19.9
	Not at all	199	16.7
	Average scores (±SD)[a]	3.17 (±1.366)	
Interest in the novel severe infectious disease vaccine			
	Extremely	427	36.4
	Not at all	104	8.7
	Average scores (±SD)[a]	3.83 (±1.218)	
Interest in the nasal influenza vaccine			
	Extremely	116	9.7
	Not at all	297	24.9
	Average scores (±SD)[a)]	2.75 (±1.282)	

[a]*Average scores of Likert-type scales ranging from 1 (not at all) to 5 (extremely). SD, standard deviation.*

Comparison Among the Vaccines

The attack message had a significant impact on willingness to be vaccinated [$F_{(2,1,184)} = 14.204$; $p < 0.01$]. Willingness to be vaccinated with the intranasal influenza vaccine was significantly lower compared to the other two vaccines. Willingness to be vaccinated with the subcutaneous and intranasal influenza vaccines decreased significantly after receiving the attack message. However, willingness to be vaccinated increased after receiving the attack message about the "novel severe infectious disease" vaccine (**Figure 1A**). The attack message significantly increased anxiety regarding vaccine side effects [$F_{(2,1,184)} = 14.483$; $p < 0.01$). Participants in the intranasal influenza vaccine group had significantly higher levels of anxiety than those in the other two groups (**Figure 1B**). However, in the "novel severe infectious disease" group, anxiety decreased after receiving the attack message (**Figure 1B**).

There was no significant impact of the attack message on the ARI (**Supplementary Table 1**). However, the ARI differed significantly between the vaccine groups [$F_{(2,1,184)} = 37.966$;

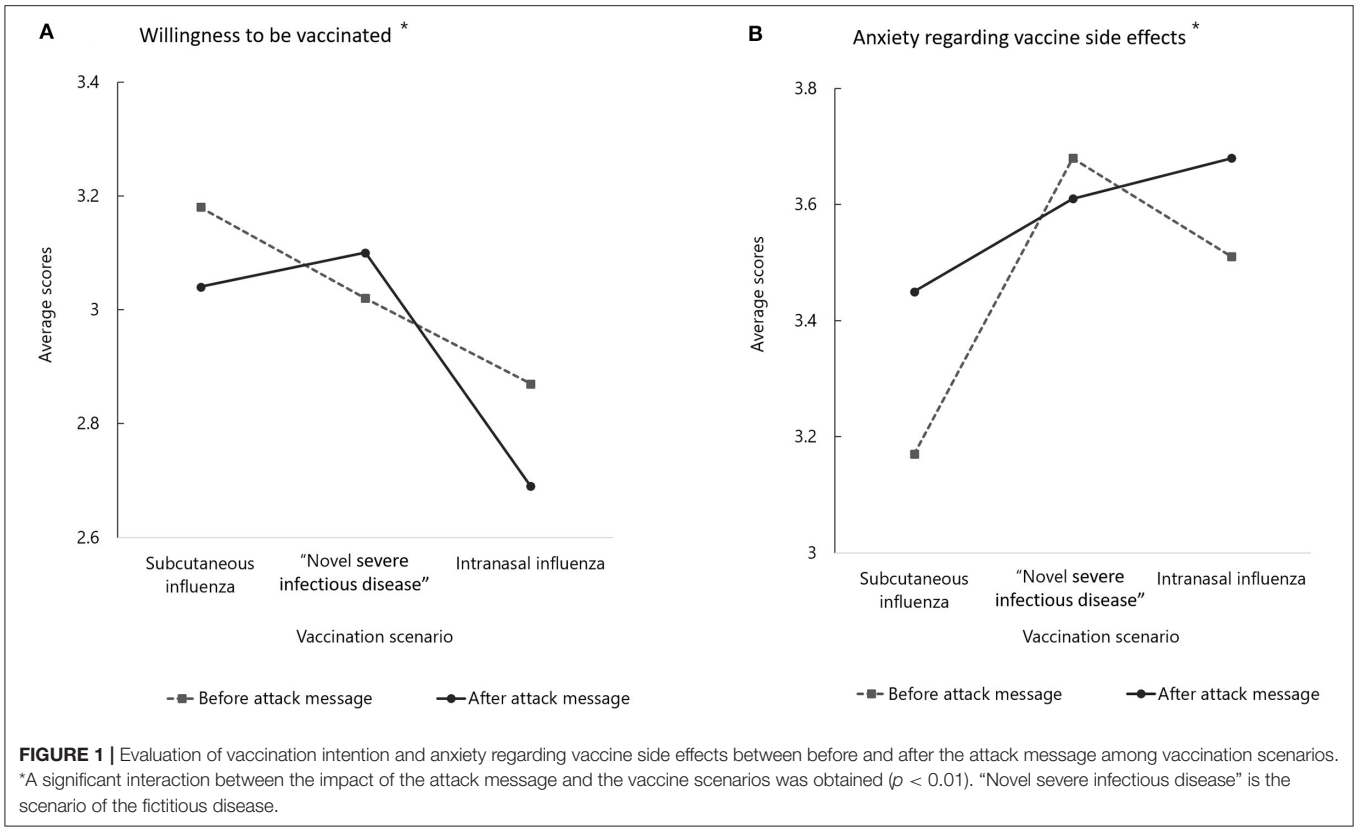

FIGURE 1 | Evaluation of vaccination intention and anxiety regarding vaccine side effects between before and after the attack message among vaccination scenarios. *A significant interaction between the impact of the attack message and the vaccine scenarios was obtained ($p < 0.01$). "Novel severe infectious disease" is the scenario of the fictitious disease.

$p < 0.01$]. ARI was higher in the "novel severe infectious disease" group than in the other groups. There was a significant interaction between the attack message and ARA. There were significant differences in the impact of negative interaction on the ARA among the groups [$F_{(1,\,1,184)} = 16.032$; $p < 0.01$]. There was a decrease in ARA in the "novel severe infectious disease" and intranasal influenza vaccine groups after receiving the attack message. However, the ARA in the subcutaneous influenza group increased after receiving the attack message (**Supplementary Table 1**).

Evaluation of the Impact of the Message in the Novel Vaccine Group

In the "novel severe infectious disease" group, there was a significant difference between the message types in terms of willingness to be vaccinated [$F_{(2,402)} = 5.572$; $p < 0.01$]. Willingness to be vaccinated was significantly lower in the one-sided message group than in the other two message groups (**Figure 2A**). Additionally, willingness to be vaccinated decreased in the one-sided message group after receiving the attack message. However, in the non-refutational two-sided and refutational two-sided message groups, willingness increased after receiving the attack message. There was a significant interaction between the impact of the attack message and the message groups in terms of anxiety regarding side effects (**Supplementary Table 2**). After receiving the attack message, anxiety increased in the one-sided message group and decreased in the non-refutational two-sided and refutational two-sided message groups.

ARI was highest in the refutational two-sided message group. Pairwise comparisons using Bonferroni correction revealed a significant difference between the one-sided and refutational two-sided message groups ($p = 0.03$; **Figure 2B**). ARA increased significantly after receiving the attack message [$F_{(1,\,402)} = 21.977$; $p < 0.01$]; however, no significant differences were noted between the three message groups [$F_{(2,\,402)} = 0.84$; $p = 0.20$; **Figure 2C**].

DISCUSSION

In this study, the impact of the attack message (negative information) differed significantly among the vaccine groups. In the "novel severe infectious disease" group, participants were more willing to be vaccinated and had lower anxiety regarding vaccine side effects after receiving the attack message (i.e., information about vaccine side effects) compared to the other two vaccine groups. Therefore, providing information regarding vaccine side effects does not necessarily induce reluctance to be vaccinated.

Participants in the refutational two-sided message group rated ARI higher for the "novel severe infectious disease" vaccine compared to the other vaccines. Because most people are risk-averse, they are motivated to avoid regret in the future (loss aversion). Anticipated regret is an important factor in risk perception and vaccine uptake (19–21). Reiter et al.

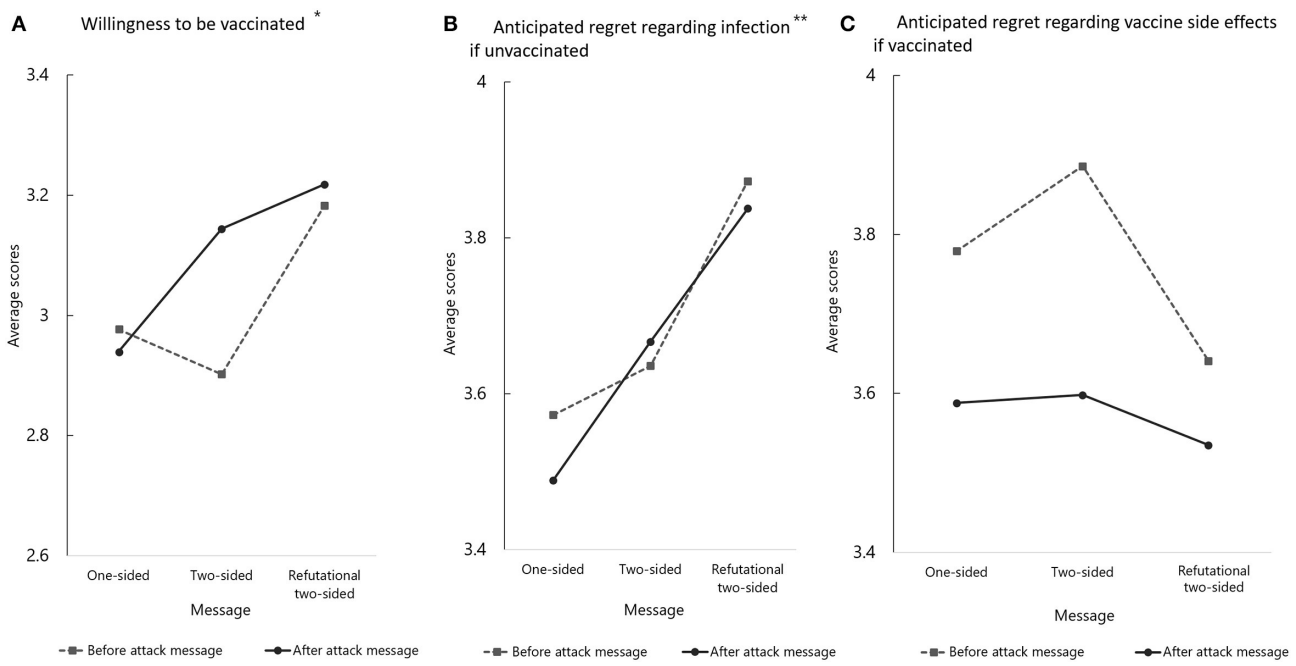

FIGURE 2 | Evaluation of vaccination intention and anxiety regarding vaccine side effects between before and after the attack message in the fictitious infectious-disease scenario. *A significant interaction between the impact of the attack message and the message groups was obtained ($p < 0.01$). **Pairwise comparisons using Bonferroni correction revealed a significant difference between the one-sided and refutational two-sided message groups ($p = 0.03$).

reported that ARI led to greater willingness to receive the HPV vaccine (22). The higher ARI among participants of the refutational two-sided message group implies that these messages were more effective than one-sided messages in terms of risk communication, especially for a novel infectious disease. There were no significant differences among the message groups in terms of ARA. Therefore, informing individuals of the side effects of a new vaccine against a novel infectious disease does not necessarily lead to a negative attitude toward receiving the vaccine.

Because participants were unfamiliar with the arguments in support of the vaccination for the novel infectious disease, participants were not able to refute the arguments by themselves. Therefore, the refutational messages provided to the study participants informed them regarding the arguments and counter-arguments. These messages were useful for "inoculating" the patients against the attack message regarding vaccination. Their willingness and ARI increased after receiving the attack message in the form of refutational two-sided messages, indicating the effectiveness of refutation. After receiving the attack message, anxiety about vaccine side effects increased in the one-sided message group, implying that the participants in this group could not generate refutation arguments or defend their attitude against attacks. This could have implications for combatting misinformation and conspiracy theories about COVID-19, as Compton et al. suggested (23).

We used a fictitious name for an infectious disease to increase the generalizability of our results. The results of this study may be applied to new vaccines for diseases other than COVID-19, because we did not specify that the "novel severe infectious disease" was COVID-19. Our results could help policy-makers and medical experts to convince people to get vaccinated, i.e., by using refutational two-sided messages before they develop their own attitudes. When new vaccines are introduced, policy-makers may be inclined to emphasize the benefit of vaccines, to establish herd immunity, and to communicate paternalistically. However, this strategy is risky because contradictory evidence will eventually appear. As Ivanov and Parker pointed out (24), "inoculation-based messages are well-suited to assist the efforts of civic leaders to convince the public to accept the forthcoming coronavirus vaccine." Our results reinforce their contention.

The relatively low willingness to be vaccinated with the intranasal influenza vaccine may be interpreted as follows. In Japan, subcutaneous influenza vaccine is commonly used, and people are familiar with the use of this vaccine. Therefore, the Japanese population are not aware of the practical benefits of the intranasal vaccine. Participants were less interested in the intranasal influenza vaccine compared to the COVID-19 or subcutaneous influenza vaccines (**Table 1**). The study participants were not willing to receive an unknown vaccine, especially when an alternative was available. Although the numbers of studies on the research and development of intranasal influenza vaccines have been increasing (25), further studies on risk communication are required, especially when a new intranasal influenza vaccine is introduced.

There are several limitations to this study. First, we used a scenario based on a fictitious disease because of ethical considerations. Therefore, we did not directly evaluate the

effectiveness of refutational and non-refutational two-sided messages for COVID-19 vaccines. However, as described previously, we consider this a strength of this study rather than a limitation. Participants in this study were extremely interested in COVID-19 vaccines (**Table 1**). Therefore, it is possible that the participants assumed COVID-19 to be the "novel severe infectious disease." To confirm or refute this, further studies are required that directly evaluate the effects of different types of messages on attitudes toward COVID-19 vaccines. Second, we did not directly measure threat. That is, we did not establish the threat level using conventional measures (12). As Compton and Pfau stated (26), "inoculation is impossible without threat." Participants had little knowledge about vaccinations except for subcutaneous influenza vaccines when the study was conducted. In other words, they were in a "germ-free" situation, where any counterargument could be a threat. Future studies are necessary to confirm the validity of our interpretation. Third, we recruited participants using a Japanese online panel. Although two-sided messages (with or without refutation) have been reported to be superior to one-sided messages in studies conducted in many countries, attitudinal differences toward vaccination depend on local cultures and may reduce the effectiveness of these messages. Japanese society is characterized as privileging masculinity and focused on avoiding uncertainty as well as on long-term orientation. Therefore, attitudes toward vaccination may be more positive in Japan, as compared to other countries with different characteristics (27). In addition, anti-COVID-19 vaccination attitudes and conspiracy theories have not gained traction in Japan compared to other countries where these issues are a matter of serious concern (24, 28). Studies of the effects of the messages based on cultural differences will allow us to tailor messages to specific cultures (29). Finally, we demonstrated the short-term effects of refutational two-sided messages using an online survey. We did not evaluate the duration of the effects of these messages. Although the inoculation theory suggests that attitudinal immunity will last a long time (8), and that immunity provides umbrella protection against new arguments, generalizing the current results should be done with caution, since the pandemic is still ongoing and new arguments for and against vaccinations have been increasing (30).

CONCLUSIONS

Our results are in agreement with those of previous studies, which demonstrated that refutational two-sided messages are effective for vaccine communication, especially for novel infectious diseases. To the best of our knowledge, this is the first study to show the effectiveness of refutational two-sided messages for risk communication for new vaccines introduced during the COVID-19 pandemic. Communicating the risks and benefits of vaccines is a fair, transparent, and effective strategy for vaccine communication.

Previous studies detected the superiority of refutational two-sided messages over one-sided messages for conventional vaccines. This study validated the results of previous studies using vaccines introduced during the COVID-19 pandemic.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding authors.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the National Institute of Infectious Diseases, Japan. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

HO and TK designed the study, analyzed data, and wrote the manuscript. HO, SA, and TK performed the study and collected data. SA and MS gave support and conceptual advice. All authors read and approved the final manuscript.

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The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.775486/full#supplementary-material

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Determinants and Variations of COVID-19 Vaccine Uptake and Responses Among Minority Ethnic Groups in Amsterdam, the Netherlands

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The outbreak of the deadly novel coronavirus disease (COVID-19) has disrupted life worldwide in an unprecedented manner. Over the period, scientific breakthroughs have resulted in the rollout of many vaccination programmes to protect against the disease, reduce the fear and ease public health restrictions for lives to return to some normalcy. The aim of this study was to identify the factors responsible for COVID-19 vaccine acceptance or vaccine hesitancy and to develop a framework to improve vaccine uptake in the Ghanaian-Dutch, Afro and Hindustani Surinamese-Dutch communities in Amsterdam. Using a mixed method approach, this community-based cross-sectional survey recruited 160 respondents consisting of 57 Ghanaian-Dutch, 54 Afro Surinamese-Dutch and 49 Hindustani-Dutch residents in Amsterdam. Our findings showed that the choice of a vaccine as well as the likelihood of self-reported willingness to receive a vaccine is highly dependent on vaccine efficacy and safety. Available evidence of high vaccine effectiveness and safety could encourage about 41.3% of the respondents to accept the vaccine. Additionally, 69.6% of the respondents indicated their willingness to accept the vaccine when vaccine passports are made mandatory by the government. Other major factors that could drive the likelihood of accepting the COVID-19 vaccine include travel requirement for vaccination (28.3%), the safety/probability of only minor side effects (26.1%) and recommendation by family and friends (15.2%). The study therefore provides systematic evidence of factors associated with individual preferences toward COVID-19 vaccination. It demonstrates that the needs of each community are unique and specific interventional efforts are urgently needed to address concerns likely to be associated with vaccine hesitancy.

Keywords: minority ethnic groups, COVID-19 vaccine, vaccine efficacy, vaccine hesitancy, perception

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INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) is a deadly respiratory and systemic disease caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2), which has infected over 210 million people and unfortunately killed over 4 million globally as of August 18th 2021 (1). About two thirds of people with COVID-19 are asymptomatic, but other individuals may become severely ill and require hospitalization with respiratory support (2, 3). Human-to-human transmission of COVID-19 occurs through respiratory droplets, contaminated objects, direct physical contact with infected people, and potentially aerosols (4).

At the early onset of the pandemic, the World Health Organization (WHO) strongly recommended countries to implement interventions to curb the rapid spread of COVID-19 through minimizing contact between infected and uninfected persons (4). So far these measures have included lockdowns, closure of educational institutions and public places, banning of large gatherings, self-isolation/quarantine, shielding of the individuals most vulnerable to the infection, use of personal protection equipment (including use of face masks), and stringent personal methods of hand hygiene and physical distancing (5). These measures were necessary at the onset of this novel pandemic to help health systems and policymakers adopt strategies to tackle the virus adequately (5).

The COVID-19 pandemic is arguably the biggest global health crisis of the twenty-first century (6). It continues to impose enormous strain on healthcare systems and plunges nations to a standstill with an unprecedented social and economic impact worldwide (6). Considering that vaccine development is the most effective strategy to prevent and eliminate infectious diseases (7), the global health community began work in earnest with regards to COVID-19 vaccines. Recently, the Pfizer/BioNTech reached a critical milestone in the vaccine development programme at a time when the infection rates continue to rise and stretch hospitals beyond their capacities amidst prolonged lockdowns and economies struggling to reopen (8). With the recent breakthrough development of COVID-19 vaccines by several manufacturers, governments across the globe are in a race against time to acquire and rollout large-scale vaccinations of its population. However, this will require strategies and frameworks that promote peoples' trust in and the acceptance of the vaccine.

Despite the availability of COVID-19 vaccines, generally vaccination has continued to be a subject of many different controversies and vaccination scares. These controversies have affected vaccine acceptance to varying degrees and led to rising incidence of vaccine hesitancy worldwide, particularly among minority groups. Vaccine hesitancy ranked among the 2019 top ten global health threats and is often characterized by a delay or refusal of vaccines despite the availability of vaccination services (9). Though the reasons for vaccine hesitancy are multifaceted, a prominent factor may be the proliferation of conspiracy theories and misinformation arising from several sources particularly anti-vaccination activists. Until this is addressed, it poses an enormous threat to achieving coverage and community immunity. Therefore, there is the need for more research to address this hesitancy and identify potential factors that could build public trust to accept the vaccination programmes.

The COVID-19 pandemic has further illustrated that vaccine research, development, and rollout is crucial for combating emerging infectious disease outbreaks, but has also revealed many unanticipated side effects, ethical, behavioral and inequality questions. We hypothesize that vaccine hesitancy is prevalent among minority ethnic populations and might vary from the Ghanaian-Dutch, Afro and Hindustani Surinamese-Dutch communities in Amsterdam. Available evidence from the most successful countries in terms of COVID-19 vaccines rollout and percentage of population vaccinated against COVID-19 indicates that the uptake of the vaccination programmes is lower among people from minority ethnic groups (10, 11). Scientists have been attempting to understand contemporary vaccine hesitancy leading to refusal, particularly by focusing on the influences around how people make decisions. Sobo (12) has demonstrated how vaccine "refusers" in schools in the United States are not homogenous, showing how hesitancy can lead to selective refusal of vaccines or doses, and hesitancy can be traced along nuanced roots of efficacy, adverse reactions, as well as the broader political and economic culture of vaccine products, processing and procurement.

This present study attempted to identify and understand public perceptions and decision making among the Ghanaian-Dutch, Afro and Hindustani Surinamese-Dutch people resident in Amsterdam regarding COVID-19 vaccine. This is because vaccine hesitancy might partly be fuelled by inadequate knowledge about the prevalence and actual burden of the disease. Unaddressed concerns about the safety of a vaccine could contribute to vaccine hesitancy. It could also be influenced by the lack of confidence of the vaccines and complacency regarding the need for vaccination, and the perception of how conveniently it can be obtained (13). In this study therefore, we plan to investigate the driving factors and causes of vaccine hesitancy with reference to the uptake of COVID-19 vaccines, and develop a framework to mitigate vaccine hesitancy in these communities. This is because mass vaccination programmes and its acceptability are shaped by context (e.g., cultural connotations, history of previous vaccine programmes and availability at community-based health interventions) in addition to individual and vaccine-specific factors (e.g., perceptions often vary by vaccine) (14, 15). We attempt to evaluate the potential vaccination compliance rates among the minority ethnic populations in Amsterdam.

Vaccine hesitancy remains a complex public health issue referring to concerns about the safety, efficacy or need for vaccination. Relatively little is known about vaccine hesitancy among these minority ethnic groups. We aim to assess the sociocultural determinants of vaccine hesitancy regarding COVID-19 vaccines among the three communities in Amsterdam. Our aim is to provide a detailed characterization of vaccine hesitancy and the sociocultural factors to assist policy developers in designing an intervention tailored to improve COVID-19 vaccination among people from minority ethnic groups in Amsterdam. It is against this background that we

explore some issues relating to peoples acceptance, refusal or delay regarding the COVID-19 vaccines.

MATERIALS AND METHODS

Study Design

This was a pilot study that applied a mixture of quantitative and qualitative methods to investigate the spectrum/factors responsible for vaccine hesitancy and develop a framework aimed at improving vaccine uptake in the Ghanaian-Dutch, Afro and Hindustani Surinamese-Dutch communities in Amsterdam. The application of these mixed methods allowed for the triangulation of the data to increase its accurateness. This was a community-based cross-sectional survey study and in-depth interviews conducted from January 30th to April 30th 2021.

Study Area and Population

The study was conducted in the city of Amsterdam, the capital and most populous city of the Netherlands. The metropolitan region of Amsterdam has an estimated population of 2,480,393 and home to many non-Dutch immigrants who either settled for economic reasons or as asylum seekers and undocumented migrants (16). Available statistics show that native Dutch residents constitute about 46.6%, while the remaining trace their routes through immigration (17). Among these minority ethnic groups in Amsterdam are people with Surinamese and Ghanaian backgrounds.

According to current figures as published by the Statistics Netherlands, there are 356,402 people of Surinamese origin making up nearly 2.1% of the Dutch population (18). Out of this Surinamese population, 176,963 belong to the first generation, while 179,439 representing more than half of them were born in the Netherlands. Surinamese with an African background (referred to as Afro Surinamese or "Creole" in the Dutch context) are mainly the descendants of West Africans, and those with a South-Asian background (referred to as "Hindustani" in the Dutch context) have their roots in North India (19). It is also estimated that there are about 12,184 persons who trace their route from Ghana and live within the municipality of Amsterdam (14). Available records showed that about half of the officially registered people with Ghanaian and Surinamese background reside in the Bijlmermeer (popularly known as Bijlmer), a suburb of Zuid Oost (Southeast) municipality (20).

The Zuid Oost municipality is ethnically highly diverse, and it is often referred as Amsterdam city's "black neighborhood" due to the presence of many African migrants (21). Numerous shops sell foods, articles, and fabrics from Ghana and Suriname. It is also an area where several beauticians and hairdressers with diverse background are located. The Ghanaian-Dutch as well as the Surinamese-Dutch residents form a closely-knit community and are predominantly religious (22).

Ethics Considerations

Sampling for this study was part of a bigger research project "Sexual well-being and relationships among migrants from sub-Sahara Africa in the Netherlands". This study was approved by Amsterdam Institute for Social Science Research (AISSR) the Ethics Advisory Board of the University of Amsterdam, the Netherlands. Respondents were informed about the purpose, nature and procedures of the survey and the in-depth interviews. No respondent was coerced to participate in this survey and all those who responded did so willingly. Likewise, all respondents who took part in the in-depth interviews willingly consented to be part of this study. There were no personal identifications requested as part of this survey. All names used in this report are pseudonyms.

Selection and Recruitment of Study Respondents

The target populations for this study were people with a Ghanaian or Surinamese background residing in Amsterdam. It included all persons aged 18 years and above. Respondents were recruited through personal invitations on the streets, from churches, online social media platforms, community parks, and snowballing. Most of the respondents were recruited at hairdressing saloons/shops, marketplaces, and workplaces.

Study Procedure and Data Collection

Quantitative Procedures

Sample Size Justification

Sample size for this study was estimated using G* Power© statistical software (version *3.1.9.2*). The input assumptions for the sample size calculation were an A priori F test with a 5% margin of error at 95% confidence level. Following this, the minimum sample size required to sufficiently power the study (at 80%) assuming a 100% response rate and no dropout is approximately 70 per community, making a total of 210 participants. However, assuming a 20% non-response rate, the number of participants per community is 84. This will make a total effective sample size of about 250 participants for the study.

Administration of Survey Questionnaire

Using a standard questionnaire, sociodemographic data including sex (male or female), age (18–25, 26–35, 36–45, 46–55, and $\geq$ 56 years), ethnicity, level of education, occupation, and household composition of respondents were collected. Respondents were asked about their previous history of vaccination against other flu-like diseases such as influenza, and whether they intend to accept the COVID-19 vaccination. Respondents who accepted or declined the acceptance of COVID-19 vaccine were asked further questions to determine the push and pull factors toward COVID-19 vaccination. Data collection was done through face to face interview (in-person and virtual video platforms) and digitally using an online survey tool (Google forms).

Determination of Vaccine Hesitancy

The most widely used model in explaining and developing strategies to overcome vaccine hesitancy is the 3-Cs model developed by the SAGE Working Group on Vaccine Hesitancy from the World Health Organization (13). The three concerns that influence vaccine acceptance, hesitancy, delayal or refusal are as follows:

- Confidence (trust in the effectiveness and safety of vaccines).
- Complacency (perceived low risk without vaccination/view that vaccines were unnecessary).
- Convenience (accessibility/availability and lack of understanding).

As part of the survey questionnaire, this study sought to measure the confidence (level of trust in the safety and effectiveness) of respondents from these communities in the COVID-19 vaccines or vaccination programme in Amsterdam, The Netherlands. The level of trust was answered using a 10-choice scale ranging from a very low level (one) to a very high level (ten). The study also sought to measure the level of complacency by asking respondents if they thought it was important for everyone to take vaccine and whether they perceived COVID-19 as a risk to their health or wellbeing. In terms of convenience, respondents were asked if they were aware about the availability of COVID-19 vaccines in Amsterdam and whether they were planning to take the vaccine.

Qualitative (Ethnography) Procedures

In-depth Interviews

Respondents who agreed were invited for additional in-depth interviews to determine the sociocultural factors driving their decison-making toward the COVID-19 vaccine acceptance or hesitancy. In-depth interviews (IDI) were conducted simultaneously alongside the collection of the survey data with the respondents. During the IDIs, the questions that generated further elaborations from the respondents were probed to investigate reasons for any discrepancies between data from the survey and what people do or say. In addition, this study explored further to understand the choices people made and the motivations behind those choices. This was a mechanism to ensure accurate data on the sociocultural beliefs and provide an understanding of the factors behind the choices people made. The IDIs were also used to discuss *immediate past* practices of the survey respondents that informed their current behavior, decisions, knowledge and opinions. This allowed for the researchers to link the choices of the respondents.

Participant Observation

Participant observation was a continuous element throughout the data collection procedure. During data collection, a considerable time was spent in places that Amsterdam residents of Ghanaian or Surinamese background pointed out as the most popular public places they visited for diverse reasons. The average number of people going there each day was also observed. The research team also visited some churches on different Sundays (most common day of worship), to observe the interaction between congregants present. Besides generating important contextual information, participant observation enabled the building of rapport with respondents but also generated conversations on prevention methods that were difficult and/or easy to adhere to. Most of the data were completed through face-to-face or use of video call interviews and that enabled the respondents to seek further clarification on some questions they did not completely understand. At all times, both the respondent and interviewer had their face/nose mask on and maintained a physical distance of 1.5 m from each other.

Collection of Ethnographic Data and Its Validation

Through a systematic inquiry, attempts were made by the researchers to consider all matters sensitive to the Ghanaian-Dutch and Surinamese-Dutch communities regarding the objective of this survey study. To assure the quality of the collected data, the questions were prepared first in English and then translated into the Dutch or Twi languages by the researcher for respondents who could not adequately understand or express themselves in English. Appropriate modifications such as wording, changing terms, rephrasing for better understanding, deleting, and adding some information for clarity were made on the tool accordingly. The researchers closely observed and monitored data collection.

Data Analysis

The data collected through paper questionnaires and Google Forms were entered into excel and exported for analysis using SPSS software (SPSS Inc.). The descriptive proportions of participants who used each common source to obtain information about COVID-19 were presented in terms of number and percentage. The survey aimed to collect 50 responses from the Ghanaian-Dutch and each of the Surinamese-Dutch (Afro and Hindustani) communities. Putting together a representative sample of the Ghanaian-Dutch and Surinamese-Dutch residents in Amsterdam was not possible within the limited time and budget for this study. However, as previous research works have shown and this present study shows, efforts directed at specific groups and focus on their unique concerns were more effective than broad messages directed to the whole population (23, 24). Due to the method of sampling, some results and analysis are generalizable to the various age, occupational and ethnic groups who make up the sample, but this is not a representative cross-sample of the three communities in Amsterdam.

RESULTS

Demographic Characteristics of Study Respondents

The demographic characteristics of the study respondents are presented in **Table 1**. At the end of the survey, a total of 160 responses for the survey and 36 IDI were collected through face-to-face, telephone and online interviews. There were more male respondents 86 (53.8%) compared to females 74 (46.2%). In both the Afro and Hindustani Surinamese-Dutch groups, there were more male respondents than the female respondents. However, among the respondents from the Ghanaian-Dutch community there were more females 30 (52.6%) compared to the males. Respondents belonging to the 18–25 years constituted the lowest proportion 25 (15.6%), while those in the 36–45 years had the highest proportion 37 (23.1%), with a median age range of all the respondents between 36 and 45 years.

All but one of the respondents had some level of formal education ranging from primary school to doctoral degrees.

TABLE 1 | Sociodemographic characteristics of respondents from the Ghanaian-Dutch, Afro and Hindustani Surinamese-Dutch communities in Amsterdam.

Variable	Ghanaian-Dutch	Afro Surinamese-Dutch	Hindustani-Dutch	Percent (%)
Number of respondents	57	54	49	
Sex				
Male	27 (47.4%)	28 (51.9%)	31(63.3%)	53.8
Female	30 (52.6%)	26 (48.1%)	18 (36.7%)	46.2
Age				
18–25	8	10	7	15.6
26–35	8	9	13	18.8
36–45	15	12	10	23.1
46–55	14	10	9	20.6
≥56	12	13	10	21.9
Level of education				
Doctoral	2	1	3	3.8
Masters	10	8	6	15.0
Bachelor	13	18	13	27.5
Senior/Vocational/technical	26	23	20	43.1
Junior high school	1	2	4	4.4
Primary or elementary	5	1	3	5.6
None	0	1	0	0.6
Area of occupation				
Healthcare	8	6	7	13.1
Education	4	5	9	11.3
Transport/Construction	4	4	4	7.5
Hospitality/catering	10	5	8	14.4
Administrative /IT	3	9	5	10.6
Religious (pastoral, etc.)	2	1	3	3.8
Student	5	6	2	8.1
Unemployed/Retired	8	6	7	13.1
Others/Prefer not to answer	13	12	4	18.1

TABLE 2 | Household characteristics of study respondents.

Variable	Ghanaian-Dutch	Afro Surinamese-Dutch	Hindustani-Dutch	Percent (%)
Total Household composition				
1	5	8	13	16.3
2	9	14	19	26.3
3	12	10	5	16.9
4	5	9	6	12.5
≥ 5	24	13	6	26.9
Prefer not to answer	2	0	0	1.3
Adults (≥18years) in household				
1	7	12	14	20.6
2	12	25	24	38.1
3	19	7	4	18.8
4	11	6	6	14.4
≥ 5	6	2	1	5.6
Prefer not to answer	2	2	0	2.5

TABLE 3 | Response on compliance to previous vaccinations against other flu-like diseases.

Variable	GD	ASD	HD
N	55	54	49
Previous vaccines taken against other flu-like disease			
Yes	45	44	40
No	10	10	9
Driving factors toward accepting vaccines against other flu-like disease			
Mandatory government policy	18	19	15
Proven safety and effectiveness	25	20	22
Religious or ideological belief	0	0	0
Lack of effective medication or treatment	3	3	6
Expensive treatment without vaccination	3	2	6
Protection from a deadly disease or ill-health	11	11	7
Other	2	3	3

The single most popular employment sector for majority of the respondents was in the hospitality 23(14.4%), followed closely by healthcare 21(11.3%), and the unemployed or retired category 21(13.1%). A total of 29 (18.1%) respondents were either employed in other non-formal sectors or preferred not to answer. **Table 2** shows that majority of respondents' household were composed of 5 or more people 43(26.9%), followed by those that had 2 persons 42 (26.3%) and 3 persons 27 (16.9%). There were 61 individual respondent's homes with 2 adults living together and that constituted the highest proportion (38.1%).

Compliance Rate of Study Respondents to Previous Vaccinations Against Other Flu-Like Diseases (Influenza)

All respondents were asked if they had previously been vaccinated against other flu-like diseases such as Influenza. In the Ghanaian-Dutch community, 45 out of the 55 (81.8%) respondents answered "Yes". Out of the 54 respondents to this survey from the Afro Surinamese-Dutch community, 44 (81.5%) had accepted previous vaccines to other flu-like diseases. Among the Hindustani-Dutch respondents 40 (81.6%) out of 49 had also previously been vaccinated against other Flu-like diseases (**Table 3**).

Factors That Promoted Compliance to Previous Vaccination Programmes Against Other Flu-Like Diseases

Among the 44 Afro Surinamese-Dutch respondents who took previous vaccine against other flu-like diseases, 20 (45.5%) reported that they took the vaccine because they considered it was safe and effective (**Table 3**). Meanwhile, 19 (43.2%) took the vaccine because it was mandatory (government policy) and part of a nationwide vaccination programme. However, beyond mandatory and perceived safety or efficacy, some respondents 11 (25%) also felt convinced that the vaccine provided protection against a deadly disease. Among the Ghanaian-Dutch

TABLE 4 | Perception and acceptance of COVID-19 vaccination.

Variable	GD	ASD	HD
Have you already taken a COVID-19 vaccine shot?			
Yes	2	7	7
No	53	47	42
Are you planning to take the COVID-19 vaccine shot?			
Yes	26	26	23
No	16	11	13
Undecided	13	17	13
What do you think about the COVID-19 vaccine?			
It is effective and safe	10	7	13
I don't trust the effectiveness and safety	25	18	25
Conspiracy by the government to control us	1	2	5
It is important for everyone to take it	16	26	22
It is not important	1	0	4
Other/prefer not to answer	5	6	4

respondents the main driving factors for accepting previous vaccine against other flu-like diseases were based on the proven safety and effectiveness of the vaccines (55.6%) and because it was mandatory or government policy (40%). Similarly, for the Hindustani-Dutch community, most of the respondents also accepted previous vaccines against other flu-like diseases because of the proven safety and effectiveness of the vaccines (55%) and because it was mandatory or government policy (37.5%) as shown in **Table 3**. No respondent reported from the three ethnic groups indicated that religious or ideological belief influenced them toward or against taking the other flu-like vaccines (**Table 3**).

Determining Factors for Uptake of COVID-19 Vaccine

All the respondents who took part in this study were asked if they had already taken the COVID-19 vaccine. Only 2 representing 3.6% out of the 55 respondents from the Ghanaian-Dutch (GD) community had taken at least one dose of the vaccine. Among the Afro Surinamese-Dutch respondents (ASD), only 7 (13%) had also taken at least one dose of the vaccine while a further 7 (14%) out of the 49 Hindustani-Dutch (HD) respondents had taken the vaccine (**Table 4**). Furthermore, respondents in this study were asked if they were planning to take the COVID-19 vaccine. The results showed that the number and percentage of respondents who were likely to take the vaccine among the Ghanaian-Dutch, Afro Surinamese-Dutch and Hindustani-Dutch were 26 (47.3%), 26 (48.1%) and 23 (47%), respectively.

There were 16 (29.1%), 11 (20.4%) and 13 (26.5%) respondents from the Ghanaian-Dutch, Afro Surinamese-Dutch and Hindustani-Dutch, respectively, that indicated they would not take the COVID-19 vaccines. A further 13 (23.6%), 17 (31.5%) and 13 (26.5%) of respondents from the Ghanaian-Dutch, Afro Surinamese-Dutch and Hindustani-Dutch were undecided about taking the vaccine (**Table 4**). In summary, the willingness to take the COVID-19 vaccine was relatively similar among respondents from the Ghanaian-Dutch and Afro Surinamese-Dutch respondents. However, the highest proportion of respondents who are undecided about taking the vaccines are from the Afro Surinamese-Dutch community. The data collection for the Ghanaian-Dutch respondents were completed on 14th February, 2021 and at this time the total number of people who had received at least one dose of COVID-19 vaccine in the Netherlands was 694,075 representing 4.0% of the population.

Generally, the willingness to take the COVID-19 vaccine appeared to be dependent on age groups and gender. The dependence on occupational status was not clearly determined in this study. The level of education was evenly distributed among the groups and showed no effect.

In specific terms with regards to age, although older respondents (46 years or more) were more likely to say they would be vaccinated, younger respondents, age 26–35 were also more likely than those younger than them (18–25 years) or immediately older than them in the 36–45 age group (**Figure 1**). In terms of gender, males were significantly more likely to agree to be vaccinated than the females. The relationship between Level of Education and willingness to be vaccinated was not linear. However, respondents with a high/vocational school education formed a large proportion of those who were more willing to be vaccinated. In terms of occupation, those who showed willingness to be vaccinated include students, unemployed, self-employed and retired personnel. For most students, the willingness to get vaccinated was largely dependent on their eagerness to focus on their education with limited interruptions while the self-employed people who traveled for their businesses favored getting vaccinated. Interestingly, healthcare workers were the least willing to be vaccinated among the various occupations.

Perceptions and Assessment of Vaccine Hesitancy

The result on perception and assessment of vaccine hesitancy is presented under complacency, confidence and convenience.

Complacency (Perceived Risk and Significance of Vaccination)

All respondents were asked the question "do you perceive COVID-19 crisis as a threat to your personal health or well-being?" Out of a total of 55 respondents from the Ghanaian-Dutch, 40 representing 72.7% perceived COVID-19 as a threat to their personal health or wellbeing. Out of 52 respondents from the Afro Surinamese-Dutch community, 37 representing 71.2% answered "yes" indicating that COVID-19 had negatively affected their wellbeing. From the Hindustani-Dutch community, 42 out of 49 respondents (86%) also perceived COVID-19 as a threat to their personal health or wellbeing. Many of the people affected by the pandemic explained their choice was based on the distressing effects of the COVID-19 on people in their families and communities' health or even loss of family, friends and neighbors. Others talked about it mainly because of the financial hardships that accompanied because they lost their jobs or were unable to pay for bills. For some, their businesses did not run fully and led to accumulated debts. All of these had resulted in a psychological toll on their lives of many respondents. Talking

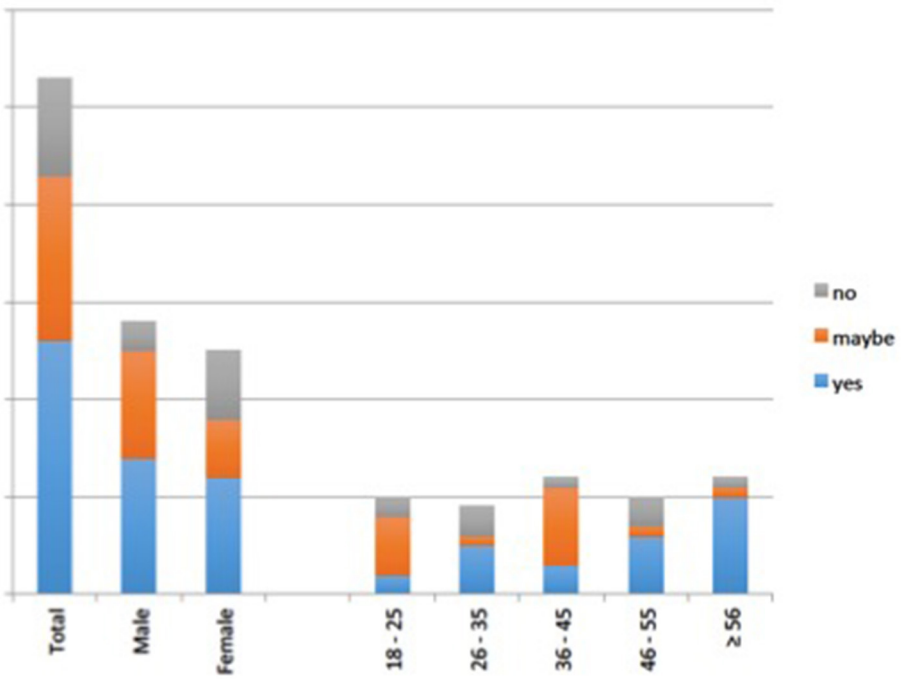

FIGURE 1 | Willingness by respondents to take COVID-19 vaccination against gender and age.

to 53-year-old Anish (male), he explained that the Hindustani community in Amsterdam is perhaps the worst hit with COVID-19 fatalities, saying. . . .

Due to the lockdown, many of us were not seeing each other. We socialize less but after that I heard people telling me other people I knew had died from corona. You ask of people you used to play cards with and then you are told they died, so very sad. I even read an article that said that a lot of Hindoestaanse have died from COVID. It is very serious. And most of us apart from age have some other sicknesses; I have diabetes. When age and these heart conditions come together plus corona then we are heading toward a lot of death

Among the Ghanaian-Dutch respondents, 27% (16) indicated that it is important for everyone to take the vaccine. Among the Afro Surinamese-Dutch respondents, majority of them 26 (48.1%) responded that "I think it is important for everyone to take it. A high proportion of respondents from the Hindustani-Dutch community, 22 (44.9%) think that it is important for everyone to take the vaccine". Compared to the other two groups, the Hindustani-Dutch community had a slightly higher proportion of respondents who think the vaccine is not important 4 (8.2%). None of the respondents from the Ghanaian-Dutch or the Afro Surinamese-Dutch indicated that "It is not important".

Confidence (Trust in the Effectiveness and Safety of Vaccines)

To gauge the perception toward the current COVID-19 vaccines, respondents were asked "what do you think about the COVID-19 vaccine?" The responses received across the different ethnic communities are presented below in **Table 4**. The majority of respondents 25 (43%) from the Ghanaian-Dutch community reported that they do not trust the effectiveness and safety of the COVID-19 vaccine and only 10 (17%) of the respondents believed that the vaccines are effective and safe. Only 1 respondent indicated it was a conspiracy by the government to control the people. Among the Afro Surinamese-Dutch respondents, 18 (33.3%) also answered that "I don't trust the effectiveness and safety" while 7 (13%) indicated that "I think it is effective and safe". There were 2 (3.7%) respondents who considered the introduction of the COVID-19 vaccines was a "conspiracy by the government to control us". The largest proportion of respondents of the Hindustani-Dutch community, 25 (51%) indicated that they "do not trust the effective and safety of the vaccine". A further 13 (26.5%) think that the "vaccines are effective and safe". A few of the respondents 5 (10.2%) from the Hindustani-Dutch community also considered the vaccine as a government policy to control the citizens.

In general, the proportion of respondents who indicated that they do not trust the effectiveness and safety of the vaccine were highest among the Hindustani-Dutch, followed by the Ghanaian-Dutch and lastly the Afro Surinamese-Dutch communities.

Scaling of Confidence Level in the COVID-19 Vaccines

The results presented in **Table 4** above shows that trust in the safety and effectiveness of the COVID-19 vaccines was a major concern for most of the respondents in this survey. This survey therefore attempted to examine the level of confidence (trust in the safety and effectiveness) of the vaccines by asking the question "how would you rate your level of trust in the COVID-19 vaccine

to offer protection against severe disease?" A 10-grade scale was used to assess the level of trust by choosing from very low (one) to very high (ten). **Figure 2** shows the illustration of the level of trust as reported by all the 160 respondents from the various communities. The peak level of trust in the COVID-19 vaccines as expressed by respondents for the Ghanaian community was 7 out of 10 (range 2–9). Among the Afro Surinamese-Dutch community, 16 (29.6%) out of the 54 respondents scored their level of trust in the COVID-19 vaccines as 8/10 (range 1–9). For respondents from the Hindustani-Dutch, the peak level of trust was 7 (range 2–9). Thus, there was a general skewness above the midpoint level of confidence, an indication of a high level of trust in the effectiveness of the vaccines to protect them.

Convenience (Accessibility/Availability and Lack of Understanding)

This survey considered the level of awareness and concerns of the respondents of the on-going COVID-19 vaccination. A total of 53 (96.4%) out of the 55 respondents from the Ghanaian-Dutch community were aware of the availability or that COVID-19 vaccination has started in Amsterdam and across the Netherlands. Among the Afro Surinamese-Dutch respondents, nearly all (96%) of the 52 respondents indicated they were aware about the availability or that COVID-19 vaccination had started in Amsterdam. Out of a total of 49 responses received from the Hindustani-Dutch community, 45 representing 92% respondents indicated their awareness about the COVID-19 vaccination programmes being implemented across the metropolitan region in Amsterdam and across the Netherlands. Those who said they did not know were of the view that it was the trial period and perhaps the large-scale vaccination would start later.

A total of 35 out of the 55 (64%) respondents from the Ghanaian-Dutch community answered "yes" to the question "do you have any concerns about taking the COVID-19 vaccine?". In addition, 32 (62%) of the 52 respondents from the Afro Surinamese-Dutch community to the question "do you have any concerns about taking the COVID-19 vaccine" answered "yes". Among the Hindustani-Dutch, 32 out of 48 respondents (67%) indicated that they also had concerns about the COVID-19 vaccines. A significant proportion of the respondents indicated they fear that the COVID-19 vaccine may either be harmful or have severe side effects. Some respondents were simply concerned that the vaccine was discovered too quickly. These were followed by concerns such as the vaccine is Government policy to use/introduce vaccine passport to control us, lack of trust in the science behind the vaccine development and lack of trust in the source/manufacturer of the COVID-19 vaccine.

Taking urgency and cautiousness together, participants' views and interest in the COVID-19 vaccination were mixed. A close observation revealed that people were carefully engaging with the experiences and stories of others (raising tensions but also quest for more information) regarding the COVID-19 vaccination. As noted by Sahoed, a 57 years old Afro Surinamese-Dutch man;

It would be an understatement to say I rushed to my huisart to get my prick two days ago. Rolling down my sleeve after my prick, I felt as if I had been fully protected and can start hugging and visiting friends again. But my joy was not for long when I realized many of my friends and family did not want to get the prick or when they wanted they could hardly get it because it was not their time yet. The decision is a hard one to think of. But I am happy I am out of the dangerous zones.

Factors Likely to Influence Acceptance of the COVID-19 Vaccine

Majority of the respondents 37 (56%) from the Ghanaian-Dutch community indicated their preparedness to take the COVID-19 vaccine when it is proven to be safe and effective. Other factors that could influence the acceptance of the COVID-19 vaccine are personal understandings 12 (18%), travel requirement 7 (11%), and trust in government policy 5 (8%). Only a small proportion of respondents indicated their willingness to accept the COVID-19 vaccine when it is recommended by their family and friends 2 (3%), or by their employers 2 (3%). The study showed that 29 (58%) among the Afro Surinamese-Dutch respondents indicated that the most influential factors that can influence their willingness to take the vaccine is when there is a mandatory introduction of a vaccine passport by the government. The availability of sufficient scientific data to prove a high vaccine efficacy (proven safety and effectiveness) and mandatory vaccination as a travel requirement account for 40 and 36%, respectively. Recommendations by family and friends 8 (16%), or by respondents' general practitioners 3 (6%) or by employers 2 (4%) were other factors that could influence acceptance of COVID-19 vaccination. Among the Hindustani-Dutch community, the scientific proven high vaccine effectiveness and safety could encourage about 41.3% of the respondents to accept the vaccine. In addition, this study shows that 32 (69.6%) of the respondents appear likely to accept the vaccine when the introduction of vaccine passports is made mandatory by the government. Other major factors that could drive the likelihood of accepting the COVID-19 vaccine include travel requirement for vaccination (28.3%), the probability of minor side effects (26.1%) and recommendation by family and friends (15.2%).

DISCUSSION

Perception of the COVID-19 Vaccination

National polls conducted in the Netherlands before the roll out of COVID-19 vaccination programmes began suggested that about 40% of the population were hesitant to receive COVID-19 vaccination (25). However, the public perception and response to the COVID-19 vaccination among some minority ethnic groups remain undetermined.

This present study revealed that some respondents think that the COVID-19 vaccine is important because of the significant effect of previous vaccinations toward other contagious diseases while others had concerns about how the COVID-19 vaccines will come to shape almost every area of their lives either granting them access or not to certain spaces and settings.

The findings from this present study show that public or individual perceptions about the COVID-19 are not homogenous but appear to vary widely among people from the minority ethnic communities in Amsterdam. More so it shows that there

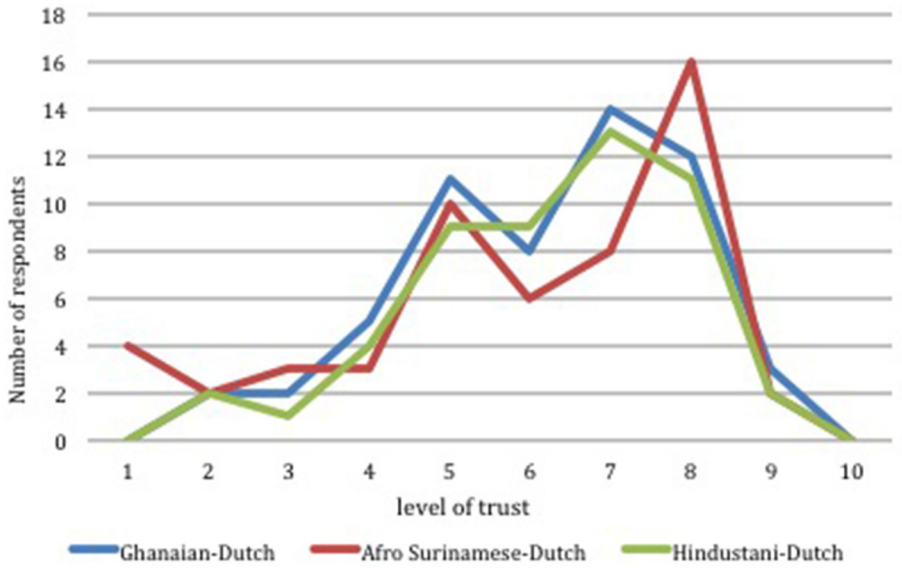

FIGURE 2 | Level of trust in the safety and effectiveness of COVID vaccines across 3 different ethnic groups in Amsterdam.

are wide sociocultural and demographic status variations in the perception or opinions and understandings among individuals within the same community or among the three selected minority ethnic groups, showing the differences concerning their vulnerability or reluctance to engage with COVID-19 vaccination programmes (26).

Even before the pandemic, public health agencies around the world were struggling to counter increasingly sophisticated efforts to turn people against vaccines in general (27). Coronavirus vaccines seem to face additional hurdles, especially the lack of a long-term safety record as well as inadequate stories of others that had received the vaccine especially at the time of data collection (28). The frenetic pace of vaccine development has played into the concerns raised by respondents in this study as seen in other research works (29). Even those who are eager to receive their shots have been worried that the vaccine could be ineffective or have harmful side effects.

Lupton's [(30), p. 7] underscores that risk perception "is intersubjective produced through social relations," and so through observation and interviews we can better understand the "ways of making sense of situations, naming responses, part of the diverse cultural meaning systems that we use to try to understand the world." One significant observation in this present study was the claims that "one [could] boost their immune system or cure COVID-19" by taking vegetables and fruits including vitamin C and hot herbal teas. When people have perceptions that taking certain medications, herbs or "immune boosters" can protect them against the virus or even heal them, it could have huge impact on their decision-making regarding taking vaccines. The implication is also that such people may hesitate, refuse or delay in taking up the COVID-19 vaccine.

Besides the safety concerns, others were concerned that the different vaccines may be a conspiracy by the governments all over the world to control population. The notion that the disease is a conspiracy involving the governments and philanthropists has an effect on the reception of the COVID-19 vaccine. Many of our study respondents have relied on social media posts to create the psychological habits that makes them think doing nothing is safer than taking action. The Health Belief Model (HBM) and its conceptual framework have been very instrumental for evaluating some of these psychological habits, beliefs and attitude toward some major vaccines including those against influenza, swine flu and COVID-19 (31–33). However, our present study did not examine the COVID-19 acceptance or hesitancy factors based on the constructs of the HBM. This is because as our findings show using such models alone to evaluate health decisions by people could be inadequate as their decisions are influenced also by their current living situation, advice from friends or experts, past experiences and embodied routines (34).

More so, in a media environment that favors speed, emotion, and memorable stories that can easily circulate, it is essential that the accurate and reliable information on vaccine safety and effectiveness is clearly available. Thus, it may be important for the media as well as the Dutch public health agencies to focus on publishing more diverse stories with different outcomes and avoid "the danger of single story" that portrays doom. The stories people see, hear or read have an impact on how they decide on important issues that concerns their live and that of others. The Dutch public health service could follow some of the current initiatives have pioneered a more story-based approach such as the National Human papillomavirus (HPV) Vaccination Roundtable, which promotes vaccination against the human papillomavirus, a leading cause of cervical cancer,

through YouTube videos of women who survived cervical cancer to share their story with other women (35).

Determinants of COVID-19 Vaccine Among Minority Ethnic Groups in the Netherlands

Emerging evidence from some of the countries with most successful early roll out of COVID-19 vaccination for its population including Israel, Chile, United States of America and the United Kingdom shows that the uptake of vaccines among minority groups is low (10). Findings from this present study shows that <4, 13 and 14% of respondents from the Ghanaian-Dutch, Afro Surinamese-Dutch and the Hindustani Surinamese-Dutch communities, respectively, had taken at least one dose of the COVID-19 vaccines. As of 7th February 2021 when data collection for the Ghanaian-Dutch community was concluded, only 694, 075 (4%) of the Dutch population had been vaccinated. Thus, it is difficult to assume that there was a higher vaccine hesitancy rate among the Ghanaian-Dutch community as the proportion seem to correspond with that of the general population at the time. However, as at 25th April 2021 when data collection for the Afro Surinamese-Dutch and Hindustani-Dutch ended, a total of 3,930,671 people in the Netherlands had received at least one dose of the vaccine representing 22.7% of the Country's population (36). This suggests that the uptake of the COVID-19 vaccines may be low among these two minority ethnic groups compared to the national average. This finding shows the need to pay particular attention to where there are divergences among population groups.

In a similar study in the UK, it was found that there was "substantial divergence in the uptake of vaccine" as the proportion of those vaccinated was lowest at 20.5% among the black population of Bangladeshi and Pakistani descent (37). The findings from this present study and others raises great public health concern since people from these minority ethnic groups seem to have the highest COVID-19 hospitalization, and mortality rates in the Netherlands (38, 39) including higher rates of job loss among others. In a recent study, the Ghanaian-Dutch population had a high seropositive prevalence for COVID-19 and was found to be associated with age and large household composition (40). Our findings also showed a high proportion of respondents across the three ethnic groups live in homes with high household sizes and that could pose a great public health threat if efforts to improve vaccination rate are not implemented to protect individuals and their households.

The findings from this study revealed that the percentage of respondents who were likely to take the vaccine among the Ghanaian-Dutch, Afro Surinamese-Dutch and Hindustani-Dutch were 47.3, 48.1 and 47%, respectively. Our findings show that the male respondents were more likely to accept the vaccine than the female respondents. Age-dependent analysis also indicated that the likelihood to accept the COVID-19 vaccination was linearly correlated with increasing age with the highest acceptance among respondents aged 56 years or older. This finding is similar to other findings from Israel, which showed the highest uptake of COVID-19 vaccine among persons aged 50 years or older (11).

Consequently, there were nearly 23.6, 31.5 and 26.5% of respondents from the Ghanaian-Dutch, Afro Surinamese-Dutch and Hindustani-Dutch, respectively, who were undecided about taking the vaccine. A further 29.1, 20.4 and 26.5% of respondents from the Ghanaian-Dutch, Afro Surinamese-Dutch and Hindustani-Dutch, respectively, opted not to take the COVID-19 vaccines. As suggested by earlier studies the main factors for the low uptake of COVID-19 vaccines include perceived lower risk of infection, socially disadvantaged groups (41), socioeconomic status, level of education, inconvenience and access barriers (42). In addition, this present study show that other factors for the low uptake of COVID-19 vaccines is the lack or low level of confidence in the safety or efficacy of the vaccines across all ethnic, demographic and occupational groups (43, 44). In this present study, this confidence is grounded not in the reputation of any single manufacturer of vaccines, but on the scientific method that is required by manufacturers to demonstrate that a vaccine works and is safe.

Our findings revealed that respondents showed trust and confidence in the ability of the COVID-19 vaccine to protect them but were skeptical about the notion of "good" and "bad" COVID-19 vaccines. This is in reference to the news in the media about certain types of vaccines causing some rare form of thrombosis in persons who took that vaccination (45–47). As evident by this, the fear of the COVID-19 vaccine causing harmful or severe side effects (90.6%) appears to be the major concern respondents had about the COVID-19 vaccines. The finding from this study supports the findings by the UK Scientific Advisory Group for Emergencies (SAGE) ethnicity sub-group review in December 2020 that looked at the factors influencing COVID-19 vaccine uptake among minority ethnic groups (42, 48).

The causes of vaccine hesitancy often correspond strongly with past research around public confidence in various vaccines (12, 49, 50). This study has demonstrated that COVID-19 vaccine decision-making of some ethnic minorities in the Netherlands may hinge on issues, concerns and anxieties. A vitriolic public (health) message or representations that single out minority ethnic groups may only run the risk of damaging their relations with public health and other health institutions or workers, and can be avoided by better understanding the processes of vaccine decision-making.

The main limitation of this study was that data collection was conducted at the period when the COVID-19 infection rate in the Netherlands had reached its second peak (second wave). The imposition of strict lockdown and other mitigation measures such as "work from home" and "ban on mass meeting" made it difficult to recruit a high number of study participants. As a result, participant observations were limited to participants who were willing to invite us into their homes, meetings in addition to open public spaces.

CONCLUSION

The COVID-19 pandemic has created the need of developing a prioritized set of vaccine recommendations and communications as well as varying them among different communities. This

survey study provided a systematic evidence of factors associated with participants' decision making regarding COVID-19 vaccination among the Ghanaian-Dutch, Afro Surinamese-Dutch and the Hindustani-Dutch communities in Amsterdam. The findings show that vaccine choice and likelihood of self-reported willingness to receive a vaccine were associated with vaccine efficacies. As shown in this study, the scientific demonstration of high vaccine efficacy could encourage about 41.3% of the respondents to accept the vaccine. In addition, 69.6% of the respondents appear likely to accept the vaccine when the introduction of vaccine passports is made mandatory by the government. Other major factors that could drive the likelihood of accepting the COVID-19 vaccine include travel requirement for vaccination (28.3%), the probability of minor side effects (26.1%) and recommendation by family and friends (15.2%). The analyses in this study provide insights about the groups or factors that are likely to be associated with vaccine hesitancy, so as to inform public health efforts to communicate effectively about the COVID-19 vaccine.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by AISSR Ethics Board. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

DA-B and AZB conceived and planned the experiment, carried out the data collection, and supervised the findings of this work. DA-B, AZB, KBO, and AK verified the analytical methods and discussed the results and contributed to the final manuscript. All authors contributed to the article and approved the submitted version.

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"Italy, for Example, Is Just Incredibly Stupid Now". European Crisis Narrations in Relation to Italy's Response to COVID-19

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Crisis narratives shape public understanding and, consequently, the response to the crisis itself. In the context of the COVID-19 pandemic, when in February 2020 Italy was experiencing more cases than any other country, the Italian response to the crisis originated debates over how to best respond to the outbreak. Informed by Critical Discourse Analysis theory and using narrative networks as a framework for the critical analysis of narratives, this study analyzes the discourse strategies employed by experts, politicians and other social actors from Spain, France, the Netherlands, and the UK when presenting their domestic measures in relation to Italy's response to coronavirus. The analysis shows that the narratives attached to nation-specific decisions were highly culturalized and connected to country-specific shared experiences, such as a sense of national exceptionalism built in opposition with the denigration of Italy as the Other-identity. Attribution of blame and blameworthiness was also found to be a common pattern across countries according to which Italians were framed as wrongdoers but also as deserving blame. The article also presents a comprehensive "timeline of narratives" which opens avenues for a critical reflection on the impact such narratives may have had on the understanding of the crisis, including the creation of a negative climate of division and inappropriate crisis responses.

Keywords: crisis communication, COVID-19, narrative analysis, Italy, Critical Discourse Analysis, narrative network analysis

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INTRODUCTION

The COVID-19 virus was not the first time that the causative agent behind SARS—a novel kind of coronavirus—was identified in human populations; the SARS epidemic of 2002–2003 had preceded it (Drosten et al., 2003; Ksiazek et al., 2003). Much of the same questions about the SARS-associated coronavirus (SARS-CoV) that had puzzled scientists 17 years before reemerged. For instance, how to distinguish the diagnosis from a seasonal flu, what the mortality rate and the incubation period were, what the best way to treat patients was, and how medical personnel and the most vulnerable people in society could be best protected (Fidler, 2004, p. 5). Although national and international public health officials and practitioners thought that they were confronted with what at first seemed to be a *déjà vu* scenario, the speed and volume of the coronavirus contagion rate eventually made it clear that COVID-19 was a much more severe infectious disease than SARS. In 2004,

SARS had been called "the first pandemic of the 21st century" (LeDuc and Barry, 2004) as it had spread across 29 countries, infected 8,098 people over the course of 8 months, and killed 774 (WHO); just a month after the first COVID-19 confirmed case, the total global case count had surpassed that of SARS. Although it seemed to have a lower infection fatality rate, the novel coronavirus was spreading much faster. Therefore, without any effective diagnosis, therapeutic modalities, enough intensive care facilities, prevention protocols, or vaccine technologies, the most urgent challenge of all was how to contain the spread of a new virus transmitted by respiratory means in the context of the highly globalized world society of the twenty-first century.

The combination of fear and confusion that COVID-19 was bringing represented a global threat to individuals and societies around the world, while to countries and industries, it was painting the terrifying picture of a global economic collapse. Such major disruption of established paradigms therefore required urgent intervention and the rapid devise of effective strategies, including communicative. Indeed, when uncertainty and confusion are at their most acute peak, the way a crisis is communicated becomes a central component of the crisis management itself (Reynolds et al., 2005; Coombs, 2007; Seeger and Sellnow, 2016; Patrona, 2018). According to Seeger and Sellnow (2016), as a highly uncertain and deeply disruptive situation, crisis creates "a narrative space, a communication vacuum, or a meaning deficit" (Seeger and Sellnow, 2016, p. 5) which needs to be filled with stories that can help make sense of it. But in the context of the COVID-19 health crisis, particularly the early stages of the outbreak were characterized by great discrepancy in national and international positions of how to best respond to the emergency; such discrepancy necessarily created competing narratives and counter-narratives of the COVID-19 crisis, persuasive stories that could legitimize and explain to the public the country differences in crisis-management approaches but which, at the same time, created a complexity of voices that added even more confusion to an already uncertain, historically unprecedented situation. For example, in late February 2020 when Italy was the country with the highest number of confirmed cases of COVID-19, the Italian crisis response soon became the center of European governments' attention and originated debates over how to best respond to the epidemic. Thus, in addition to being a health, economic, security, political, and social issue, the COVID-19 health crisis became also a discourse event in which many different versions of the situation constructed competing discourse realities of both the crisis and the measures to tackle it. This study analyzes the narratives constructed and used to communicate the crisis and the measures to contain it in the very first moments of the emergency. Specifically, the analysis compares discourse strategies and narratives employed by experts, politicians and other social actors from a range of European countries—Spain, France, the Netherlands, and the UK—when presenting their domestic management measures in comparison to Italy's response to the health crisis. The study rests on the foundation that examining the narratives used by key players to express blame and responsibility, to legitimize their response strategy, and to mobilize support clarifies how a crisis is understood at national and international levels.

The study uses Critical Discourse Analysis theory (CDA—Fairclough and Wodak, 1997) as the applied theory for the analysis of the COVID-19 crisis narratives. Crises are shaped by those in positions of power, hence crisis narratives are also attempts at maintaining power. CDA focusses on how power is manifested and enacted through language and it looks at the historical, political and ideological mechanisms at work within a discourse event; it therefore helps uncover the latent assumptions and ideologies embedded in and circulated through stories and consequently the larger culture that creates the narratives and generates the wider discourse attached to them (Stokes, 2021). Here crisis is conceptualized through the lens of discourse and therefore its communication is understood as a form of social practice (Fairclough and Wodak, 1997, p. 258) rather than a purely linguistic phenomenon.

As a distinctive feature, the study integrates CDA with the analytical method of narrative networks (Bearman and Stovel, 2000; Gimenez, 2010). Seeger and Sellnow (2016) argue that crisis narratives cluster around a core set of meanings which ensue a network of narratives; this network of narratives impact on culture, beliefs, norms, policies, and institutions thus ultimately shaping the crisis. Narrative networks looks at narratives as embedded in a wider network of meanings between the local and social functions that they represent; it therefore perfectly complements CDA theory as it best captures when local narratives are networked with other narratives, in both local and global contexts (Gimenez, 2010). The tension between these two contexts make narratives compete in the public forum for power, credibility, and acceptance; understanding the role of these narratives sheds light on how crises are understood and it helps anticipate the post-crisis social changes (Seeger and Sellnow, 2016, p. 14). In this way, this study also presents a comprehensive "timeline of narratives" which opens up avenues for a critical reflection on the impact these may have had on the general understanding of the crisis, including the creation of a negative climate of criticism and division and inappropriate crisis responses.

A second distinctive feature of this study is that it adopts a cross-cultural perspective. As recently pointed out by Bajaj et al. (2021), there are to date few studies that have analyzed transcultural crises through a cross-cultural and intercultural lens. Yet narratives are influenced by the cultural, social, and ideological views of both the narrator and the message's recipients and therefore culture is a key factor to crisis management and response. Thus, the cross-cultural approach in this study has wider relevance for practitioners as well as health communication researchers as the findings offer important knowledge about the cultural dimension of global health crisis communication management.

COVID-19 AS A DISCOURSE EVENT

While to this date it is unclear who the so-called patient zero was, according to the WHO, the first ever case of COVID-19 might have been in China on 8 December 2019

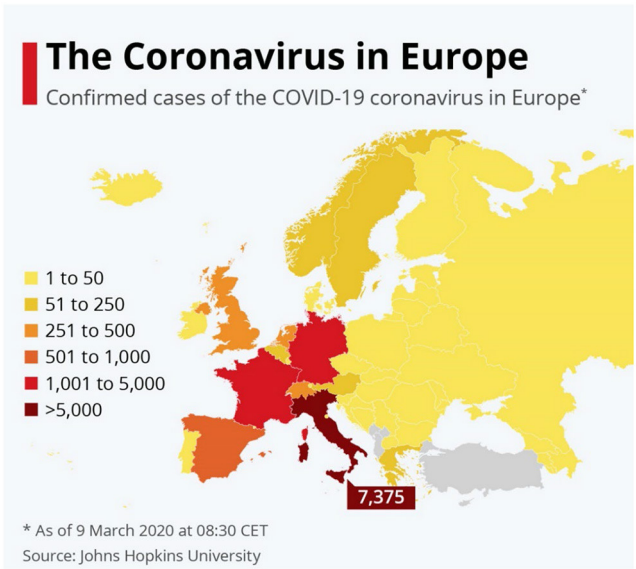

FIGURE 1 | COVID-19 confirmed cases in Europe as of 9 March 2020. Chart available at https://www.statista.com/chart/20964/covid-19-cases-europe-map/.

(WHO|Novel Coronavirus—China, 2020). In Europe, the first reported case was found in Bordeaux, France on 24 January 2020 (Reuters, 2020) with two more cases reported in Paris later that day. Two other cases were reported in Bavaria, Germany on 27 January 2020 (Berliner Morgenpost, 2020) and in Finland, on 28 January (Yle Uutiset, 2020). On 31 January, the first two cases were confirmed in Rome (Corriere della Sera, 2020). Although scattered cases had since appeared all over Europe, it was in the Italian region of Lombardy that the first cluster of 16 cases was detected on 21 February (Amante and Anzolin, 2020). On 22 February, additional 60 cases were confirmed and Italy reported the first deaths (Corriere della Sera, 2020).

As of late February, with confirmed cases in all regions, Italy had been hit harder than anywhere else in Europe. Prime Minister at the time Giuseppe Conte declared a state of emergency, placed under quarantine the eleven municipalities that had been identified as the centers of the two main clusters, later expanded the quarantine to all of Lombardy and 14 other northern provinces, and finally to the entire country on 8 March 2020, placing more than 60 million people in quarantine (BBC News, 2020). The Italian lockdown decree prohibited all non-essential shops and services, businesses and industries and all public and private gatherings of any number of people; it also restricted movement, including movement across regions as well as within the same region (Safi et al., 2020). **Figure 1** shows the distribution of cases in Europe as of 9 March 2020 and evidences that the highest concentration of cases was reported in Italy.

On 30 January 2020, WHO Director-General, Dr. Tedros Adhanom Ghebreyesus, had declared that the novel coronavirus outbreak was "a public health emergency of international concern" (WHO, 2020a). At that moment, there were 98 cases and no deaths in 18 countries outside China. On 11 March 2020, with more than 118,000 cases reported in 114 countries and 4,291 deaths, WHO announced that the outbreak could be characterized as a pandemic (WHO, 2020b); 2 days later, the organization stated that Europe was "the active center of the pandemic" (WHO, 13 March 2020). On 19 March 2020, Italy had surpassed China for number of deaths, while by 26 March, with the highest number of confirmed cases in the world, the United States had overtaken both China and Italy. Since then, a steady growing number of cases has been recorded globally, albeit with differences across countries. **Figure 2** shows the aggregated number of confirmed cases of COVID-19 in the world from 22 January to 18 July 2020.

The overview given here illustrates the very rapid escalation of events that characterized the COVID-19 pandemic, particularly in the first months of 2020 and it highlights two important facts relevant to this study: (1) governments and public health officials found themselves confronted with an unprecedented situation that required immediate action and (2) to be accepted by the nation, such actions—no matter how extreme—needed to be presented to the public as the best possible solutions. These stories created a complex and often conflicting set of discourse realities; the plethora of storylines primarily concerned the origin, prevention, diagnosis, and treatment of the disease. Even authoritative figures and institutions were giving insufficient, often contradictory information and advice that were later reversed. Moreover, deliberate misinformation practices and conspiracy theories spread particularly but not exclusively through social media and were propagated by private citizens, celebrities, politicians and other prominent figures (Douglas, 2021; Stein et al., 2021; Pummerer et al., 2022). The enormous media distribution of false claims eventually led the WHO to declare that together with the pandemic, the world was facing an "infodemic" of incorrect information about the virus, which was posing additional risks to global health (United Nations, 2020).

Research has pointed out how media are active coproducers of discourses, hence discourses produced via media not only shape meaning but determine reality too (Jäger, 2001, p. 36; Wodak and Meyer, 2001). Works in a large variety of fields such as media studies (Bryant et al., 2002; Entman, 2003), discourse studies (van Dijk, 1985; Baker et al., 2013), political communication studies (Arceneaux and Johnson, 2013; Boydstun, 2013; Atkinson, 2017), to name but a few have consistently demonstrated that, as public opinion is largely informed by mass media, media discourse gradually alters the public perception of reality, for instance by creating a sense of urgency in a crisis, by using "us" vs. "them" narratives to negatively frame specific social categories, or by emphasizing policy priorities and government choices, thus *de facto* playing an agenda-setting role. Indeed, as crises are in general newsworthy, the media discourse attached to them greatly influences public opinions and alignments (Patrona, 2006, 2012). Therefore, while the concrete facts of a crisis may be objectively undeniable, the narratives used to explain them may shape the way they are interpreted and determine whether they will be accepted or contested. At the same time, they may influence the way other producers will construct their own narratives thus ultimately impacting on the general understanding of the crisis. Understanding discourse as social

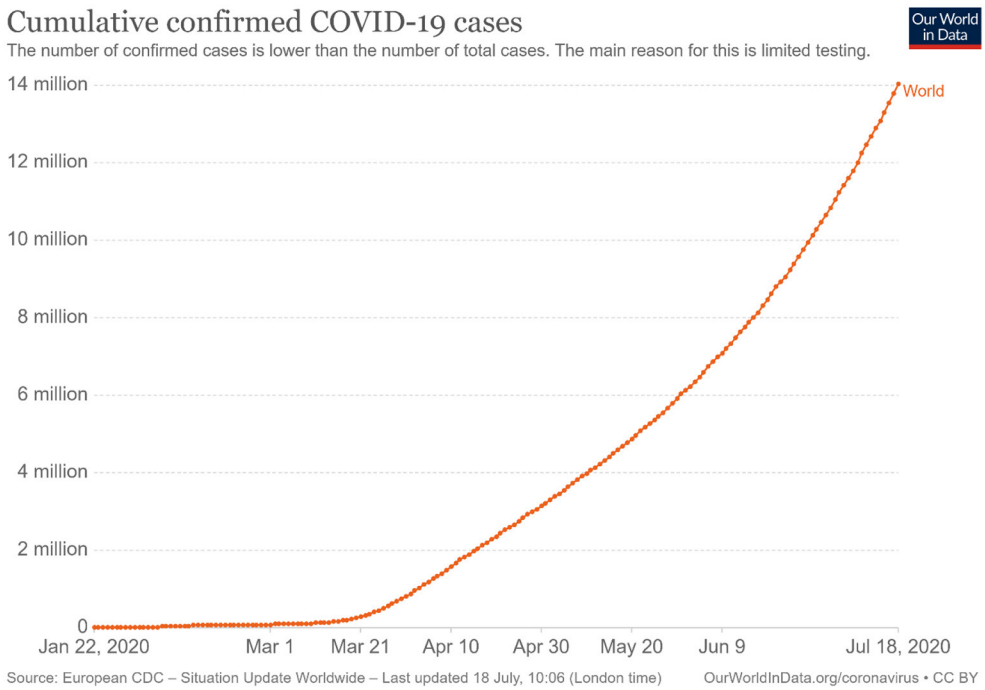

FIGURE 2 | Confirmed cases of COVID-19 globally as per 18 July 2020.

rather than purely linguistic crucially entails that meaning is continually negotiated through interaction. It also means that it is performance-oriented (Potter and Wetherell, 1987; Edwards, 1997; Potter et al., 2016) in the sense that it constructs realities (i.e., a discourse event) in which blame can be attributed, facts can be accounted for, and specific actors can be presented or obscured (Fairclough and Wodak, 1997, p. 258), for instance to justify the governments' unpreparedness in managing a crisis. Thus, from the perspective of agency, they can conceal or point to specific actors and allow for a strategic attribution of blame (e.g., Wodak and Angouri, 2014); they can legitimize specific management decisions or serve to justify an incompetent response; or they can explain the resolution strategies to the involved actors in order to mobilize the necessary support. The integration of CDA with narrative networks and the cross-cultural perspective taken in this study examine narratives not as isolated discourse events but as part of a wider network of discourse realizations in which narratives are produced, shared and reproduced and it offers rich insights into the many factors at play determining the understanding of the crisis and the governments' response to it. Significantly, the approach identifies potential patterns and common themes in the narratives across countries which also contribute theoretical insights to research on health communication.

METHODOLOGY, DATA COLLECTION AND SOURCES

In the very early stages of the COVID-19 pandemic, the high uncertainty about how to best respond to the crisis combined with governments' generalized unpreparedness created a discourse void that needed to be filled with plausible stories. As the country with the highest number of recorded cases and deaths, Italy soon came under close scrutiny from other European countries and much of the discussion about the health crisis revolved around the Italian response to it. Following Seeger and Sellnow (2016), the main hypothesis of this study is that these crisis narratives shared recurring themes and characteristics such that specific discourse strategies can be identified across nations. Guided by CDA theory, the analysis focusses on how narratives of the health crisis were constructed with specific reference to: (1) the attribution of blame and type of object blamed; (2) minimizing strategies; (3) references to country-specific shared experiences; (4) use of familiar images (especially cultural); (5) explicitness and implicitness of language used; and (6) specific contextual factors such as the time of the message production and infection's figures. The intention is to understand how different actors in the analyzed four countries defined the terms to legitimize the domestic response to the pandemic in tension with the Italian response. The overarching aim is to explore if and how these positionings varied cross-culturally and whether the framing of the disease and crisis changed accordingly. As such, the study applies an a priori thematic saturation model (Saunders et al., 2018), whereby saturation "may refer to the extent to which pre-determined codes or themes are adequately represented in the data." Data has therefore been collected so as to exemplify theory—as opposed to develop theory—at the level of the pre-defined conceptual categories outlined above.

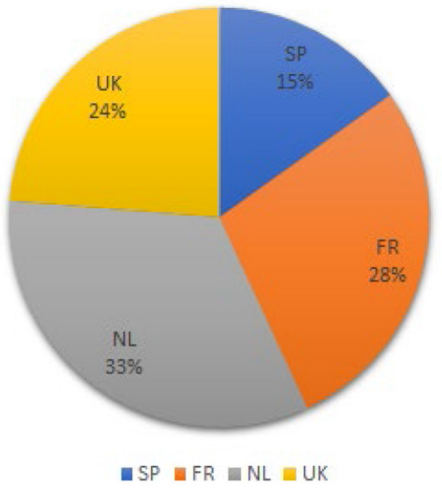

FIGURE 3 | Distribution of sources in the data-set.

The data sampling focused therefore on selecting material that could be considered representative of the established categories in each nation when discussing specifically the adopted domestic measures in relation to Italy's response to coronavirus. Efforts have been made toward choosing examples that could also be considered as emblematic—at least to an extent—of each country's predominant narrative, for example national media were preferred over local and regional media in the respective countries and editorial commentaries, experts' interviews and official statements were preferred over statements from the general public. However, due to the relatively limited number of excerpts analyzed, the material presented here should not be understood as fully illustrative of each country's main narrative, rather as part of the wider public discourse that rapidly unfolded in the first stages of the pandemic. However, as these narratives were produced by official spokespersons, experts and other prominent public voices and shared on national media, it can nevertheless be assumed that they did contribute to how the pandemic was being understood and internalized within each country and across countries.

The material for the analysis has been collected from the Europresse database,[1] an aggregator of European media news outlets that includes printed press, television, radio, web press, blogs, social media, newsfeeds, and media reports from a variety of mainstream media outlets for a total of 8,044 media sources. The platform interface allows for granular searches through keywords and advanced filters such as language(s) of preference, type of media, media coverage (i.e., local, regional, national, international, continental), country's origin, media periodicity, and timeframe of publication. To allow for the same searches to be performed across languages, the following non-language specific keywords were used for the queries: *COVID-19* OR *coronavirus* AND *Ital**[2]; the search was restricted to headlines containing the keywords' parameters and by selecting only European media outlets other than Italy. The timeframe of relevance was set to the first 2 weeks of March 2020 as this is when Italy became the first country experiencing the peak of the crisis. Finally, to limit the sample to a manageable size and to allow for CDA and narrative network analysis to be performed, Spanish, English, French, and Dutch were chosen as the languages of preference[3]. The search returned 1,702 media items evenly distributed across the four countries as shown in **Figure 3**, thus making the data-set a balanced resource.

This is fundamentally a focus study; however, using the concordances software AntConc 3.5.8 (Anthony, 2019), preliminary observations were conducted; this step helped both validate the suitability of the collected material and the identification of relevant examples destined to the subsequent qualitative analysis. The search was conducted by using the AntConc's KWIC (KeyWord In Context) feature which allows to observe how words and phrases are commonly used in a corpus of texts in relation to specific words. The used keywords were: *Ital**, *COVID-19*, *pandemic*, *coronavirus*, *British*, *Français*, *Español**, *Nederlander**. The results contributed useful material to map how Italy and the Italian response were linguistically represented in the media in tension with the domestic strategy. Finally, a close reading of these results focused on further selecting material containing statements by officially or institutionally entitled public voices such as doctors, politicians, and official spokespersons. Further examples have been retrieved from sources quoted or referred to in the sample; these excerpts are provided in **Table 1** in the Discussion Section. Moreover, for the reconstruction of the events and figures of infections, tests and deaths, the data were taken from reports by the World Health Organization (WHO), John Hopkins University, and the European Centre for Disease Prevention and Control (ECDC).

The qualitative analysis proceeds in three steps; firstly, guided by narrative networks analysis, it places narratives in a structure of time sequence. The narratives are accordingly analyzed in chronological order and examined in relation to the concurrent events in Italy and in the country where each given discourse was produced. The problematization of time and events as integral part of the narratives' interpretation overcomes at least partially the potential risk in biases always present in qualitative analyses. Secondly, guided by CDA theory, the narratives of the health crisis are analyzed with specific reference to the six categories outlined above.

Thirdly, with specific reference to (6) (i.e., specific contextual factors such as the time of the message production and infection's figures), the analysis investigates potential patterns between the time when the discourse was produced, the use of the identified narratives and communicative strategies and potential escalations over time. The aim is to create a "timeline

[1]http://www.europresse.com

[2]The asterisk is a commonly used wildcard symbol that broadens a search by finding words that start with the same letters and end with all possible combinations (e.g., Italy, Italian, Italiana, Italienne, Italië).

[3]The language selection was motivated by the author's language proficiency.

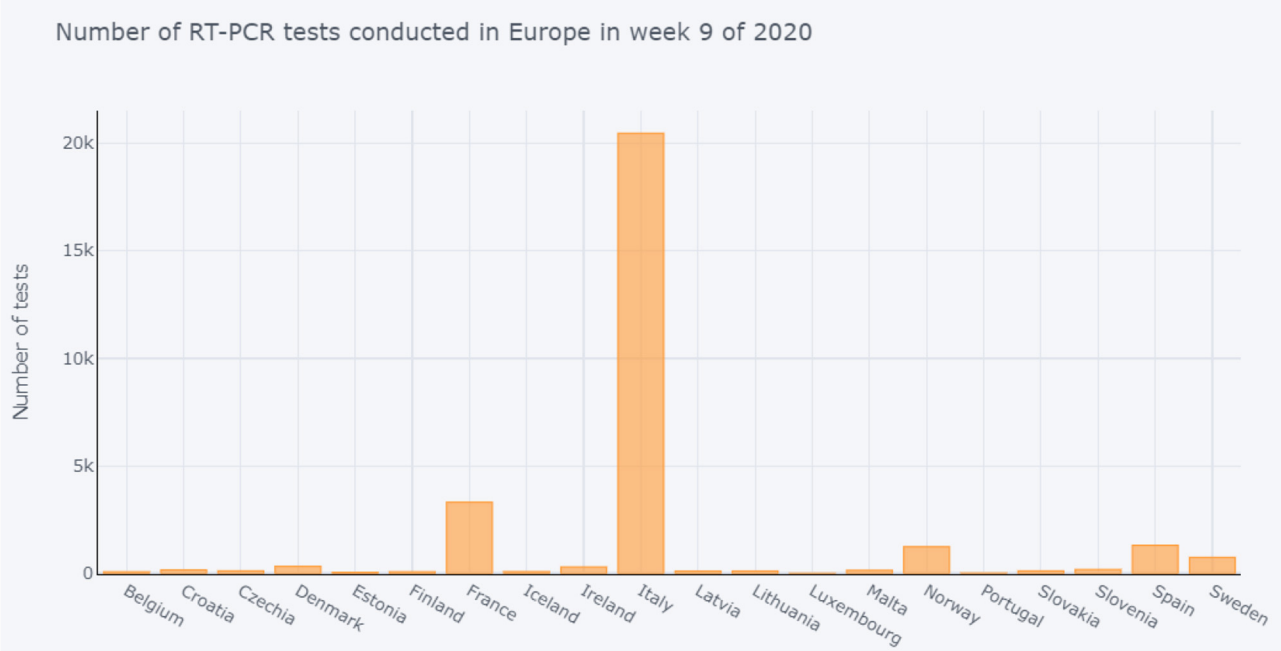

FIGURE 4 | Number of COVID-19 tests carried out in week 9 in Europe. Source: European Centre for Disease Prevention and Control (ECDC).

of narratives" in which narratives are triangulated both with events in the respective countries and the time of the analyzed statements. The final goal is to obtain a holistic, cross-cultural representation of crisis communication strategies in the analyzed European narratives and to open up avenues for a critical reflection on emerging common themes and the impact they may have had on the general understanding of the crisis, including the creation of a negative climate of criticism and division, for instance by becoming increasingly aggressive, and inappropriate crisis responses.

ANALYSIS AND RESULTS

This section applies CDA and narrative network analysis to several official or institutional statements from the four countries. The selection of the excerpts followed a chronological order so as to place the narratives within the context of each country's situation at the time when the corresponding analyzed speech event occurred; this approach helps identify potential relations across events, given reasons and causes. A discussion and synthesization of the findings are provided at the end.

Spain, 2 March 2020

As of 2 March 2020, Italy was counting 1,128 active cases (European Centre for Disease Prevention and Control—ECDC), 34 deaths and an average of 500 new daily infections. This was by then the highest number of reported cases in Europe; at the same time, however, since the outbreak, the country had carried out significantly more tests than any other country in Europe (**Figure 4**). Just as an example, in the first week of March, Italy had carried out 20,457 tests while France—the second European country for number of tests—had conducted 3,318 tests.

In the same week, Spain had registered 80 cases out of 1,318 tests. The so-called test positivity rate, that is the fraction of positive tests calculated from dividing the number of positive tests by the total number of tests, was 5.127829105 for Italy and 6.069802731 for Spain. This measure essentially indicates whether a country is carrying out enough tests: a higher rate suggests that there may be many more undetected cases. According to WHO, the test positivity rate from a comprehensive testing program should be at or below 5% for at least 14 days (WHO, 2020c). Based on such guidelines, Italy appeared to not only conduct enough tests, but in comparison with Spain, it was also likely to have fewer undetected cases.

Nevertheless, the director of the Centre for Health Emergencies Coordination of the Spanish Ministry of Health (Centro de Coordinación de Alertas y Emergencias Sanitarias del Ministerio de Sanidad), Fernando Simón, on 1 March 2020, claimed that Italy had shown lack of coordination and that their management crisis measures had been "contradictory" (El Mundo, 2020). At that moment in time, Italy had enforced a series of emergency decrees which included crisis management measures such as the suspension of all sporting events in the regions of Lombardy and Veneto. Such containment measures were described by Simón as "strange" (*extraño*) particularly regarding the fact that Italian citizens were still allowed to leave Italy to attend sport events in other countries. Antoni Trilla, head of the Preventive Medicine and Epidemiology service (servicio de Medicina Preventiva y Epidemiología) at Hospital Clínic de Barcelona, echoed Simón's thoughts:

(1) *"Sobre todo al principio, Italia adoptó medidas **controvertidas**,*[4] *como la decisión de tomar la temperatura a los viajeros que llegaban al país y, sin embargo, no a los que salían cuando ya había un foco de contagion."*
(2) "Especially at the beginning, Italy adopted **controversial** measures, such as the decision to take the temperature to travelers arriving in the country but not to those who left when there was already a source of contagion[5]".

A normative stance about the importance of coordination is taken:

(3) *"En una situación de crisis como la actual es necesaria una gestión **coordinada** que siga unos mismos protocolos y lleve a cabo medidas armonizadas a todos los niveles."*
(4) "In a crisis situation such as the current one, it is necessary to have a **coordinated** response which follows the same protocols and carries out harmonized measures at all levels."

After criticizing the controversial measures taken by the Italian government, Simón claimed that 90% of the registered cases in Spain were in fact coming from Italy:

(5) *"Vamos a basar nuestras decisiones en la **evidencia** de la circulación del virus de nuestro país. **Ahora** mismo **sabemos** que el **90%** de los casos en España provienen de Italia."*
(6) "We will base our decisions on the **evidence** of the virus circulation in our country. **We now know** that **90%** of the cases in Spain come from Italy."

By framing the narrative as "empirical" ("evidence," "we now know"), Simón's statement conveys absolute certainty and therefore trustworthiness. It should however be noted that his use of figures ("90% of the cases") is not supported by official sources but it is nonetheless linearly constructed in direct opposition with the "strange" and "uncoordinated" measures adopted in Italy. The oversimplified narrative creates a perception of reality which blames Italy for causing 90% of infections in Spain and Spain is cleared from responsibility. The frame is further strengthened by the following statements in which both experts agree that the Spanish health system was responding very well, especially in terms of coordination:

(7) *"Creo que **España**, en ese sentido, lo está haciendo **muy bien**" (Antoni Trilla)*
(8) "I think **Spain**, in this sense, it's doing this **really well**"
(9) *"Yo creo que tenemos unos profesionales asistenciales, unos médicos asistenciales y un servicio médicos **buenos**" (Fernando Simón)*
(10) "I think that we have **good** professional assistants, professional doctors and a **good** health system"

On the whole, the narrative adopted by what the public may perceive as the two Spanish leading experts of coronavirus (for instance, the journalist from *El Objetivo* introduces Fernando Simón as "*una de las personas que más sabe de este tema en España*[6]") is built around criticism of the handling of the pandemic by the Italian government. However, the use of the image of Italians as being disorganized and uncoordinated seems to circulate a latent narrative: rather than being a mere analysis of a crisis management style, the Italian government is in fact scrutinized for having *directly* caused the spreading of the virus in Spain. This narrative is built according to a linear logic: if Italy had not failed to impose effective and more organized measures, Spain would only have 10% of infections. In such linear plot, oversimplified events allow narrators to disclaim responsibility for the negative outcome while placing the blame onto the other side.

France, 9 March 2020

By the third week of March 2020, the situation in Europe had changed dramatically. The number of reported infections was close to surpass those in China; cases were doubling over periods of 3–4 days on average and every 2 days in countries such as Italy, Spain, Austria and Germany (Roser et al., 2020). Different measures were being taken across the continent: Austria had prohibited major events, Spain and Denmark had prevented flights to and from risk areas, schools had been closed in Greece and the Czech Republic. It was Italy, however, that on 9 March, took the most drastic measure of all: with 1,492 new cases and a total of 366 deaths, the Italian Prime Minister Giuseppe Conte extended the quarantine lockdown to all of Italy, forbidding travels and public gatherings. Two days later, on 11 March 2020, the government issued the so called *#IoRestoACasa* (#IStayHome) decree which imposed further measures such as the suspension of all non-essential activities (Ratto Trabucco, 2020).

On the same day, France counted 1,126 total infections, of which 410 new, 19 total deaths and 9 new deaths. Minister of Solidarity and Health Olivier Véran was asked to comment on the Italian lockdown:

(11) *"L'Italie fait face à une **très grande détresse de son système hospitalier**. L'Italie n'a pas le même système hospitalier **que nous à la base**. […] Ils prennent donc une décision dans l'urgence, et qui est une décision qui **leur** appartient."*
(12) "Italy is now experiencing a **severely stressed hospital system**. Italy does not have the same hospital system **as us to begin with**. […] They are therefore taking a decision under pressure, and this is **their** decision" (BFM TV, 2020).

The adopted discourse strategy oversimplifies complex problems, selectively obfuscates agency while responsibility for failures is overtly attributed ("its hospital system") (Patrona, 2006, p. 2). On the whole, the crisis is presented as an "us" vs. "them" situation, in which the latter is blamed. Although Italy's hospital system is "severely stressed," the narrative does not frame the country as a victim, rather as being *blameworthy* (Wodak and Angouri, 2014, p. 418). This process of attributing blame necessarily has to involve "explanations, justifications and argumentation, as well as shared values which are referred to" (Wodak and Angouri, 2014). Here it is legitimized by the masked reference to an

[4]Unless otherwise specified, bold in the quotations is always added by the author.
[5]In this article, unless otherwise specified, all translations are by the author.
[6]"One of the figures who knows more about this topic in Spain" (Guzmán, 2020).

inefficient heath care system, not as efficient as the French one ("to begin with"), which forced Italians to make a rush decision in extreme circumstances. The implicit side of the argument appears to be that Italy is the ultimate cause of its own crisis. As France benefits from a more efficient health care system, the decision of ordering a lockdown does not apply ("it's their decision"). Prime Minister at the time Édouard Philippe also commented on the effectiveness of the Italian crisis management approach:

(13) *"**Bloquer** le pays ne permet pas d'endiguer l'épidémie, l'Italie l'avait fait et que cela avait été une **catastrophe.**"*
(14) "To **block** the country does not allow to contain the epidemy, Italy has done it and it has been a **disaster**" (Valeurs actuelles, 2020).

Here the "us" vs. "them" narrative is used in a slightly different way. By adopting the image of "blocking a country," the lockdown measure is framed as overly aggressive and wrongly targeted: it is the country that is put to a halt, not the spread of the virus. The strategy is therefore criticized for being inappropriate ("it does not contain the epidemy") and even detrimental ("it has been a disaster").

Six days later, on 15 March, the count of total infections in France had reached 4,499, of which 838 were new cases, 91 total deaths and 12 new deaths. Moreover, the test positivity rate was 12.770482395436 (ECDC), thus suggesting that there were many more undetected cases. On 13 March, French President Emmanuel Macron ordered all schools and universities to close and gatherings of more than 100 people were also banned; a lockdown was also announced starting on the 17 March.

The Netherlands, 11 March 2020

As of 11 March, the situation in the Netherlands did not appear to be as worrying as in Italy: a total of 382 cases and 4 deaths had been reported (Roser et al., 2020) and no particularly strict measures were being taken, besides the general recommendations by the National Institute for Public Health and the Environment (RIVM) of not shaking hands, washing hands regularly and staying at home in case of a cold. Crisis management experts such as the director of *Crisislab*—a research center of Radboud University Nijmegen—Ira Helsloot were asked to comment on the difference between Italy and the Netherlands in crisis management approaches (Nos.nl, 2020).

(15) *"De huidige Nederlandse aanpak **de enige juiste is**. Zwaardere maatregelen zoals het afsluiten van Nederland of enkel Brabant zullen de economie volgens hem alleen maar **onherroepelijke** schade toebrengen."*
(16) "The current Dutch approach is the **only correct one**. More severe measures such as shutting down the Netherlands or just Brabant will only cause **irrevocable** damage to the economy."

Hesloot's statement leaves no room for doubt: the "Dutch approach" is not only sound and appropriate, it is the only correct one; the adopted legitimization strategy includes recalling the country's sense of national exceptionalism and using a linear explanation which frames anything else as illegitimate, ineffective, wrong, or worse "stupid":

(17) *"Italië bijvoorbeeld, is nu gewoon **ongelooflijk dom** bezig. Ze zorgen door de isolatie dat de eigen samenleving tot stilstand komt. Straks is het coronavirus uitgeroeid, maar ligt de Italiaanse economie op z'n gat. Dan is er geen geld meer voor gezondheidszorg en dat zal het jaren duren voor je erboven komt."*
(18) "Italy, for example, is just **incredibly stupid** now. With this lockdown, they will surely cause a paralysis of their own society. The coronavirus will soon be eradicated, but the Italian economy will be into disrepair. Afterwards, there will be no more money for health care and it will take years before they'll recover."

The much less drastic handling of the pandemic by the Dutch government compared to the Italian strategy is further justified by using the image of a terrifying economic collapse. As in the case of Spanish and French commentators, the minimizing narrative to legitimize the domestic crisis management approach is simple and linear and makes use of explicit and implicit culturalized images that may be familiar to the public: the Dutch are skilled economists, therefore, the Dutch approach is the only possible one. At the same time, however, Hesloot resorts to inappropriate speech: Italians are damaging their own economy, they're being "stupid"; the "us" vs "them" frame is used to explain the "Dutch approach" to the public and in order to seek the necessary support, it justifies a drastic measure to complex problems by dividing the world into an "us" and a "them," in which them are vilified.

The very same strategy of building a simple narrative by means of familiar, culturalized images was adopted by the Dutch Prime Minister Mark Rutte who also resorted to a national stereotype, that of the Dutch as being pragmatic and concrete people:

(19) *"Wij zijn **een nuchter volkje** en zitten niet te wachten op **symboolmaatregelen**, alleen maar omdat dat dan past bij een gevoel van nu gebeurt er iets."*
(20) "We are **down-to-earth people** and we do not wait for **symbolic** measures simply to give the **feeling** that something is being done."

The justifying argument for the Dutch more moderate crisis management strategy is built by using a familiar, highly culturalized image of the Dutch as being sober and pragmatic people in opposition to another cultural stereotype, that of Italians as being superficial, perhaps even frivolous people who therefore care about appearances more than about substance. Within this discourse frame, the Italian lockdown is downplayed as "symbolic" rather than effective, as it only gives "the feeling that something is being done." The repeated use of "we" further stresses the dividing "us" vs. "them" narrative and places emphasis on group identity. This discourse path highlights the differences of the two groups, rejects the values of the Other, and builds confidence and pride in the "us" group.

UK, 13 March 2020

As of 13 March 2020, Italy counted 21,157 total infections, 3,497 new cases, 1,441 total deaths and 173 new deaths; by the same day, the United Kingdom counted a total of 1,282

cases, 406 new infections, a total of 9 deaths and 2 new deaths (Roser et al., 2020). On 12 March, after having already prohibited all non-essential activities and services, the Italian government had ordered all Rome's Catholic churches to close due to the pandemic, an unprecedented decision, at least in modern times. On the same day, the UK Chief Medical Officers (CMOs) announced that the coronavirus risk to the UK had been raised from moderate to high (GOV.UK, 2020). With no stricter action taken in comparison with the previous phase, the general recommendations remained to "wash hands more often, for at least 20 seconds, with soap and water," to cough or sneeze into a tissue, and to self-isolate for 7 days if showing certain symptoms, "regardless of whether [people] have traveled to affected areas" (GOV.UK, 2020). Schools were also asked to cancel trips abroad, and people over 70 and those with pre-existing medical conditions were advised to avoid cruises. During a radio show hosted by the UK radio station FUBAR Radio, the British physician and television personality Christian Jessen was asked to comment on the Italian national lockdown. He answered:

(21) "This might be a little bit racist to say this, [and] you'll have to make apologies, but do you not think it's a bit of **an excuse**? The Italians, **any old excuse** to, you know, shut down everything and stop work **for a bit** and have a long siesta."

As done previously by authoritative figures in Spain and the Netherlands, it is again a cultural stereotype that is central to the discourse construction of the crisis as *mild*. Just like Italians had been framed as "disorganized" in Spain and "stupid" and "frivolous" in the Netherlands, they are now framed as "lazy" and perhaps even "opportunistic" by the British physician. The comment is part of a larger dismissive discourse strategy in which the pandemic is presented as a crisis that has been sensationalized by the media. It is also possible to identify a specific *topos,* the flu *topos* which is used to downsize the risk of the novel coronavirus:

(22) "I think it's an epidemic lived out **more in the press** than in reality. I mean, if you think about **flu** right, without getting too heavy, **flu** kills thousands every single year [. . .] Now I know that's tragic for those involved but it's not exactly huge numbers is it compared to **flu**, which is thousands. [. . .] This is like **a bad cold** really, let's be honest."

The risk of Covid-19 is minimized, this time by drawing comparisons with the flu, framed as much more dangerous ("flu kills thousands" vs. "not exactly huge numbers") than the current pandemic. Such comparisons with the seasonal flu were often made, especially during the first months of the pandemic and not just in the UK. Sometimes they regarded the COVID-19 symptoms, frequently referred to as "flu-like symptoms," some other times they referred to the severity of the disease which was "just like the flu" or "like a bad flu," other times yet they concerned the alleged duration of the virus which was "seasonal, just like the flu" or the suggested prevention strategies which were the same "as in any flu season." Although perhaps the most visible public figure of all who repeatedly compared COVID-19 with the flu was President Donald Trump and his administration (Brooks, 2020), such messages were also spread by traditional media as well as health practitioners—as in the case of UK physician Christian Jessen—, infectious diseases experts[7] and other authoritative figures. In some cases, the comparison was not explicitly made but nonetheless suggested. Following this linear logic, any alarmism is an irrational overreaction as COVID-19 is "like a bad cold, let's be honest." Within this discourse framework, the risk of COVID-19 is minimized and any alarmism considered as an irrational overreaction. The flu *topos* immediately associates the novel coronavirus with a known, manageable disease which, in the collective imagination, can be easily overcome. The comparison drawn between an unknown virus and a well-known disease also serves to frame the crisis—and particularly the response to it—as scientifically sound and builds the necessary framework to legitimize specific strategies as well as effectively communicate the "reality" of the pandemic to the public. By using the stereotypical image of Italians being lazy ("siesta") and opportunistic ("any old excuse") together with representing the crisis as almost a total media fabrication ("lived out more in the press than in reality"), drastic measures imposed by other countries such as the lockdown in Italy are framed as excessive responses, perhaps even nonsensical if compared to the measures routinely taken by governments to deal with a much more serious disease such as the flu. This stance is confirmed by excerpt 23: when asked whether he agreed with Prime Minister Boris Johnson's decisions to delay closing schools, Jessen said:

(23) "I do agree with him actually. [. . .] I don't think it's a—it's a real epidemic. Well, it's obviously a real epidemic, but I think we are more worried than we need to be."

DISCUSSION

The combination of CDA with narrative network analysis allowed for the identification of shared recurring themes and characteristics in the crisis narratives across nations as well as the use of specific discourse strategies across the analyzed categories. In addition to the statements analyzed above, **Table 1** below includes further retrieved examples of crisis narratives and themes produced in each country and divided by category.

The findings can be synthetized as follows: attribution of blame and blameworthiness was found to be a common pattern constructed around two main themes: (1) Italy was to blame for having taken inappropriate measures; this narrative was found in all the four countries and (2) Italy was responsible for spreading the virus (Spain). Whereas a comparison with the flu was found to be the most adopted theme used as minimizing strategy in the four countries, the framing of Italian measures as too premature or excessive was found a theme shared by the UK and the Netherlands. All countries adopted culturalized images which were found to be positive if self-referred to the

[7]One above all is the example of Dr. Anthony Fauci, director of the American National Institute of Allergy and Infectious Diseases and currently considered among the most official authorities on the COVID-19 response who, on 17 February, described the risk from the novel coronavirus "minuscule" and urged caution in regarding the "influenza outbreak" instead (USA Today, 2020).

TABLE 1 | Statements produced in each category per country.

	Attribution of blame	Minimizing strategies	References to country-specific shared experiences	Use of familiar images (especially cultural)	Explicitness or implicitness of language used
Spain	We now know that 90% of the cases in Spain come from Italy	It's a simple flu and that's it. More people die of hunger, cancer and we don't care or talk about it that much[a]	My Spanish antibodies will defeat the damn Chinese viruses[b]	Italians are too "expansive" and that contributes to the spread of the virus[c]	Explicit
	Italy adopted controversial measures				
France	Italy took measures that did not stop the pandemic[d]	The virus mostly affects old people. Italy is the European country with the highest number of old people on average[e]	Are the French irrational?[f]	The French discover that the Italians are able to follow the rules[g]	Both
Netherlands	Italy, for example, is just incredibly stupid now. With this lockdown, they will surely cause a paralysis of their own society	Now there is one patient. It's a flu virus, which later will become a common flu. We should not take disproportionate measures[h]	We are down-to-earth people	Italians are less compliant with hygiene measures than us[i]	Explicit
			The current Dutch approach is the only correct one		
UK	Italians have brought this trouble upon themselves. Haven't they always adopted a laid-back attitude to rules?[j]	Acting too prematurely could become problematic as anything we do, we have got to be able to sustain[k]	Quietly does it. It is when our lives are at threat, and panic is at its highest, that the quiet, sensible voice of reason is most valued [l]	Italians are hardly renowned for sticking to official rules and regulations[m]	Both
		This is like a bad cold really		The Italians, any old excuse to, you know, shut down everything and stop work for a bit and have a long siesta	

[a] *Es una simple gripe y ya esta. Muere mas gente de hambre, de cancer y ni se le da tanta importancia ni se habla lo suficiente (Semana, 11 March 2020).*
[b] *Mis anticuerpos españoles derrotarán a los malditos virus chinos (El Mundo, 2020).*
[c] *Los italianos son demasiado "expansivos" y eso contribuye a la expansión del virus (niusdiario.es, 3 March 2020).*
[d] *L'Italie a pris des mesures qui n'ont pas permis d'enrayer l'épidémie (Huffington Post—France, 12 March 2020).*
[e] *Le virus touche essentiellement des personnes âgées. L'Italie est le pays avec la moyenne d'âge la plus élevée de l'Union européenne (Atlantico, 11 March 2020).*
[f] *Les Français sont-ils irrationnels? (Le Figaro, 4 March 2020).*
[g] *Les Français découvrent que les Italiens peuvent respecter les règles (Le Figaro, 15 March 2020).*
[h] *Nu is er sprake van één patiënt. Het is een griepvirus, dat later een gewone griep zal worden. We moeten geen disproportionele maatregelen nemen (Knack, 1 March 2020).*
[i] *Italianen houden zich minder goed aan de hygiënemaatregelen (Nu.nl, 14 March 2020).*
[j] *The Daily Telegraph, 11 March 2020.*
[k] *The Telegraph, 10 March 2020.*
[l] *The Daily Telegraph, 14 March 2020.*
[m] *The Telegraph, 10 March 2020.*

country-specific shared experiences and negative when referred to Italy. For example, the stereotype of Italy as being incapable of following rules was found in the French, Dutch and British excerpts whereas characterizations of Italians as expansive or lazy were found respectively in the Spanish and British excerpts. The use of language was found to be mostly explicit, although instances of implicit language use were also found in the French and British statements. Generally, the adopted discourse strategy constructed a linear, oversimplified "us" vs. "them" narrative. The criticism of Italy as Other-identity was found to be a common communicative device used by the analyzed actors to position themselves and the domestic handling of the crisis as strategically sound. **Table 2** shows the relevant statements for each category per country.

TABLE 2 | Themes and strategies across countries.

	Spain	France	Netherlands	UK
Italy adopted inappropriate measures	Yes	Yes	Yes	Yes
It's just like the flu	Yes	Yes	Yes	Yes
Us vs. them (self-referred)	Yes	Yes	Yes	Yes
Us vs. them	Yes	Yes	Yes	Yes
Explicit language	Yes	Yes	Yes	Yes

The combination of CDA and narrative networks analysis allowed to look specifically at how narratives were produced within a network of sequential discourse and factual events and thus also at how they may have impacted on the general understanding of and response to the crisis in the early stages. The identification of the root causes of the crisis as tied to

the cultural traits of Italians, for example, shaped the crisis as specific to Italy and to its adopted crisis measures and it reassured the population about the concurrent domestic situation. This, in turn, tended to be paired with xenophobic or exceptionalism ideas (e.g., the Netherlands and UK). Similarly, the idea that the virus was merely a flu and not special measures needed to be taken to overcome it framed the crisis as mild. However, if on the one hand this narrative helped to temporarily manage the chaos, on the other, it may have contributed to the subsequent countries' unpreparedness (i.e., subsequent high dead tolls, repeated national lockdowns). Finally, the statements were produced in the space of few days from each other; although it is difficult to establish whether countries were intentionally reproducing each other's narratives, the striking similarities identified in the use of discourse devices and images supports the validity of narrative network analysis as a suitable method for the study of transnational crises and it has therefore much to recommend to communication researchers.

CONCLUSIONS

Crisis defines a temporary situation which requires immediate intervention and lucid and sound management for order to be restored. This conceptualization frames crisis as a problem-solving challenge which can be resolved through *ad-hoc* governmental strategies. In the context of the COVID-19 crisis, domestic pressures and different styles of public health governance resulted in conflicting approaches to the handling of the pandemic across different nations. Especially in the early stages, confronted with an urgent, unprecedented public health crisis, officials found themselves faced with the additional challenge of having to secure public support, especially when their decisions were differing considerably from those of other countries. Such an additional challenge created a discourse void that needed to be filled with credible and compelling narratives to mobilize the general support from the public. This article analyzed the discourse strategies and narratives employed by experts, politicians and other social actors from Spain, France, the Netherlands, and the UK when discussing the Italian crisis management approach in relation to their own response to the COVID-19 outbreak in the early stages of the pandemic. The aim was to identify and compare similarities and differences across these countries in how the crisis was communicated by relevant actors and which discourse strategies were adopted to legitimize their crisis management approaches. Combining CDA with narrative networks analysis, the study also examined how narratives were produced within a network of sequential discourse and factual events and explored how they may have impacted on the general understanding of and response to the crisis.

The study followed events from early February to mid-March and analyzed the adopted communicative devices in statements produced by officially or institutionally entitled public voices from the above-mentioned countries in the first 2 weeks of March. The analysis revealed striking similarities in the way such actors framed the crisis and in the rhetorical devices and images used to describe the internal response in comparison with the Italian response; these can be grouped into three main discourse strategies. First, the narratives attached to nation-specific decisions were highly culturalized, making use of both explicit and implicit cultural stereotypes which were found to be negative when referred to Italy and positive when self-referred. Second, these familiar, stereotypical images were found to be built in contraposition with positive images of the respective countries, thus constructing an "us" vs. "them" narrative. The criticism of Italy as Other-identity was found to be a common communicative device used by the analyzed actors to position themselves and the domestic handling of the crisis as strategically sound whilst creating a sense of membership and solidifying group identity through the use of culturized images. The narratives were found to be always part of a linear, oversimplified narration of the situation in which more complex facts were obscured and the general understanding of the crisis was inevitably shaped as perfectly fitting the domestic approach. Third, although different competing discourse realities were built in each country and different aspects of both the crisis and the measures to tackle it were either emphasized or obfuscated (e.g., the economical aspect in the Netherlands, the health care system in France and Spain), attribution of blame and blameworthiness was found to be a common pattern. This normative stance not only framed Italians as wrongdoers but also as deserving blame (e.g., they don't follow the rules, they're stupid).

Finally, in the Netherlands and in the UK, the legitimization strategies resulted in inappropriate speech, as Italy was respectively referred to as stupid and lazy. These were the latest statements in the narrative network, perhaps indicating that a negative climate of criticism and division was created in the early months of the pandemic, which might have escalated over time and turned into more emotive and culturalized criticisms. Although at this stage it is difficult to assess whether each country's statement was directly responsible for producing a chain reaction and more research is needed in this direction, it is nonetheless worth noticing how the national narratives of crisis seem to have become on the whole increasingly aggressive, nationalistic and less diplomatic.

As it was driven by a close-reading approach, this study included a limited number of sources and examples. Future research could widen the material used for the investigation for instance by extending the timeframe, including more languages and a larger geographical area and pair the investigations with a quantitative network analysis. This could be indeed enriched with a comparison drawn across different times in the pandemic so as to broaden the diversity of perspectives and obtain a richer picture of the COVID-19 crisis communication strategies, in Europe and beyond.

In the context of the COVID-19 pandemic, the globalized proportion of the crisis forced governments and public health officials to take immediate action but more importantly, to present such actions to the public as the best possible strategies. With the exception of moderate differences between the analyzed countries, narrative networks analysis showed that such strategies were communicated through the lens of each country's sense

of exceptionalism and superiority, built in opposition with the denigration of Italy as the Other-identity. Ultimately, understanding the linguistic devices used for narrating a crisis is vitally important as a foundation for understanding the response to the crisis itself. Despite the limited sample analyzed here, the findings of this study have already important implications. The analysis highlighted patterns of discourse strategies across the four countries' crisis narratives which arguably shaped the understanding of the crisis as mild; they did so by criticizing the Italian strategy, by comparing coronavirus to influenza, and by resorting to xenophobic or exceptionalism ideas. As discourse shapes and it is shaped by public events, the way crises are narrated has immediate consequences for news framing, public understanding, and policy and therefore the results of this study crucially point to the wider issue of using appropriate linguistic devices when communicating a crisis. For example, in the language of crisis, rather than employing inappropriate frames which perpetuate stereotyped cultural images and create a polarized climate of mistrust and division, a more critical, self-reflective, and transparent approach should be adopted which could contribute to more appropriate crisis responses.

DATA AVAILABILITY STATEMENT

Publicly available datasets were analyzed in this study. This data can be found here: https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide.

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The author confirms being the sole contributor of this work and has approved it for publication.

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The Influence of Risk, Location, and Relationship on Refusing an Event Invitation During the COVID-19 Pandemic

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Viewed through the lens of the Revelation Risk Model (RRM), we examined whether the perceived riskiness of an activity, relationship type (family, romantic, or friends), and location in the US (California, Oklahoma, or Ohio) influenced whether and how people communicated with close others when refusing an event invitation during the COVID-19 pandemic. Additionally, we examined how these factors affected their likelihood of attending an event, their likelihood of refusing an invitation, and their anticipation of the effect of the disclosure of their refusal on future interactions. States varied widely in their response to the pandemic and our results suggest this affected participants' responses to the activity scenarios we presented. People from Ohio and California reported less likelihood of attending the event in the high-risk condition than people from Oklahoma. Participants were more likely to make up false excuses for low-risk events to avoid conflict. A three-way interaction between riskiness of the scenario, closeness of the relationship type, and location predicted the effect on future interactions. Implications for the effects of refusals on relationships are discussed.

Keywords: disclosure, risk perception, refusals, interpersonal communication, COVID-19

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INTRODUCTION

The worldwide outbreak of COVID-19 in early 2020, and restrictions put in place to limit social gatherings, created a lot of stress for people around the world (Katella, 2020). While the easing of stay-at-home orders in some states across the US alleviated stress for some people, allowing them to leave their houses and maybe interact with loved ones again, for others a whole new layer of issues emerged: what to do when people invite you to an event you are not comfortable attending. This became a popular topic of concern, with news articles covering people's experiences as they reported engaging in conversations about their own comfort level and boundaries (Chapin, 2020; Ellison, 2020). Given the importance of avoiding contact with others to slow the spread of the virus prior to the availability of vaccines (O'Reilly, 2020), having honest conversations with loved ones about comfort levels and the risk involved with activities was extremely important.

While these conversations are imperative, they are not always successful and can have negative effects on relationships, particularly when one's assessment of the situation does not match the assessment of their relational partner (Chapin, 2020). Unfortunately, research suggests perceptions of risk and comfort are influenced by political rhetoric (Hardy, 2020), creating even more

opportunity for frustration, blame, guilt, and potentially conflict. In some situations, if one's relational partner does not agree with their concerns, relationships can be permanently damaged (Ellison, 2020). Additionally, for some, just the thought of providing a refusal causes stress or fear that loved ones will blame them, making them feel guilty about not attending (Fetters, 2020). The potential negative outcomes associated with refusals might make it more likely people avoid having conversations and attend events they are uncomfortable with, or lie about their reason for not attending just so they can avoid the conversation (Whillans et al., 2020).

The anecdotal stories and research described above suggest that, at least for some people, engaging in important conversations about health protocols and comfort levels is a daunting task, and one that some might prefer to avoid. This provides a perfect scenario for communication scholars to examine the factors that influence decisions people make about refusing invitations from relational partners, should people be asked to engage in an activity they deem too risky, and how those resulting conversations influence interpersonal relationships. Therefore, this research seeks to better understand the experiences people have refusing event invitations during the COVID-19 pandemic. With research on refusals and the Revelation Risk Model (RRM) as a basic framework, the goal of this study is to determine how situational and relational factors influence three processes related to disclosures: (a) the likelihood someone will refuse an invitation to an event during the COVID-19 pandemic, (b) the communicative processes (direct vs. indirect) used to refuse the invitation, and (c) relational outcomes as a result of disclosing a refusal.

The insight provided by the results of this study will add to the current literature by examining how relational characteristics combine with a major global health crisis to influence refusal processes in personal relationships. Researchers believe being direct and honest in conversations about COVID-19 risk is best, and have found that being honest can actually bring people closer together (Whillans et al., 2020); therefore, results of this study will help practitioners understand different personal and relational characteristics that might put someone at risk of either avoiding refusal conversations or being indirect in their refusals surrounding COVID-19 so that they can work with them to make them more comfortable opening up and being direct.

Literature Review

The COVID-19 Pandemic

The COVID-19 pandemic began as the virus spread rapidly across the globe in the beginning of 2020. Although the virus was first confirmed in 2019, it was not until March of 2020 that it was declared a national emergency in the United States. By the end of March there were worldwide restrictions on travel, the Centers for Disease Control and Prevention (CDC) suggested limits on the number of people gathering together, and several US states shut down all non-essential business, with schools pivoting to online learning and many people working from home in an effort to keep people indoors and slow the spread of the virus (Bryson Taylor, 2020). Following stay at home orders, reports of stress, anxiety, and depression increased (Katella, 2020), and after one month protests against the health measures taken by state governments occurred in places like Michigan, Minnesota, and Ohio. By May and June 2020, some states started opening back up and easing quarantine restrictions (Bryson Taylor, 2020), while vaccines were not widely available in the US until spring and summer of 2021.

With the lifting of orders and nicer summer weather in 2020, the topic of conversation in many news outlets became how to handle requests to socialize with friends and family, and what to do if people are invited to an event they are not comfortable attending (Chapin, 2020; Ellison, 2020). Some people reported that these conversations were difficult and frustrating. For example, Chapin (2020) spoke with people who reported family members responding to their declaration of risk and comfort boundaries by saying they were being too cautious or loved ones who refused to compromise to match the comfort level of others. Conversations about comfort levels and boundaries during the pandemic require communicators to be vulnerable about their concerns, which opens them up to the possibility of being invalidated by their close relational partners. When there is a disagreement between relational partners, if their differing needs are not respected, it can have negative relational implications. For example, some people reported ending their friendships as a result of COVID-19 boundary differences (Ellison, 2020). Anticipated outcomes of these conversations can be so nerve-wracking, that some people might avoid having the conversations altogether. For example, Whillans et al. (2020) found people were more likely to say "yes" to attending an event when asked by a close friend, even if they were not comfortable. Additionally, turning down an invitation could count as a face-threatening act for invitees, or an act that inherently damages the positive self-image or sense of autonomy of one person by acting in opposition to the wants and desires of the other (Brown and Levinson, 1987). Ultimately, if not done carefully, refusals can cause relational harm (Tanck, 2002). Therefore, it is important researchers understand what kind of factors influence the likelihood that people might be in a position to refuse an invitation, as well as how those factors influence one's refusal strategy and the implications for the relationship after the refusal has taken place.

To examine these processes, we rely on the Revelation Risk Model and the concept of refusals as frameworks that help us understand the influence of a variety of factors that could contribute to someone's decision to turn down (i.e., refuse) an event invitation during the COVID-19 pandemic. The decision to provide a refusal is likely complicated; therefore to account for this our study seeks to examine the role of both situational (risk level and location within the US) as well as relational (relationship type: family, romantic relationship, or friendship) influences on people's communicative experiences when refusing an invitation to an event during the COVID-19 pandemic.

Refusals and the Revelation Risk Model

A refusal occurs when a speaker either "directly or indirectly says 'no' to a request or invitation" (Tanck, 2002, p. 2). Direct refusals involve specifically saying "no" in some capacity, whereas indirect refusals are vaguer and might contain excuses as to

why someone cannot complete the request. Importantly, because refusals involve rejecting someone, they are considered face-threatening acts. Because of this, indirect refusals are more common than direct ones, as they allow people to say no while still being polite and saving face (Tanck, 2002).

The first step in understanding the refusal process associated with social gathering invitations during COVID-19 is to determine what circumstances might lead to needing to provide a refusal in the first place. At its most basic, those who do not feel comfortable attending are the most likely to refuse an event invitation. However, the decision to refuse an invitation is likely more nuanced, given the frustration and conflict people have reported in their actual conversations with loved ones (Chapin, 2020; Ellison, 2020), particularly considering reports people have attended events they do not feel comfortable with in order to avoid having to refuse someone (Whillans et al., 2020). Therefore, in order to get a more holistic understanding of the refusal process, it is important to consider the variety of factors that contribute to decisions to disclose a refusal.

One framework that can help scholars understand the decision to refuse an invitation is the Revelation Risk Model (RRM). The RRM was initially developed by Afifi and Steuber (2009) as a model utilized to predict circumstances that lead to secret disclosure specifically. Although this model does not examine refusals, it does consider how factors influence people's decision to disclose information to close others. Importantly, the RRM is relevant to the refusal process examined here because it considers not just the individual considering disclosure, but also how their relationship with their disclosure target plays a role in the decision to disclose (Afifi and Steuber, 2009).

According to the RRM, when deciding whether to disclose to someone individuals consider the risk associated with disclosure, and the higher the risk the less likely they are to disclose. When assessing the risk of disclosure, people consider 1) the risk to themselves, 2) the risk to their relationship, and 3) the risk to other people. Evaluation of self-risk involves protecting oneself from negative evaluations, like judgment, ridicule, or harm. Evaluation of relationship-risk involves trying to protect one's relationship with the disclosure target from harm. Lastly, evaluation of risk to others involves considering how other people might be impacted by one's disclosure (Afifi and Steuber, 2009). In the context of invitation refusals during the COVID-19 pandemic, self-risk could involve concerns such as how one's relational partner might judge them for their COVID-related beliefs, while relationship-risk would be focused on how their relationships might be impacted by refusing an invitation, and risk to others might involve considering whether it is important to directly address the health risks associated with event attendance in order to protect others.

Additionally, the model also considers conditions under which people would be more willing to disclose. In the context of secrets, these conditions are 1) the need for catharsis, 2) feeling like the disclosure target needs to know the information, and 3) being asked by another person to reveal the information (Afifi and Steuber, 2009). Given that this study is not focused on secrets, we have used the basic premise of the RRM to examine what factors might influence someone's decision to refuse an invitation to an event during the COVID-19 pandemic. While the conditions that influence disclosure are not the same, because of the potential negative ramifications of engaging in discussions about the risk of social gatherings and the harm these conversations could pose to relationships, the general premise of RRM can be a helpful framework for unpacking the refusal process. This is particularly true if people anticipate a negative reaction from the individual who invited them (e.g., if the person does not think the invitee will agree with their decision and might get upset). To understand how individuals might weigh the risk of providing a refusal, it is important to first identify factors that might influence when a refusal would take place, beginning with conditions under which someone might not be comfortable attending an event.

One of the factors that should influence whether someone is comfortable attending an event is the level of COVID-19 related health risks associated with the event in question. In theory, the higher the risk associated with an activity, the less comfortable someone should be attending the event and the more likely someone should be to refuse an invitation. However, research on risk has found that one's perception of risk is more predictive of their behavior than the actual risk (Turner et al., 2011) and research on risk perceptions of COVID-19 specifically have found that misconceptions are common (Faasse and Newby, 2020). Therefore, it is not surprising that many news articles during the late spring and early summer months of 2020 reported on the risk of various common activities. For example, Moitke (2020) and DesOrmeau (2020) spoke with health experts to rank the risk of various summer activities. The CDC even created a searchable page people could use to learn about risks associated with various activities and steps people should take to reduce their chances of getting themselves or others sick (CDC, 2020). Even with these resources available and widely disseminated, it does not guarantee people will accurately understand risk, especially because research has found people differ in their trust of news sources and expert opinion during the COVID-19 pandemic (Hardy, 2020). Thus, in order to understand how risk influences comfort level, it is necessary to examine other factors that influence people's risk perceptions.

One additional factor that might influence how people perceive the health risk associated with various activities during the COVID-19 pandemic is their location because of the partisanship that has been associated with reactions to public health measures in the US during the pandemic (Gadarian et al., 2021; Ye, 2021). Vai et al. (2020) found COVID risk perceptions and behavioral intentions varied by location when comparing personal beliefs of those in Italy vs. Japan. There are multiple reasons to believe perceptions of COVID-19 would vary not just between residents of different countries, but also between residents of different locations within the United States.

Responses to the pandemic have varied widely by state. For example, as of November 2020, California still had stay at home orders in place, whereas many other states around the country lifted their orders as early as May. Additionally, some states, like Massachusetts, had limits on the number of people who could gather at one time, while others had no such restrictions (Kaiser Family Foundation, 2020). Some states

varied the types of business that could open while others had blanket orders that covered all business types (like restaurants and gyms) (Adolph et al., 2021). One of the explanations for widely different responses by state is political affiliation of the leaders, especially the state's Governor who were the ones making policies. For example, Adolph et al. (2021) examined COVID-19 protocols at the state level and found that Governors of Republican states began to ease lockdown restrictions or stay-at-home orders 14.5 days earlier than Governors of Democratic states, regardless of actual transmission or hospitalization rates. The Governors of Florida and Texas (both Republican-leaning states with Republican leaders) signed executive orders banning mask mandates by schools in their states. The Arizona Legislature did the same (Lombardo, 2021). Thus, by examining the policies of states by their leaders' party, Adolph et al. were able to track the partisan effects on virus transmission and compliance with COVID-19 policies like stay-at-home orders.

Importantly, in the United States, it is a common practice by the media to color-code states where red designates a state voting mostly Republican and blue designates a state voting mostly Democratic. A few states are known as "purple" which means they swing back and forth from election to election (Rader, 2019). Makridis and Rothwell (2020) utilized this color-coding system in their research and found political partisanship based on states' electoral college votes in the 2016 election influenced the types of policies states put into place to help quell the virus, with states that were "red" in 2016 being 20% less likely to adopt a statewide shut down order and 40% less likely to enforce a mask mandate compared to those that were "blue" (Makridis and Rothwell, 2020). Lastly, partisanship appears to affect vaccination rates as well. Ye (2021) examined vaccination rates by US county and found a widening gap over time between Democratic-leaning and Republican-leaning counties when tracking vaccination rates from January to May 2021 as vaccines were rolled out and made more available to younger cohorts.

The research described above has found a link between one's location and their perceptions of health risk during the COVID-19 pandemic, as well as a link between their location and their comfort engaging in various risk-preventing behaviors. Therefore, it is likely both COVID risk and one's location influence a person's comfort attending certain events, and the likelihood they do attend the event. However, given the connection between state decisions and party affiliation, much of the research has focused on the difference between red states and blue states, but little is known about how residing in a "purple" state, or swing-state, might influence risk perceptions. With this in mind, the following hypothesis was posed:

> H1: COVID risk level and location will interact to influence one's (a) comfort level and (b) likelihood of attending an event during the COVID-19 pandemic.

Lastly, although comfort level should determine whether someone accepts an invitation to an event during the COVID-19 pandemic, some research suggests relationship type influences how likely someone is to attend an event regardless of comfort level, which aligns with the importance placed on relationships in the RRM. For example, Whillans et al. (2020) found people were more likely to accept an invitation they were uncomfortable with when the invitation came from a friend than from a family member or colleague. Therefore, relationship type seems to interact with risk level of activities to influence likelihood of attending an event, although Whillans et al. (2020) did not include romantic partners in their analysis, so the insight provided by that research is incomplete. Additionally, little is known about how and whether one's location might influence the connection between relationship type and willingness to attend an event. Therefore, the following research question was posed:

> RQ1: Does relationship type interact with (a) COVID risk level, (b) location, or (c) COVID risk level and location to predict the likelihood someone will attend an event during the COVID-19 pandemic?

Strategies to Disclose a Refusal

The next step in understanding the invitation refusal process during the COVID-19 pandemic is trying to determine how people let others know they do not want to attend the event. Based on the RRM, people are more likely to avoid disclosure if they anticipate a negative reaction and/or if the topic of disclosure is considered negative (Afifi and Steuber, 2009); however, in this particular context completely ignoring an invitation to an event is unlikely, as doing so would be considered rude. Beyond simply disclosing or keeping a secret, the RRM does identify specific communication strategies people use to disclose secrets, including directness, indirect mediums, incremental disclosure, third party revelations, preparation/rehearsal, and entrapment (Afifi and Steuber, 2009). Given that refusals tend to be indirect (Tanck, 2002), it is thus important to consider indirect strategies people might use to refuse an invitation. One indirect strategy might be to lie about the reason why they do not want to attend. For example, if someone is worried the invitee will react negatively if they admit they are not comfortable attending the event because of the risk it poses, they might instead say they are busy. In fact, Afifi and Guerrero (2000) found one way people avoid sensitive topics when they cannot or will not avoid the conversation altogether is to purposefully leave out information, essentially engaging in deception as an avoidance tactic.

Additionally, Hancock et al. (2009) coined the term "butler lies" as a type of deception used to manage the entry and exit of social interactions and avoid interactions altogether. Although they were talking about technology like instant messaging taking the place of the Butlers of the elite in a bygone era, they emphasized an important point, which is that politeness is the motivation for many of our everyday deceptions. People seek to maintain their own and their partner's "face." As Hancock et al. (2009) state,

> As Brown and Levinson point out, people use different language strategies to avoid threatening one's own or another's face. Deception is one language strategy (an 'off-the- record' strategy in the Brown and Levinson terminology) that we use when committing a face-threatening act...Butler lies about avoiding an interaction, or lies related to leaving a conversation that the

> partner wants to continue, are designed to maintain our own face (not coming across as mean or haughty) as well as our partner's (that we respect and like them) (p. 519).

Similarly, we can use polite forms of deception to avoid talking about difficult topics to avert a conflict or to spare our partner's feelings. We can also refuse an invitation but give an excuse in order to preserve our own autonomy and control over our own bodies during a dangerous pandemic. The above research suggests lying when responding to an event invitation is a possibility, but are there ever times people might decide honesty is more important than keeping others happy?

Keating et al. (2013) examined how topic avoidance functioned when it came to difficult conversations. They predicted one's family communication patterns would influence whether one engaged in a difficult conversation, with those that came from very open families where different opinions are encouraged being more willing to engage in conversations than those who come from families who discuss few topics together and stress homogeneity of values. However, contrary to their predictions, their results suggested everyone regardless of their family communication patterns engaged in difficult conversations. Keating et al. (2013) asserted their results highlight the fact that when the situation surrounding the difficult conversation is considered critical, avoidance of the conversation is unlikely.

Given that attendance at events during the COVID-19 pandemic has been linked to the spread of the virus and even death of attendees in some cases (Zdanowicz and Jackson, 2020), there are likely at least certain event contexts that align with the critical situations Keating et al. (2013) highlighted in their research. Because engagement in difficult conversations was only likely when the situation is deemed critical, risk level of the activity in question should influence whether someone lies or is honest when rejecting an invitation. For example, based on Keating et al.'s (2013) findings, people might be more likely to honestly reject an invitation to a high-risk event like an indoor mask-less gathering in a crowded bar, compared to a moderate or low-risk event, such as an outdoor dinner or going for a walk outdoors with masks on and social-distancing measures in place. Interestingly, Whillans et al. (2020) found 73.8% of people wanted to communicate the risk associated with an activity to their loved one when rejecting an invitation to an event, but only 45.5% reported they would express concerns with risk when providing an excuse. They found regardless of political orientation, people were more likely to be honest about their concerns when they worried about the event harming the welfare of their friend, and suggested risk for one's friend was the biggest determinant of whether people were honest (Whillans et al., 2020).

According to the RRM, relationship characteristics should also influence one's willingness to be honest. For example, relational closeness has been positively associated with disclosure, suggesting close relationships provide people with a sense of safety, allowing them to feel like it is safe to be honest. Caughlin et al. (2005) found people more willing to disclose to people they are close to and Derlega et al. (2008) found relational closeness as a frequently mentioned reason for being willing to disclose highly personal information. Laursen and Williams (1997) found those relationships that are horizontal (i.e., relatively equal in power and status) and voluntary, such as friendships and romantic relationships, are considered closer than those that are vertical (i.e., relatively unequal in power and status) and involuntary, such as family relationships. Additionally, Derlega et al. (2008) found both willingness to truthfully disclose highly personal information and reasons for disclosure varied by relationship type. Lastly, Godbersen et al. (2020) found relationship type influenced perceptions of the effectiveness and importance of social distancing, with concerns about close family members being more influential than concerns about friends. When considered in combination with the focus on other-risk in the RRM, all the above research suggests one's relationship to the invitee might influence how worried a person is about COVID risks and therefore how willing they are to directly and honestly address their concerns.

Based on the research cited above, we believe that the closeness of the relationship and the risk level will affect the truthfulness or deceptiveness of the reasons provided. Thus, the following hypothesis was proposed:

> H2: Relationship type and COVID risk level will interact to predict truthfulness of an excuse provided when declining an invitation to an event during the COVID-19 pandemic.

Relational Implications of Refusals

Considering the importance of relationships in the RRM, the last step in understanding people's experiences with refusals during the COVID-19 pandemic is to examine the relational implications of rejecting an invitation. News reports of conversations related to event invitations during the pandemic support the idea that some people experienced negative relational implications. For example, when describing an upsetting situation with a friend, Ellison (2020) interviewed someone who indicated she did not talk to a friend for two weeks after that friend insisted she come to an event that she was uncomfortable attending. The whole situation was frustrating, she claimed, because her friend promised the circumstances were safe and tried to persuade her to attend by asking if she trusted them. Because of her friend's claims, and the trust she had for this friend, she went to the event; however, when she arrived, she felt the situation was too risky and left at once (Ellison, 2020). In this case, according to the individual interviewed, once she realized her friend's comfort level and hers were not the same, her perception of her friend changed and their relationship suffered, at least in the short term.

The example above suggests it is likely people perceive their relationships will be negatively impacted as a result of declining an invitation; however, this process is likely influenced by COVID risk level associated with the event, location, and relationship type. In general, people fear negative relationship implications because they worry their relational partner will be upset by their disclosure, or the disclosure itself will cause conflict (Afifi and Steuber, 2009). In the context of COVID-19 event invitations, those who decline an invitation and expect their relational partner to be disappointed and/or angry should fear a negative outcome as a result of their refusal of the invitation, whereas

those that accept the invitation should experience positive relationship outcomes. This means in order to determine how risk, location, and relationship type might influence relational outcomes, one must consider how these factors might lead to the requestor becoming upset and/or the refusal leading to conflict in the first place.

In terms of COVID-19 risk level, it is more likely people would be upset when someone declines an invitation to a low-risk event than a moderate or high-risk event. This is because declining a moderate or high-risk event invitation would likely be expected, whereas people would be less likely to expect a rejection to a low-risk event. Therefore, people should report worse relationship outcomes when rejecting an invitation from a low-risk event than a moderate or high-risk event. However, given the influence of location on one's perception of risk described earlier, location should also influence whether someone gets upset because a loved one declined an invitation. According to Lenz (2013), constituents form their own opinions about public issues based on the positions of political elites. The opinions of elites have the power to either encourage people to engage in safe practices, or to reject suggestions supported by scientific research (Darmofal, 2005; Brulle et al., 2012). This means policy decisions of local officials, as well as their public messaging about the risk of contracting COVID-19, have the power to influence individual beliefs about the risk of certain events, and in turn whether someone would be upset by an event refusal. For example, based on Lenz's (2013) research, someone who lives in an area with public officials who denounce mask mandates and suggest constituents should not be afraid to eat indoors or attend events would likely be influenced by the opinions and messages provided by their officials, ultimately believing that event attendance is less risky than it really is. Because of these beliefs they would also be more likely to get upset when someone refuses an event invitation they have extended, perhaps ultimately believing the invitee is being unnecessarily worrisome. Conversely, someone who lives in an area with public officials who support mask mandates and encourage constituents to only congregate outside and always follow social distancing measures would be more likely to believe event attendance is too risky. Because of these beliefs they would be more likely to understand why someone refused an invitation and would therefore not get upset at receiving a refusal. In the context of state politics, given that blue states had a higher likelihood of instilling strict safety measures compared to red states (Makridis and Rothwell, 2020; Adolph et al., 2021), when declining an invitation to an event during COVID-19, those from red states should expect poorer relationship outcomes as a result of declining an invitation than those from blue states, even if the risk is high. Therefore, the following hypothesis was proposed:

> H3: COVID risk level and location will interact to predict relational implications after declining an event invitation during the COVID-19 pandemic.

Lastly, relationship type could influence perceptions of relational implications. For example, Furman and Buhrmester (1992) found friendships and romantic relationships were more egalitarian than parent-child relationships, and research has shown when someone has less power they are more likely to experience psychological aggression from their relational partner (Dunbar and Johnson, 2015). Additionally, Warner et al. (2020) found when people disagree with their family members, they are less likely to engage in respectful communication when discussing those differences. Therefore, people might expect worse relationship outcomes when declining an event from a family member than a friend or romantic partner. However, given descriptions of people ending relationships because of frustrations after engaging in COVID-19-related conversations (Ellison, 2020), it is possible people are more worried about seriously harming voluntary relationships, like friendships and romantic relationships, than involuntary relationships, like family relationships. For example, Roper et al. (2018) found people anticipated more relational harm following an aggressive argument with a romantic partner than a family member and the authors suggested this might be because family relationships are more stable and more difficult to end. All in all, the influence of relationship type on the future of one's relationship seems uncertain, and when combined with information about the influence of risk and location it is unclear how all three factors will influence perceptions of the relationship together. Therefore, the following research question was posed:

> RQ2: Do COVID risk level, location, and relationship type interact to predict perceived impacts of an invitation refusal on the future of a relationship?

MATERIALS AND METHODS

Participants

An online survey circulated between September and October 2020 was compiled via Qualtrics from the scales listed below and completed by undergraduate students in three different states meant to represent blue [California ($n = 131$)], red [Oklahoma, ($n = 172$)], and purple[1] [Ohio ($n = 78$)] states in the summer and early fall of 2020. Subjects were recruited at large Universities in each state through research pools and courses in three different Departments of Communication. To qualify to participate, individuals needed to be at least 18 years of age and enrolled in an undergraduate communication course. A total of 451 people began the survey, but after deleting those surveys that were completed in <10 min and two surveys that were almost completely blank, a total of 381 completed surveys were utilized for analysis. Those who completed the survey were compensated with extra credit to apply to their communication courses. During the pandemic, some College students were telecommuting from other locations, but the majority were still residing in the state where they attend University (California, 88.5%; Oklahoma, 82.6%; Ohio, 97.4%).

Age of the participants ranged from 18 to 60 ($M = 20.56$, $SD = 4.11$). The majority of participants identified as female ($n = 282$, 74%), while 24.7% identified as male (n = 94), one

[1] From 2000 to 2016, Ohio voted for the Republican Presidential Candidate 3 times and the Democratic Candidate twice. During that time, they elected Republican Senators 5 times and Democrats 4 times. In California, all Presidential Candidate winners and Senators have been Democratic and in Oklahoma all have been Republican during the same span.

person (0.3%) identified as non-binary, and four people did not provide this information. A majority of the participants identified as white ($n = 246$; 64.6%), 15.7% identified as Asian or Asian-American ($n = 60$), 9.7% identified as Hispanic or Latino/a ($n = 37$), 3.9% identified as Black or African American ($n = 15$), 2.1% identified as American Indian or Indigenous North American ($n = 8$), and 2.9% indicated "other" as their racial/ethnic identity, with answers ranging from a mixed identity to Middle Eastern. Lastly, on average participants reported wearing a mask 85.32% of the time when they left their home and were within 6 ft of another person.

Measures

COVID Risk Level

To understand the role of risk and relationship type on event invitation refusals, the authors developed a total of nine vignettes, which were randomly presented to participants. In the vignettes, three different relational partners were accounted for (friend, family member, and romantic partner) and within each relationship type category, the authors created three different situational activities, one of low-risk, one of moderate-risk, and one of high-risk. Risk of each situation was determined based on the rankings of the Texas Medical Association Chart (Texas Medical Association, 2020). See **Appendix A** for a list of the vignettes associated with each relationship type and risk level, as well as information concerning the number of participants assigned to each of the nine vignettes.

Participants were randomly presented with one vignette for each relationship type (for a total of three), asked to think of a person in their life that represented that relationship type (ex: think of a close friend, think of a sibling, think of a current or imagined romantic partner) and write their initials down to help them remember who they were thinking of. In order to simulate the refusal process, they were then presented with the scenario and asked various questions about their comfort attending the activity, their likelihood of attending the activity, the excuse they would provide to the invitee when refusing an invitation, the truthfulness of their excuse, and their perception of future interactions with this person as a result of their conversation.

Comfort With Activity

Comfort was measured with one item asking participants to indicate how comfortable they would be attending the activity described in the vignette on a scale of 1 (Extremely Comfortable) to 7 (Extremely Uncomfortable). The item was reverse coded so that higher levels meant more comfort, $M = 4.93$, $SD = 2.09$.

Likelihood of Attending Activity

Likelihood of attending the activity was measured with one item asking participants to indicate how likely they would be to attend the activity described in the vignette on a scale of 1 (Extremely Likely) to 7 (Extremely Unlikely). The item was reverse coded so that higher levels meant a higher likelihood of attending, $M = 4.98$, $SD = 2.16$.

Deception

Deception used in the excuse participants provided was measured using one item asking participants to rate the truthfulness of the excuse they provided on a 1 (Definitely True) to 5 (Definitely False) scale, $M = 1.56$, $SD = 0.91$.

Perceptions of Future Interactions

To determine how participants predicted future interactions with their relational partner might go, participants were asked to consider, based on their response to the person's request to engage in an activity, how they anticipated their future interactions with the person would be. This question was developed by the authors. The question utilized 10 items on a 7-point semantic differential scale. Examples of options included, positive vs. negative, satisfying vs. unsatisfying, more sad vs. happier, and closer vs. more distant. Some items were reverse-coded so that a higher score reflected a negative impact on future interactions, Reliabilities ranged from $\alpha = 0.95$–0.97 across the nine scenarios, $M = 2.05$, $SD = 1.12$.

Covariates

When conducting hypothesis tests the authors controlled for a variety of factors, including age, sex, the percentage of time one reported wearing a mask, risk perception accuracy, risk aversion, perceived stress, and closeness between the participant and the individual extending the invitation.

Risk accuracy was determined by presenting participants with a list of common activities found on the Texas Medical Association's risk assessment scale provided on the Texas Medical Association website, 2020. The authors selected this list because it was compiled by medical experts and was widely publicized and cited by several popular news sources in the summer of 2020. It ranks 37 different activities on a scale from 1 to 10, 1 being the least risky and 10 being the most. Examples of activities ranked on the list include playing tennis, shopping in a mall, and going to a bar. Participants were randomly presented with 20 of the 37 activities, told medical authorities had ranked each activity on a scale of 1–10 based on how risky each activity was, and were asked to rank each of the 20 activities on a 1–10 risk scale themselves. Risk accuracy was then determined by calculating an absolute value of the differential between each person's rankings and the rankings of the Texas Medical Association, which ranged from 15 to 99, $M = 39.28$, $SD = 13.65$. For this item, scores closest to zero would be considered more accurate.

Risk aversion was measured using the General Risk Aversion scale by Mandrik and Bao (2005). This scale presents participants with six statements on a 1 (Strongly Disagree) to 7 (Strongly Agree) Likert scale, asking them to indicate how much they agree or disagree with each statement. Example statements include, "I do not feel comfortable taking chances" and "Before I make a decision, I like to be absolutely sure how things will turn out." One item was dropped from the scale due to poor reliability, after the item was dropped, $\alpha = 0.75$, $M = 3.34$, $SD = 1.00$.

Perceived stress was measured using Cohen et al.'s (1983) Perceived Stress scale. This scale presents participants with four statements on a 0 (Never) to 4 (Very Often) Likert scale, asking them to indicate how often they have felt or thought in a certain way. Example statements include, "In the last month, how often have you felt that things were going your way?" and "In the last month, how often have you felt difficulties were piling up so high

that you could not overcome them?" Higher numbers on this scale meant more stress, $\alpha = 0.72$, $M = 2.48$, $SD = 0.53$.

Relational closeness was measured using Aron et al.'s (1992) Inclusion of Other in the Self scale. This scale uses Venn diagrams to help participants visualize closeness in their relationships. In the diagram, one circle represents the participant and the other circle represents their relational partner. The participants are presented with seven different Venn diagrams, with different amounts of overlap between the circles in each one. The circles go from 1 (Not Touching) to 7 (Almost Completely Overlapping). Participants were asked to indicate which diagram best represented their relationship with the person they associated with each vignette, $M = 5.08$, $SD = 1.76$.

RESULTS

All hypotheses and research questions were tested with a MANCOVA that examined the independent variables of level of risk (low, moderate, high), type of relationship (family, friend, romantic partner), and location of participant (the red state of Oklahoma, the blue state of California, and the purple state of Ohio, as designated in terms of typical political leanings of the state's populations). Significant covariates included participant age, Wilks' $\lambda = 0.96$, $F_{(5,814)} = 6.53$, $p < 0.001$, partial $\eta^2 = 0.04$; sex, Wilks' $\lambda = 0.98$, $F_{(5,814)} = 2.88$, $p = 0.01$, partial $\eta^2 = 0.02$; percent of time they reported wearing a mask, Wilks' $\lambda = 0.94$, $F_{(5,814)} = 11.17$, $p < 0.001$, partial $\eta^2 = 0.06$; their general risk aversion, Wilks' $\lambda = 0.94$, $F_{(5,814)} = 11.32$, $p < 0.001$, partial $\eta^2 = 0.07$; their relational closeness with the individual about whom they were reporting, Wilks' $\lambda = 0.78$, $F_{(5,814)} = 45.12$, $p < 0.001$, partial $\eta^2 = 0.22$; their accuracy in assessing the riskiness of the activity presented in the scenario, Wilks' $\lambda = 0.98$, $F_{(5,814)} = 3.46$, $p < 0.01$, partial $\eta^2 = 0.02$; and their perceived stress levels in the last month, Wilks' $\lambda = 0.99$, $F_{(5,814)} = 2.28$, $p < 0.05$, partial $\eta^2 = 0.01$.

The multivariate test of the MANCOVA showed a significant main effect for the riskiness of the scenario, Wilks' $\lambda = 0.75$, $F_{(10,1,628)} = 25.65$, $p < 0.001$, partial $\eta^2 = 0.14$. Significant univariate effects for riskiness of scenario included comfort with the proposed activity, $F_{(2,818)} = 127.91$, $p < 0.001$, partial $\eta^2 = 0.24$; likelihood of attending proposed activity, $F_{(2,818)} = 94.21$, $p < 0.001$, partial $\eta^2 = 0.19$; and deception level in response to the request, $F_{(2,818)} = 6.77$, $p = 0.001$, partial $\eta^2 = 0.02$. See **Table 1** for means and standard deviations for each riskiness condition (low, moderate, high).

The multivariate test also showed a significant main effect for the type of relationship about which they were asked to report, Wilks' $\lambda = 0.96$, $F_{(10,1,628)} = 3.00$, $p = 0.001$, partial $\eta^2 = 0.02$. Significant univariate effects for type of relationship included comfort with the proposed activity, $F_{(2,818)} = 4.95$, $p = 0.007$, partial $\eta^2 = 0.01$; and likelihood of attending proposed activity, $F_{(2,818)} = 4.83$, $p = 0.008$, partial $\eta^2 = 0.01$. See **Table 2** for means and standard deviations for each relationship type (friend, romantic partner, family member).

The multivariate test showed a significant main effect for the location of data collection, Wilks' $\lambda = 0.95$, $F_{(10,1,628)} = 4.25$, $p < 0.001$, partial $\eta^2 = 0.03$. Significant univariate effects for location included comfort with the proposed activity, $F_{(2,818)} = 10.79$, $p < 0.001$, partial $\eta^2 = 0.03$; likelihood of attending proposed activity, $F_{(2,818)} = 15.31$, $p < 0.001$, partial $\eta^2 = 0.04$; and predicted positivity of future interaction with the individual requesting, $F_{(2,818)} = 5.91$, $p = 0.003$, partial $\eta^2 = 0.01$. See **Table 3** for means and standard deviations for each location of data collection (California, Oklahoma, Ohio).

In addition, the multivariate test showed that the interaction between relationship type and riskiness of scenario was significant, Wilks' $\lambda = 0.90$, $F_{(20,2,701)} = 4.24$, $p < 0.001$, partial $\eta^2 = 0.03$. Significant univariate effects for the interaction between relationship type and riskiness of scenario included comfort with the proposed activity, $F_{(4,818)} = 8.98$, $p < 0.001$, partial $\eta^2 = 0.04$; and likelihood of attending proposed activity, $F_{(4,818)} = 14.99$, $p < 0.001$, partial $\eta^2 = 0.07$. The multivariate

TABLE 1 | Means and standard deviations by riskiness of scenario.

	Low risk	Moderate risk	High risk
Comfort	5.14_a (1.34)	3.15_b (2.12)	2.99_b (2.17)
Attend?	4.99_a (1.57)	3.25_b (2.26)	3.09_b (2.25)
Future interaction	2.18_a (1.18)	2.02_a (1.16)	2.16_a (1.14)
Deception level	1.76_a (0.99)	1.55_b (0.94)	1.43_b (0.81)

Within each row, means with different subscripts are significantly different from each other at α = 0.05. A higher score on comfort corresponds to greater comfort with the activity. A higher score on attend signifies a higher likelihood of attending an event. A higher score on future interaction corresponds to a more negative impact on future interactions. A higher score on deception level indicated greater levels of deception.

TABLE 2 | Means and standard deviations by relationship type.

	Friend	Romantic partner	Family member
Comfort	3.55_a (2.08)	3.63_b (2.25)	3.94_b (2.13)
Attend?	3.46_a (2.19)	3.81_b (2.31)	3.92_b (2.19)
Future interaction	2.16_a (1.15)	2.03_a (1.14)	2.15_a (1.19)
Deception level	1.69_a (1.01)	1.52_a (0.84)	1.61_a (0.93)

Within each row, means with different subscripts are significantly different from each other at α = 0.05. A higher score on comfort corresponds to greater comfort with the activity. A higher score on attend signifies a higher likelihood of attending an event. A higher score on future interaction corresponds to a more negative impact on future interactions. A higher score on deception level indicated greater levels of deception.

TABLE 3 | Means and standard deviations by location of data collection.

	California	Oklahoma	Ohio
Comfort	3.04_a (2.16)	4.17_b (1.99)	3.60_c (2.27)
Attend?	2.96_a (2.29)	4.24_b (2.01)	3.66_c (2.33)
Future interaction	2.37_a (1.20)	1.91_b (0.98)	2.23_a (1.40)
Deception level	1.55_a (0.91)	1.59_a (0.93)	1.59_a (0.91)

Within each row, means with different subscripts are significantly different from each other at α = 0.05. A higher score on comfort corresponds to greater comfort with the activity. A higher score on attend signifies a higher likelihood of attending an event. A higher score on future interaction corresponds to a more negative impact on future interactions. A higher score on deception level indicated greater levels of deception.

test also showed a significant interaction between location and riskiness of scenario, Wilks' $\lambda = 0.96$, $F_{(20, 2,701)} = 1.88$, $p = 0.01$, partial $\eta^2 = 0.01$. Significant univariate effects included comfort with the proposed activity, $F_{(4, 818)} = 3.78$, $p = 0.005$, partial $\eta^2 = 0.02$; likelihood of attending proposed activity, $F_{(4, 818)} = 3.40$, $p = 0.009$, partial $\eta^2 = 0.02$; and predicted positivity of future interaction with the individual requesting, $F_{(4, 818)} = 3.13$, $p = 0.01$, partial $\eta^2 = 0.02$.

Finally, the three-way interaction between riskiness of scenario, relationship type, and location was also significant for the multivariate test, Wilks' $\lambda = 0.93$, $F_{(40, 3,551)} = 1.44$, $p = 0.04$, partial $\eta^2 = 0.01$. Significant univariate tests included predicted positivity of future interaction, $F_{(8, 818)} = 3.09$, $p = 0.002$, partial $\eta^2 = 0.03$.

Now, each hypothesis test and research question will be discussed along with the relevant results from above. Hypothesis one claimed that risk level and location would interact to influence comfort level and likelihood of attending the event illustrated in the vignette. The interaction between risk level and location on comfort was significant, $F_{(4, 818)} = 3.78$, $p < 0.01$, partial $\eta^2 = 0.02$ (see **Figure 1**). In addition, the interaction between risk level and location on likelihood of attending an event was also significant, $F_{(4, 818)} = 3.40$, $p < 0.01$, partial $\eta^2 = 0.02$ (see **Figure 2**). Thus, hypothesis one was supported.

Research question one asked if there were interactions between the variables risk level, location of data collection, and type of relationship presented in the vignette to predict likelihood of attending a particular event during the pandemic. Relationship type and risk level interacted to predict likelihood of attending the event presented in the vignette, $F_{(4, 818)} = 14.99$, $p < 0.001$, partial $\eta^2 = 0.07$ (see **Figure 3**). No other interactions including relationship type significantly predicted likelihood of attending.

Hypothesis two claimed that relationship type and risk level would interact to predict the truthfulness of the excuse provided when declining an invitation to an event during the COVID-19 pandemic. The interaction between relationship type and risk level did not significantly predict truthfulness, $F_{(4, 818)} = 2.18$, $p = 0.07$, partial $\eta^2 = 0.01$. Thus, hypothesis two was not supported.

Hypothesis three asked whether risk level and location interacted to predict future relationship implications. Risk level and location interacted to significantly predict future relational implications, $F_{(2, 818)} = 3.13$, $p = 0.01$, partial $\eta^2 = 0.02$ (see **Figure 4**), supporting hypothesis three. Additionally, research question two asked whether risk level, location of data collection, and relationship type interacted to predict the perceived impacts of invitation refusals on the future of the relationship about which the participant was reporting. This predicted three-way interaction was significant, $F_{(8, 818)} = 3.09$, $p = 0.002$, partial $\eta^2 = 0.03$ (see **Figure 5**). In fact, the three-way interaction between risk level, location of data collection, and relationship type superseded the interaction between risk level and location predicted by hypothesis three.

DISCUSSION

Conversations surrounding risk and comfort attending events during the COVID-19 pandemic have caused dilemmas for individuals' interpersonal relationships, particularly when people's perceptions of risk and comfort differ from their loved ones and situations arise when discussing those differences may be necessary (Chapin, 2020; Ellison, 2020). This study used the RRM framework to examine factors that might predict how individuals feel about attending events during the pandemic, how these factors might predict the disclosure strategies people use when refusing an invitation to an event, and the relational implications such refusals might have for people's interpersonal relationships.

The first step in applying the RRM to event invitation refusals is to identify factors that might put people in a situation where they need to refuse an invitation. To do this we sought to identify how both situational and relational factors influenced one's comfort level attending an event, as well as their likelihood of attending said event. Two situational factors we posited might predict individuals' feelings and behavior related to an invitation to attend events during the COVID-19 pandemic included the health risk associated with the event and the location where the person lived. Given the importance of accurately understanding risk to discouraging risky behavior (Turner et al., 2011), medical and health personnel have provided the public with assessments of how risky certain behaviors are during the pandemic (Moitke, 2020). Unfortunately, even with this widespread information perceptions of risk still differ across the country and seem to be influenced by the political ideology of the state's leaders. For example, researchers have found differences in steps taken by states to manage the pandemic are influenced by political partisanship (Makridis and Rothwell, 2020), and Hardy (2020) found those who identified as right-wing were less likely to believe it was necessary to engage in recommended hygiene practices. Additionally, Ye (2021) and Adolph et al. (2021) found differences by county and state in vaccination rates and the lifting of stay-at-home orders.

The results of hypothesis one and research question one found that risk level and location did significantly interact to predict comfort levels with events during the pandemic. Specifically, while everyone reported being more comfortable with low-risk activities than moderate or high-risk activities, individuals in California, a blue state, reported lower levels of comfort from the high-risk activities than those from other locations, particularly Oklahoma. Risk level and location also interacted to predict one's likelihood of attending an activity they've been invited to. Again, individuals from all locations showed a clear pattern of a higher likelihood of attending the event in the low-risk activity scenario and reported a lower likelihood in the moderate or high-risk scenario. However, when location was taken into consideration people from Ohio and California reported being less likely to attend the event in the high-risk condition than people from the red state of Oklahoma.

California has maintained strict guidelines throughout the pandemic, particularly when compared to the guidelines in Oklahoma and Ohio. For example, as of November 2020 (shortly after data for this study was collected) California still had a statewide stay at home order and a ban on gatherings, while Oklahoma lifted both its ban and stay at home order and Ohio lifted its stay-at-home order and only maintained its ban on large gatherings (Kaiser Family Foundation, 2020). Additionally, Grossman et al. (2020) found those in democratic-leaning areas

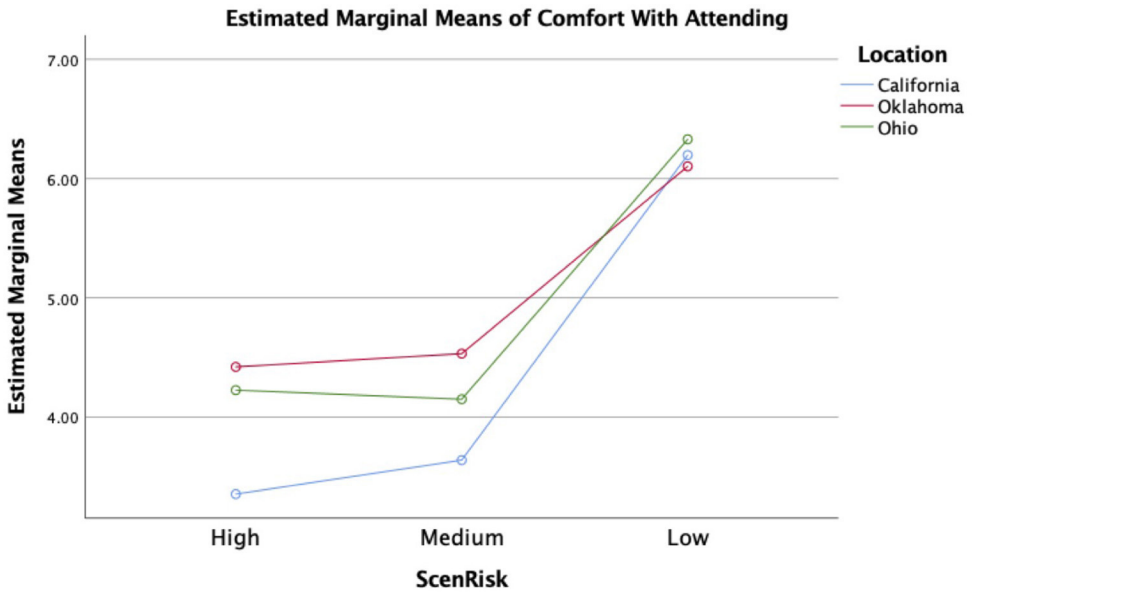

FIGURE 1 | Interaction of risk level and location of data collection to predict comfort attending an event during the COVID-19 pandemic.

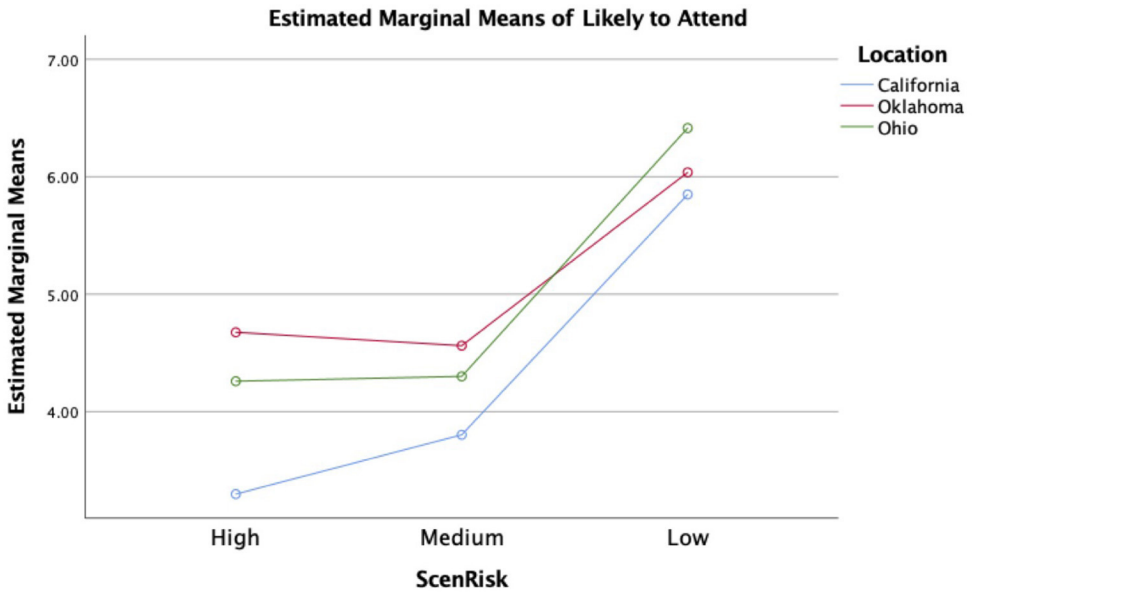

FIGURE 2 | Interaction of risk level and location of data collection to predict reported likelihood of attending an event during the COVID-19 pandemic.

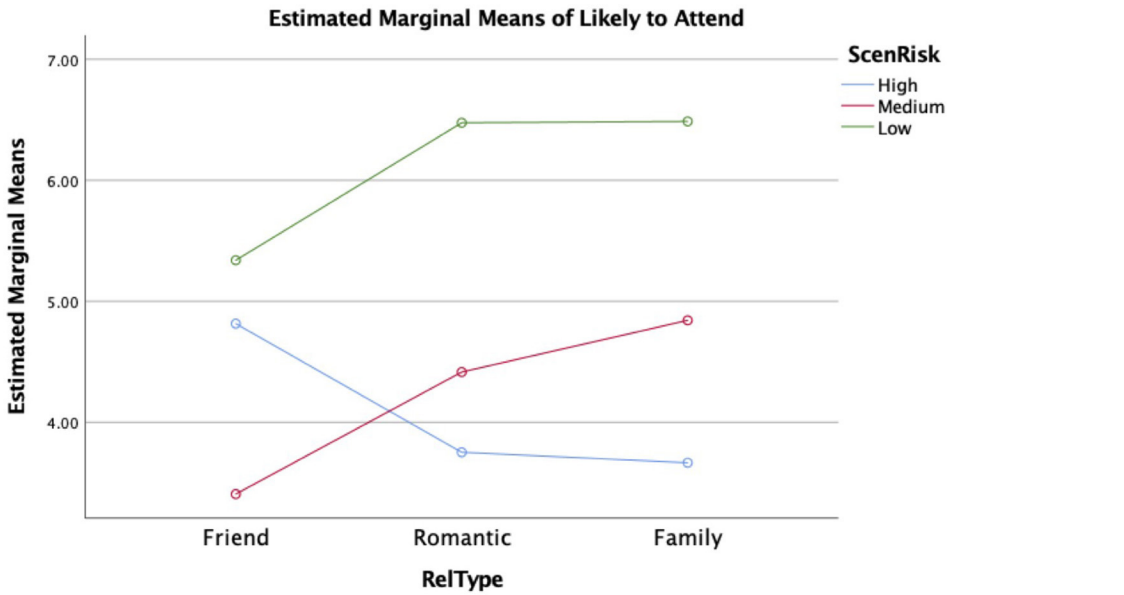

FIGURE 3 | Interaction of relationship type and risk level to predict reported likelihood of attending an event during the COVID-19 pandemic.

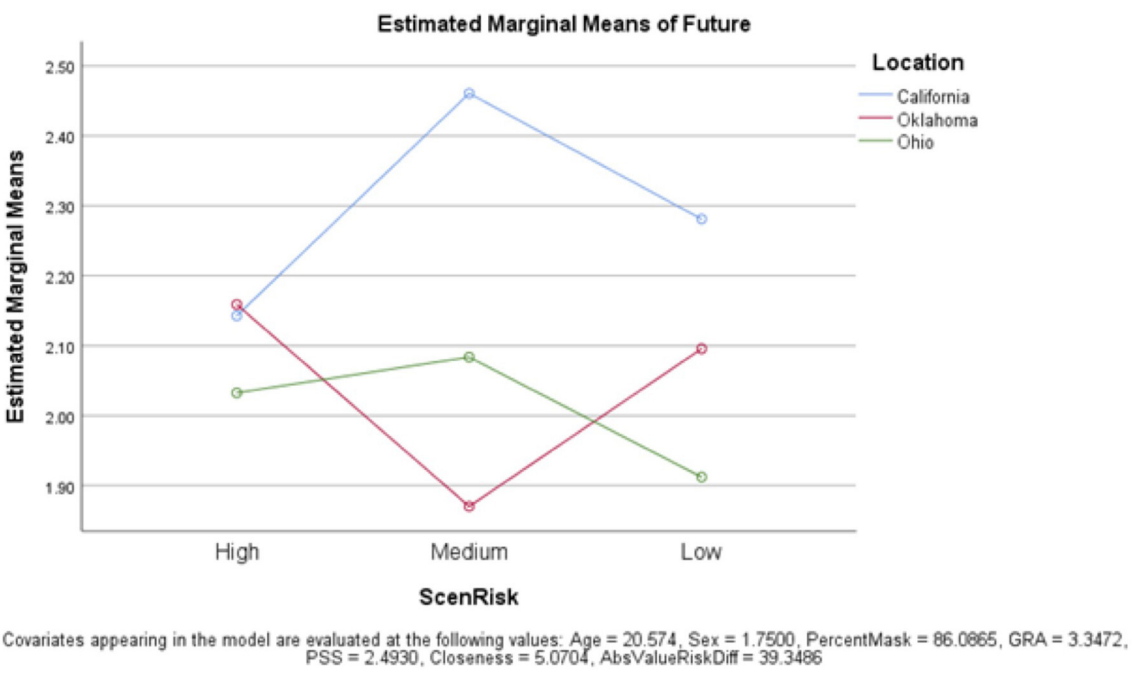

FIGURE 4 | Interaction of risk level and location of data collection to predict reported perceived future relationship implications of an event invitation refusal during the COVID-19 pandemic.

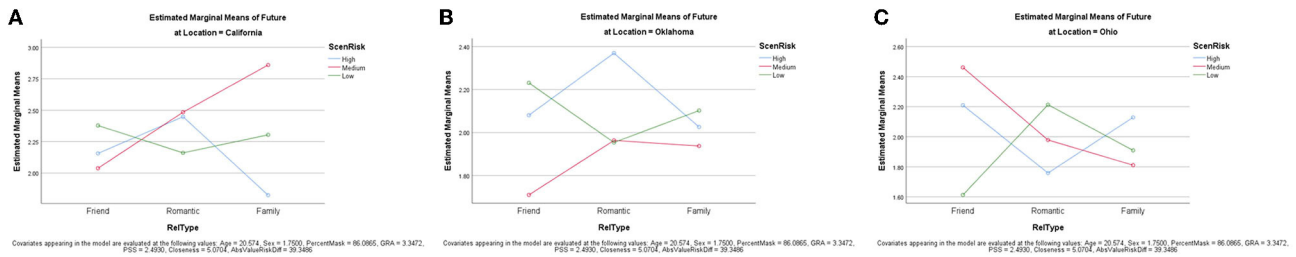

FIGURE 5 | (A–C) Three-way interaction between risk level, type of relationship, and location of data collection to predict reported perceived future relationship implications of an event invitation refusal during the COVID-19 pandemic.

are more likely to be influenced by government safety regulations than those from republican-leaning areas, and the results of this study lend further support to their conclusion.

Relationship of the individual offering the invitation also predicted one's likelihood of attending an event. In general, people were less likely to attend an event when asked by a friend than when asked by a romantic partner or family member. However, this relationship was altered when COVID risk level and relationship were considered in tandem. Specifically, when the activity in question was high-risk, people were more likely to attend said activity when asked by a friend rather than a family member or romantic partner. In the context of event refusals, this means when someone is invited to a high-risk event, they are more likely to find themselves in a situation where they need to provide a refusal when they are invited to that event by a romantic partner or family member than when invited by a friend. Whillans et al. (2020) found when people were invited to an event that made them uncomfortable, they were more likely to accept an invitation from a friend than they were to accept one from a family member or coworker; the results of this study support Whillans et al.'s (2020) conclusions.

There are a few reasons why people would be more likely to attend a risky event when asked by a friend than when asked by their family or romantic partner. First, in Whillans et al.'s (2020) study they found people were more likely to attend high-risk events when asked by a friend because they felt like their friends were less likely to get infected, thus making event attendance seem safer. Perhaps our participants also felt this way. Second, it is possible people spent most of their time with their friends and therefore felt safer spending time with them than they did with others. For example, in order to help people manage the loneliness that many reported experiencing as a result of quarantining at home, public health experts started suggesting people create "coronavirus bubbles," or small groups of people that interact with one another safely (Brueck, 2020). Therefore, these results could be reflective of the bubbles people have created in their lives. Overall, these results suggest that concerns about health risks associated with events, not just for oneself but also for others in attendance, are important and play a role in people's decisions to attend or refuse an invitation.

Importantly, in the context of the RRM, identifying the factors that influence comfort with and likelihood of attending an event during a global pandemic is important because these factors influence whether someone would be in a situation where a refusal would even be necessary. Without this first step, it is impossible for researchers to then consider how these factors influence the likelihood of disclosing a refusal, the strategies used to disclose the refusal, or the relational implications of a refusal. While the three factors examined here are likely not the only relevant ones, this study provides a glimpse into the thought processes people engage in when faced with an event invitation during this time.

The next step in applying the RRM to event invitation refusals was to determine what kind of disclosure strategies people engage in when they do refuse an invitation. Previous research has found refusals can be either direct or indirect, with indirect strategies being more common as they are viewed as polite and face-saving (Tanck, 2002), and we examined this process by considering how truthful people would be when providing an excuse for their refusal. Truthful refusals were considered direct, while untruthful refusals were considered indirect. Although reports of deception were low in general ($M = 1.56$ on a 1–7 scale), only riskiness of scenario predicted deception level, with people being more likely to report lying about their refusal in the low-risk condition, and people reporting higher levels of truthfulness in the moderate and high-risk conditions. An examination of additional open-ended data where participants provided the excuse they would give someone when refusing an invitation shows when people lied about their excuse for not attending low-risk events they were likely to say things that suggested they were too busy. For example, when turning down an invitation to go on a walk with a romantic partner one person indicated they would say, "Hey I'm busy with school right now." Additionally, when declining an invitation from a sibling to go to a grocery store where masks were required and social distancing was monitored, one person indicated they would say, "I have a paper due and I'm so far behind on it." Lastly, when declining an invitation to go play tennis with a friend, one person indicated they would say, "I would most likely say I am busy and have other plans going on." Although the authors did not conduct a formal analysis of this open-ended data, it seems as if when people lie, they try to provide an excuse that will limit pushback from their relational partner by suggesting they have other things going on at the time of the event.

Given the importance of saving face when providing a refusal (Tanck, 2002), it makes sense that people would lie in these

circumstances. The relatively "safe" nature of attending low-risk events means a refusal to an invitation to these events would be more unexpected. Therefore, when people do refuse they are more likely to be concerned about upsetting their relational partner and a lie could be considered one way to honor their own comforts while also limiting the likelihood the invitee will get upset. For example, people are less likely to complain and argue with you if you say you do not have time than if you say you are not comfortable going for a walk. Comparatively, in moderate and high-risk situations, people are more likely to be honest because they probably expect their relational partner to understand their concern. Additionally, these results might reflect the connection between sense of responsibility, blame, and appeasement. For example, Knight (2018) found when people did not feel like they have done anything wrong, but want to avoid blame they communicate in ways that appease a relational partner. Perhaps lying about a reason for not attending a low-risk event is one way people try to appease their relational partners and therefore avoid guilt and blame.

The likelihood people would tell the truth when refusing an invitation to a moderate or high-risk event supports the conclusions of Keating et al. (2013), who found when the circumstances are critical (in this case a moderate or high-risk situation) people are more likely to engage in conversations with a relational partner, even if the topic of conversation is one they might rather avoid. Whillans et al. (2020) found that the main motivator for talking to one's relational partner about their concerns associated with attending events during the COVID-19 pandemic was the risk the event posed, and the results of this study support Whillans et al.'s (2020) conclusions and show that risk concerns outweigh the concerns people might have about being open and honest with their loved ones. If this is related back to the RRM, the perceived risk to others seems to be what motivates people to be truthful, above and beyond the concerns they might have about how they are perceived by their relational partner and/or how their relationship with that person might be impacted.

Finally, in order to account for the importance of relationships in the RRM, we posited that one's event invitation refusal during the age of social distancing might relate to implications for the relationship between the participant and the person extending the invitation. To examine how relationships are impacted by refusals, we tested how our three factors worked together to predict perceptions of future relationship outcomes. Although we predicted that individuals from the red state of Oklahoma might report more negative implications for future interactions, Oklahomans actually reported significantly fewer negative implications for future interactions than people from California or Ohio. This finding reflects the results from hypothesis one that one's location influences perceptions of risk. Out of everyone in this study, participants from Oklahoma reported the most comfort attending high-risk events and were most likely to report being likely to attend a high-risk event. These findings suggest those from Oklahoma viewed COVID-19 as less risky than those from other locations, and therefore were less likely to find themselves in a situation where they would have to refuse an invitation to an event in the first place. If they were less likely to refuse an invitation it is also unlikely they would be concerned about conflict or a negative reaction from their relational partner, so it makes sense that many people from Oklahoma reported perceiving positive future interactions with their relational partners.

A three-way interaction (illustrated in **Figure 5**) found that location and relationship type predicted negative implications for future interactions differently for the three locations. People from Ohio predicted the fewest negative implications with friends in the low-risk condition, while people from Oklahoma predicted the fewest with friends in the moderate-risk condition. Californians, on the other hand, reported the fewest negative implications for family members in high-risk conditions, perhaps suggesting that family members in this blue state might have more similar perceptions in the high-risk condition than the other locations, resulting in less negative implications for refusing an invitation to such an event. However, conclusions regarding this interaction are very speculative and need to be replicated by future research.

Theoretical and Practical Implications

The results of this study have both theoretical and practical implications. First, the RRM was developed to examine secret disclosure specifically. This study suggests the basic framework of the model can be utilized to examine communication processes in other contexts, specifically when refusing an event invitation. Secret disclosure is a stressful process because it requires people to weigh the pros and cons of letting others in on private information. As Afifi and Steuber (2009) describe, both the decision to disclose and the decision to withhold secrets comes with risk so in order to determine what to do, people consider all of the risks involved. While event invitations are certainly different, this study suggests people do weigh the risks associated with being open and honest about their refusals, with risks about the health and safety of others seemingly being the main motivator. Importantly, this study did not formally test the RRM model and instead applied the basic ideas of the model to the event refusal context. Therefore, in order to add to our theoretical understanding, future researchers interested in this line of scholarship could utilize the list of relevant factors and refusal techniques uncovered here to develop and test a RRM model for refusals specifically.

In terms of practical implications, research suggests being direct and honest when discussing COVID-19 concerns is the best approach for people to use (Whillans et al., 2020), and the results from this study shed some light on situations where people might be more hesitant to be honest. Practitioners, and even journalists, could use this information to help ease people's anxieties about having conversations about COVID-19 related risk and help encourage them to be honest even in low-risk situations. Additionally, it is important to note that Whillans et al. (2020) found people reported feeling closer to their loved ones after discussing their concerns about risk during the pandemic, so even if people are concerned about their relational partner's response, research suggests their worries might be unfounded.

Future Directions

Beyond the suggestions mentioned above, future researchers should continue to examine how high-stakes, critical situations influence the likelihood of refusing an event invitation, as well as strategies used to communicate the refusal to close others. In the context of the COVID-19 pandemic, as vaccines become more readily available in the United States it would be interesting to examine how concerns about vaccinations add an additional layer to conversations surrounding event invitations. For example, when considering whether to accept an invitation to an event in addition to considering the riskiness of the event itself, people might now consider whether those in attendance will be vaccinated. This additional concern could add another layer of frustration or concern, particularly for those whose opinions about vaccines differ from the invitee. It would also be interesting to examine the influence of conflict on how people refuse invitations to events in more detail. In this study the authors argued that fear of conflict and negative reactions from one's partner would encourage people to lie about their reasoning for turning down an invitation and were able to gauge those fears by measuring perceptions of future interactions, but asking people about their fears of conflict directly might provide more insight. More generally, future researchers should continue to try to determine what kinds of contexts are considered critical and necessary, and therefore more likely to encourage people to be direct and honest in their refusals rather than indirect. Research on refusals suggests they are more likely to be indirect in order to save face, but this research suggests this might not be the case in some contexts.

Limitations

This study is not without its limitations. First, in this study the authors utilized location as a proxy for political ideology, and future research should ask participants about their political beliefs directly. Although research supports the idea that location is indeed related to one's political beliefs, of course republicans live in blue states and democrats live in red states. Therefore, measuring for each participant's political beliefs would have provided a more specific and nuanced understanding of how political partisanship influences individual perceptions, as well as their political activity and voting regularity. Additionally, these data were collected from college students, which is not representative of all individuals across the country. Participants were also mostly female, and mostly identified as white. Future researchers should replicate this research in more diverse samples to see if the results are supported. Lastly, this research is based on responses to imagined vignettes, not actual situations that have taken place in people's lives. Therefore, we cannot assume the answers provided in this study perfectly reflect what happens in real life, although given the fact that the data were collected during the pandemic and during the time participants might have had to turn down invitations in real life, those real-life experiences could have influenced how they responded to the vignette scenarios.

CONCLUSION

Overall, this study utilized the basic RRM framework to examine the role of risk level, one's location within the United States, and relationship type on one's experience with event invitation refusals during the COVID-19 pandemic. Results suggest that all three factors influence one's likelihood of attending an event and perceptions one has of future interactions with their relational partners, while the health risk posed by the event was the most important factor in determining whether someone would be honest or lie when refusing an invitation. The results highlight the influence of perception on the disclosure of refusals and show how important people believe it is to be direct and honest when refusing invitations to high-risk situations. As such, by utilizing the RRM, this study has added to knowledge of the importance of openness and honesty and has expanded our understanding of the refusal process to see how issues such as risk and relationship characteristics influence conversations during a hopefully once in a lifetime pandemic event.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because the authors do not have IRB approval to share the data with others. Requests to access the datasets should be directed to e.n.bostwick@csuohio.edu.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by IRB at Cleveland State University, IRB at the University of Oklahoma, and IRB at the University of California, Santa Barbara. The participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

EB wrote the literature review, method, and discussion. ND created the survey used for data collection, completed the analyses, and created the figures. AJ wrote the analyses up in the results section and provided the accompanying tables. All authors collected data for this piece from their respective institutions, edited the piece, and contributed to the research design and choice of survey items. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fcomm.2022.742283/full#supplementary-material

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Community-Based Organizations as Effective Partners in the Battle Against Misinformation

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INTRODUCTION

The COVID-19 pandemic has increased the need for delivering accurate and timely health information to the public (1). However, the public is being increasingly exposed to a barrage of health misinformation amplified by social media (2–4). The World Health Organization (WHO) and the United Nations coined the term "infodemic" to describe this unprecedented spread of health misinformation (5). A recent report by the United States Surgeon General's Advisory highlighted how the rapid proliferation and decentralization of health information coupled with insufficient communication from trusted sources has led to the public's increased exposure to health misinformation (6). Health misinformation easily spreads in the current communications environment that includes social media, independent news outlets, and online forums that feed content into algorithms which often prioritize popularity and controversy over accuracy (4, 6, 7).

Misinformation is more likely to take hold when people have poor eHealth literacy and thus are unable to appraise health information (2, 8–10). While health literacy is broadly defined as the skills needed to make health decisions in the context of everyday life, eHealth literacy is "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem" (9). Having eHealth literacy is essential for individuals to be able to wade through the myriad of information that is found online, particularly in a highly politicized environment where there is a vacuum of credible and trusted sources of information (10–12). It is important to note that eHealth literacy is not equally distributed. Social determinants of health shape the accessibility to and use of information channels and the ability to process health information, the comprehension of health information, and the capacity to act upon that knowledge (13–17). Additionally, it is estimated that over 40 million adults in the United States have low literacy skills, resulting in health disparities and limiting equitable access to health resources (18, 19). The combination of poor health literacy and poor ehealth literacy allows misinformation to take hold (9, 11, 20).

While the US Surgeon General has called upon health organizations to partner with community members to develop and disseminate health messaging, the potential contribution of community-based organizations (CBOs) as trusted conduits is being missed (6). CBOs are essential health stakeholders who have established relationships with communities that are often overlooked by the larger healthcare system (21). We argue that including CBOs early in the health communication pathway is critically needed to combat this infodemic and reorient communities to their already trusted sources of health information. CBOs have tremendous reach within the communities that they serve, providing social networking, encouraging health promoting behaviors, and implementing health interventions through multiple modalities of community engagement (22). Additionally, because true community engagement and not

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simply community outreach is needed to gain the trust of marginalized populations, CBOs have a distinct advantage as they are already embedded within the fabric of the community.

COMMUNITY BASED ORGANIZATIONS: INTEGRAL FOR THE HEALTH COMMUNICATION CYCLE

CBOs can be exceptionally effective in health communication and health promotion planning because they are rich with social capital (22–24). Having social capital uniquely positions CBOs to identify the social networks and normative behavior within a community, particularly during a public health emergency (25, 26). This understanding is essential to implement an effective health communication strategy and combating misinformation.

The Health Communication Cycle typically involves four phases: Planning, Developing, Implementing, and Evaluating (27). While in theory the Health Communication Cycle encourages involving the community in testing health communication materials and helping in the dissemination phase (28), the role of CBOs is usually limited to community outreach. Instead of this, we recommend that CBOs be closely integrated even before the four stages of the health communication process. A first step, before planning a health communication project, government or academic health agencies should identify CBOs that are well-integrated in the communities to be served. Public health workers should approach CBOs that are already working in health-related issues that affect the relevant populations. The focus of their programming and services should already be serving the population that is of interest for the research study or intervention, thus the work should fit seamlessly into their interests. Importantly, partnerships with CBOs should not be done in a *post-hoc* fashion but should exist before health communication needs arise.

Once partner CBOs have been identified and clear collaborative common goals have been established, then it is important to integrate CBOs into the Planning Phase of the project. Their early involvement in the planning phase should include analyzing the problem, setting the intervention strategy, deciding on the population to be served, and co-creating health communication content. Partnering CBOs are needed to properly identify the health concerns of the community, so that ineffective content is not developed that shows additional mistrust in the source. Planning efforts need to be collaborative from the beginning, from setting an initial agenda to co-ownership of all health communication materials and tools created. CBOs should be involved in creating the agenda and all aspects of planning instead of being used to approve a preliminary plan. Our recommendation is that Planning Phase meetings with CBOs should start on a blank page onto which CBOs and public health workers have equal say from the very beginning of the process.

In the Development Phase of the Health Communication Cycle, CBOs expertise and nuanced understanding of their constituents ensures that information is created in a way that meets the health literacy needs of the communities and that is culturally appropriate. Recent communications around vaccination often failed to reach communities that were impacted most by COVID-19 because the messages developed lacked cultural sensitivity, linguistic nuance, and the involvement of trusted messengers. For example, messaging created by local health authorities that targeted the Afro-Caribbean community in Brooklyn was not appropriately translated and did not consider the diversity within this unique community. This communication campaign led to fragmented efforts that failed to reach the communities most in need of the information.

The Implementation Phase of the Health Communication Cycle involves preparing and distributing information to the population to be served. The role of CBOs in this phase can include disseminating health information through the appropriate existing channels. In this rapidly changing digital landscape, communities need to be reached in whatever medium is already most accessible to them, whether that be text messaging, email, or social media platforms. CBOs have a distinct advantage, as they are equipped with local knowledge, expertise, and trusted relationships to determine the best means of communication with their constituents leading to more efficacious health communication strategies (22, 29, 30). As such, the partnership should include community leaders that are seen as trusted messengers. For example, recognizing a unique relationship amongst members of their community, Arthur Ashe Institute for Urban Health partners with barbers and hair stylists to relay health related messages around COVID-19 to their patrons. This kind of health communication dissemination can only take place if well-established CBOs are included in all aspects of health communication efforts. Additionally, co-ownership of health communication materials ensures that CBOs have the resources, interest, and investment to adequately address the established common goal.

Finally, in the Evaluation Phase, CBOs should have a connection with community members that allows for a productive feedback loop to evaluate the effectiveness of the communication and identify changing community concerns to inform future messaging. CBOs bring the perspective of the on-the-ground experiences that inform appropriate evaluation measures/metrics that capture the health communication interventions scope, reach and effectiveness (22, 31). Elements of evaluation and measures of success need to be co-defined with CBOs during the Planning Phase of the project. This is important, as health authorities and academic researchers may have different ideas of what constitutes a successful communication campaign. For example, scientific publication may be an important metric of success, especially for academics. If scientific publication is a goal, it is important that partner CBOs participate in the authorship process. In the instance of the current publication, both the academics and community leaders shared responsibility and co-authorship.

CONCLUSION

In the dynamic fast-changing pandemic environment we currently inhabit, misinformation has real-world effects

on population health. The traditional means of health communication placed trusted intermediaries between information creating sources and information receivers. Our current communication landscape removes these intermediaries, allowing for misinformation to proliferate. Part of the problem has been that health information created and disseminated by public health organizations is not often tailored to the needs of those at highest risk, deepening gaps in health disparities and furthering mistrust and skepticism.

While public health authorities sometimes engage CBOs for community outreach, they miss opportunities to leverage the inroads of trust that CBOs have formed in their communities to meaningfully engage in all phases of the Health Communication Cycle. Understanding what information is needed, creating messaging that is appropriate and relevant, and disseminating information in whatever means works best are essential steps in battling the infodemic. CBOs are trusted entities that are deeply embedded within the communities they serve and have a nuanced understanding of their constituents that is essential to combating misinformation. Trust, a fundamental principle in relationship building, is a unique and intangible factor at the core of CBOs that positions them well to play an active role in the health communication cycle fostering health equity and promoting equal opportunity to health. Thus, to effectively communicate and fight against health misinformation, particularly in populations with deep-seated mistrust or poor health literacy, we must include and engage CBOs in all facets of health communication.

AUTHOR CONTRIBUTIONS

MK led the writing of the manuscript. MI, LC, and FA contributed both in writing and editorial feedback. HB provided editorial feedback. All authors contributed to the article and approved the submitted version.

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COVID-19 Vaccination Behavior Among Frontline Healthcare Workers in Pakistan: The Theory of Planned Behavior, Perceived Susceptibility, and Anticipated Regret

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Healthcare workers in Pakistan are still fighting at the frontline to control the spread of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and have been identified as the earliest beneficiaries for COVID-19 vaccination by the health authorities of the country. Besides, the high vaccination rates of frontline healthcare workers (FHWs) are essential to overcome the ongoing pandemic and reduce the vaccines hesitancy among the general population. The current research employed the theory of planned behavior (TPB) to investigate the COVID-19 vaccination behavior among FHWs in Pakistan as well as the predictors of such behavior. Following the epidemic control and prevention policies, a sample of 680 FHWs were accessed to fill in the questionnaire evaluating the components of the TPB. Moreover, the potential role of anticipated regret (AR) and perceived susceptibility (PS) on COVID-19 vaccination behavior was also assessed. The partial least square structural equation modeling (PLS-SEM) results revealed that the TPB components, as well as the AR, have positive associations with the COVID-19 vaccination behavior. The results further confirmed that PS positively affects the anticipated regret, attitude (ATT), and subjective norm (SN) to vaccinate against SARS-CoV-2. The perceived susceptibility also has a positive association with COVID-19 vaccination behavior through the mediation of anticipated regret, ATT, and SN. Our findings highlighted the importance of COVID-19 vaccination among healthcare workers, which can be applied to reduce vaccine hesitancy among the general public.

Keywords: COVID-19 vaccination, SARS-CoV-2, frontline healthcare workers, anticipated regret, perceived susceptibility, the theory of planned behavior

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INTRODUCTION

The novel coronavirus disease 2019 is a global pandemic caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Globally, as of 4:59pm CEST, 1 April 2022, there have been 486,761,597 confirmed cases of COVID-19, including 6,142,735 deaths, reported to WHO (COVID-19 Dashboard, 2020). In response, the WHO led the global efforts in fighting against the pandemic through preventing, diagnosing, and treating this exclusive pathogen. To restore normal civilian life and economic rehabilitation, the development of a vaccine is the most promising mean. For this reason, a simultaneous and sustained race to discover a safe and effective vaccine was initiated in the first half of 2020 by more than 90 vaccine development companies worldwide. Sooner than expected, on 31st December 2020, a vaccine to COVID-19 developed by Pfizer-BioNTech was approved by the United States Food and Drug Administration (FDA), which was quickly followed by authorizations to other vaccines, namely, Moderna, AstraZeneca, and Janssen (GAVI The Vaccine Alliance, 2021). Till now, more than 200 COVID-19 vaccines are under development, of which more than 106 vaccines have entered the clinical trials, whereas, 21 vaccines have been rolled out worldwide (GAVI The Vaccine Alliance, 2021).

Pakistan till the first quarter of 2022, has recorded the 26th highest number of confirmed COVID-19 cases (1,480,592) and death toll (29,731; COVID-19 Situation, 2022). The country is facing a huge economic disruption with an unknown future (Ashfaq and Bashir, 2021). A vaccine to mitigate the spread of coronavirus is perhaps the only hope to control the situation. Following the National Command and Operation Center (NCOC) of Pakistan's approval of different kinds of vaccines, the country has started a phased vaccine roll out in March 2021. Subsequent to the guidelines of NCOC, the frontline healthcare workers (FHWs) and elder citizens were scheduled to be the first beneficiaries of the vaccine followed by other age groups of the population. Till the first quarter of 2022, a total of 194,492,475 doses of different kinds of COVID-19 vaccines have been administered in Pakistan. Out of total administered doses 115,238,268 (52.16%) population is partially vaccinated, whereas, 89,853,639 (40.67%) population is fully vaccinated. Due to the advent of COVID-19 variants, 3,361,160 (1.52%) of the population is also vaccinated with booster doses. However, the excessive efforts for COVID-19 vaccines' availability cannot promise the end of the pandemic due to the ongoing vaccine hesitancy and anti-vaccine campaigns worldwide (Shih et al., 2021).

The healthcare workers in Pakistan are fighting in the frontline against the ongoing pandemic. Due to the constant exposure to the COVID-19-infected patients, these FHWs are at high risk of infection. Based on the NCOC estimates, at least 40% of healthcare workers have been diagnosed with SARS-CoV-2, and thus, their vaccination against the disease is deemed important. The literature regarding the acceptability of COVID-19 vaccines among healthcare workers is yet limited. However, most of the investigations revealed controversial results (Shih et al., 2021). There are ample cases available showing that healthcare workers themselves were vaccine-hesitant that also affected its acceptance in the general public (Grech et al., 2020; Wong et al., 2020; Xiao and Wong, 2020; Kumar et al., 2021). Studies conducted in Greece (Zampetakis and Melas, 2021) and the Democratic Republic of the Congo (Nzaji et al., 2020) revealed that only a meager sum of healthcare workers (16 and 0.2%, respectively) were willing to be immunized against COVID-19. Similarly, the survey reports in China also reported the unwillingness of Chinese nurses to get COVID-19 vaccination (Li et al., 2021). In contrast, the healthcare workers in Belgium, France, and Canada reported a comparatively high percentage of willingness to get COVID-19 vaccination (Verger et al., 2021). There could be several factors to underlie this behavior including low perceived risk of infection (Harapan et al., 2020), low perceived benefits (Wong et al., 2020), fear of side effects (Fakonti et al., 2021), and concerns regarding its safety (Wang et al., 2021) and efficacy (Grech et al., 2020).

In Pakistan, none of the researchers have explored the healthcare workers' behavior on vaccination against new coronavirus SARS-CoV-2. Given the enormous role of inoculated healthcare workers in shaping the general population's willingness to vaccinate against the disease, and as the availability of a vaccine does not essentially translate into its adoption, the current research thus aims to investigate the actual behavior of healthcare workers in Pakistan to vaccinate against SARS-CoV-2. The review of relevant literature suggests that the theory of planned behavior (TPB) and health belief model (HBM) are the widely adopted socio-psychological frameworks to predict individuals' health behavior (Khayyam et al., 2021). The current research applies the theoretical framework of the TPB to examine the COVID-19 vaccination behavior of FHWs in Pakistan. In addition to the TPB, other potential factors, such as perceived susceptibility (PS) of HBM and anticipated regret (AR), were also added in the classical TPB framework given that these factors can influence individuals' behavioral intentions, particularly when it comes to health-related concerns.

During the last decades, the individuals' vaccination uptake behavior has been thoroughly examined. Numerous socio-psychological theories which act as the foundation to examine the intended behavior have been acknowledged by literature. The TPB is an expectancy-value framework that has been widely applied to predict several health-related behaviors (Wolff et al., 2011), that includes intentions to undergo genetic screening, intentions to uptake Human Papillomavirus Vaccine (HPV; Li and Li, 2020), intentions to uptake influenza vaccine (Alhalaseh et al., 2020), and even intentions to uptake COVID-19 vaccination (Alhalaseh et al., 2020; Shmueli, 2021; Wolff, 2021). The TPB suggests that precise behavior is assessed through the behavioral intentions to perform it (Ajzen, 2012). The intention itself is further influenced by other components known as attitude (ATT), subjective norms (SN), and perceived behavioral control (PBC; Yzer, 2017). AR is the experience or feelings of regret for a current situation that we think we might feel in the future, typically about decisions we currently consider making. Anticipated regret in current research is the feelings of a future regret a healthcare worker will feel for refusing the COVID-19 vaccine and subsequently contracting the virus. Whereas,

PS is an individual perception of being vulnerable to contracting a disease. In the present research, the perceived susceptibility is the extent that frontline health workers would believe themselves at high risk of being infected with COVID-19 if they are not immunized against the disease.

Aims and Hypothesis

Subsequent to the TPB, the first aim of the current study is to explain the vaccination behavior of the FHWs in Pakistan to vaccinate against the new coronavirus SARS-CoV-2. A second aim is to investigate how anticipated regret plays its role in the current decision of FHWs to uptake COVID-19 vaccines. Based on the prime reason of being more vulnerable to SARS-CoV-2 and thus avoiding possible future infections, the third aim of the study is to investigate the role of perceived susceptibility as a background variable shaping the COVID-19 vaccination behavior among FHWs in Pakistan.

Attitude is the psychological propensity that describes how an individual evaluates self-performance (favorable or unfavorable), which predicts the intention, and consequently the actual behavior (Khayyam et al., 2021). Consequent to the TPB, when an individual holds positive attitudes toward a certain behavior, their willingness to engage in that behavior is relatively high (Yzer, 2017). Similarly, the positive associations between attitude and intentions to vaccinate against a specific disease have been highlighted by several studies. For instance, Li and Li (2020) argued that young Chinese women who have a positive attitude toward HPV vaccination would be more willing to uptake the HPV vaccine than those who hold negative attitudes. Similarly, positive associations between attitude and intentions to uptake the COVID-19 vaccination have been reported in several studies (e.g., Cai et al., 2021; Fakonti et al., 2021; Wolff, 2021). Therefore, in our study, we aimed that the healthcare workers in Pakistan that are fighting at the frontline to combat the spread of the virus, while treating the infected individuals would be more willing to immunize against the SARS-CoV-2.

Subjective norm, the second most pertinent determinant of intention also plays an important role to perform the behavior of interest (Khayyam et al., 2021). It refers to the perceived external pressure from important others to perform or not to perform a specific behavior (Yzer, 2017). Based on TPB, individuals who consider the certain behaviors of their important referent (such as family and friends) as important and imperative, are more inclined to perform that behavior (Park, 2000). Kok et al. (2011) explored that the healthcare workers in Netherland feel supported by their peers and department heads when planning to decide about the influenza vaccination. Pakistani society is formed by collectivistic cultural, social, and religious identity where group affiliation is considered important, therefore, the subjective norm to play a vigorous role in influencing the behavioral intentions to uptake COVID-19 vaccines is quite reasonable.

Following the TPB, PBC is the perceived easiness or ability to execute the behavior of interest (Yzer, 2017). The PBC predicts both intentions and actual behavior (Conner and Armitage, 1998); however, the strength of the relationship concerning the intentions and actual belief varies across studies. Ajzen (2002) argued that the individuals who feel confident of being able to execute the behavior are more likely to accomplish it. In the current study, those frontline health workers who perceive themselves as being able to uptake COVID-19 vaccination are more likely to get vaccinated against SARS-CoV-2. Thus, we hypothesize as follows:

H1: Attitudes predict the COVID-19 vaccination behavior of FHWs to vaccinate against SARS-CoV-2.
H2: Subjective norms predict the COVID-19 vaccination behavior of FHWs to vaccinate against SARS-CoV-2.
H3: Perceived behavioral control predicts the COVID-19 vaccination behavior of FHWs to vaccinate against SARS-CoV-2.

The TPB, as suggested by academic literature, allows several background variables (perceived severity, risk perception, optimistic bias, and interpersonal discussion). These variables can serve as important factors to affect an individual's belief regarding health issues. The integrated TPB framework developed for this study (**Figure 1**) contemplated anticipated regret as an additional component of TPB and perceived susceptibility as a background variable to better predict the COVID-19 vaccination behavior of FHWs. In fact, anticipated regret and perceived susceptibility are the components whose nature and importance in health-related issues are more relevant to the TPB constructs (Christy et al., 2016; Penţa et al., 2020; Wong et al., 2020; Wolff, 2021).

Brewer et al. (2016) defined regret as, "an aversive cognitive emotion that we experience when realizing or imagining that our current situation would have been better, if only we had decided differently," whereas, anticipated regret is the feelings of regret in a current situation that we think we might feel in the future (Penţa et al., 2020). According to regret theory, individuals assume the feelings they might experience in the future regarding current decisions (Wolff, 2021). Brewer et al. (2016) conducted a meta-analysis to see if anticipated regret influences a variety of health-related decisions, including vaccination. Furthermore, their analysis showed a lower rating of anticipated regret for vaccination than anticipated regret for refusing vaccination. This could be attributed to the reason that individuals anticipate less regret for easily admissible decisions than for less admissible ones. In contrast, the recent studies of Caso et al. (2021) and Galanis et al. (2021) reported a higher level of anticipated regret for vaccination among a specific groups who abide to the so-called "no-vax" groups. Several studies (e.g., Christy et al., 2016; Ng et al., 2020; Penţa et al., 2020) investigated the potential role of anticipated regret to uptake the HPV and influenza vaccinations respectively. In this research, we anticipate that the FHWs in Pakistan have less regret and self-blame to uptake COVID-19 vaccination. Therefore, we hypothesize as follows:

H4: Anticipated regret predicts the COVID-19 vaccination behavior of FHWs to vaccinate against SARS-CoV-2.

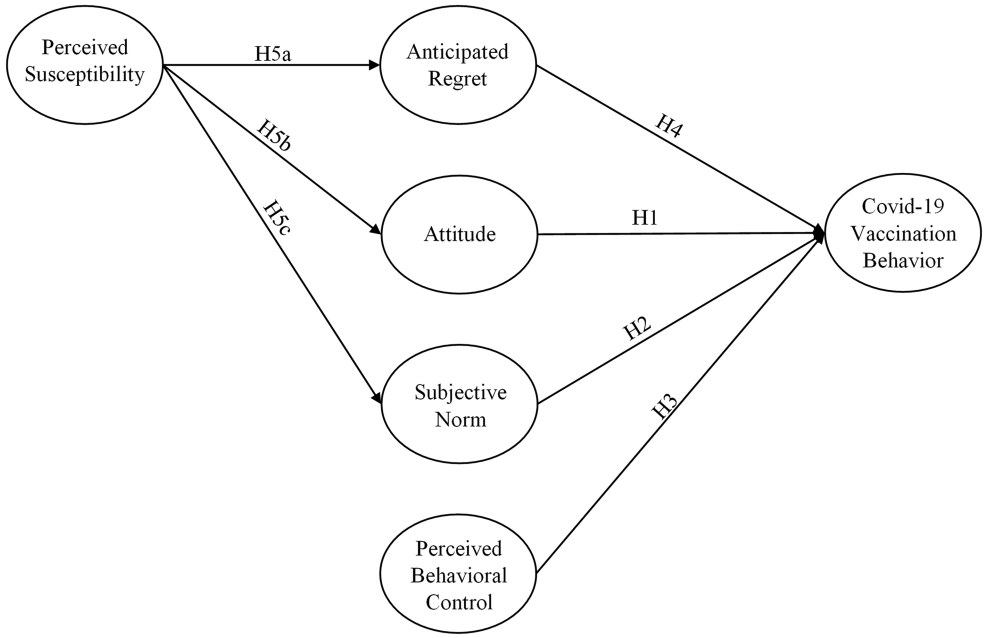

FIGURE 1 | Hypothesized COVID-19 vaccination model.

Perceived susceptibility, refers to the belief that there is an absolute risk of being infected with a disease (Zampetakis and Melas, 2021). The perceived risk to vaccine-preventable disease may also influence the gain-vs.-loss decisions. For instance, Li and Li (2020) identified perceived susceptibility as one of the important factors affecting the behavioral intentions of young Chinese women to uptake HPV vaccination. Similarly, Alhalaseh et al. (2020), Ng et al. (2020), and Tao et al. (2021) also explored that perceived susceptibility plays a vital role to shape individuals' intentions to uptake influenza vaccine in Jordan, China, and Hong Kong, respectively. Moreover, considering the seriousness of SARS-CoV-2, several recent research studies (e.g., Wong et al., 2020; Huynh et al., 2021; Iacob et al., 2021; Tao et al., 2021) also explored that the perceived susceptibility associated with SARS-CoV-2 (i.e., high infectivity ratio) contributes to higher intentions of COVID-19 vaccination among health workers and the general population as well.

Perceived susceptibility in the current research is the extent that FHWs in Pakistan believe themselves at a higher risk to contract the deadly virus if they would not uptake the COVID-19 vaccines. Furthermore, according to HBM, perceived susceptibility is an important factor to predict human behavior (Wong et al., 2020). However, based on the extensive literature review, very scant researches have examined the associations between perceived susceptibility, attitude, and subjective norms. More precisely, in the context of the current research, none of the studies have investigated the extent to which the relationship between perceived susceptibility and COVID-19 vaccination behavior is mediated by anticipated regret, attitude, and subjective norm. **Figure 1** summarizes the proposed mediated relationships among the variables.

Researchers including Yang (2015) and Shmueli (2021) argued that attitudes and subjective norms might influence the health behavioral change with the existence of some cues to action. In particular, when an external stimuli exists in the social/external environment that cue to take the recommended actions will more likely effect the attitudes and motivation to comply with important referents. The present study firstly assumed perceived susceptibility as the external stimuli that influences the FHWs attitudes and motivations to comply with important referents to vaccinate against SARS-CoV-2. Secondly, the study also assumed that the considered external stimuli influences the anticipated regret of FHWs.

Considering the severity of SARS-CoV-2, we believe that the healthcare workers in Pakistan who are fighting at the frontline to combat the virus with 40% of workers already been infected will have a lower anticipated regret to vaccinate against the disease than those who are not vaccinating. In addition, we assume that the more FHWs in Pakistan believed themselves of being vulnerable to SARS-CoV-2, the more they will be holding a positive attitude to uptake COVID-19 vaccination. Similarly, we contend that the positive relationship between perceived susceptibility and subjective norm means FHWs will comply with the guidelines and protocol provided by NCOC. Thus, we hypothesize the following hypothesis:

> *H5a:* Perceived susceptibility has a negative effect on the anticipated regret of FHWs to vaccinate against SARS-CoV-2.

H5b: Perceived susceptibility has a substantial positive effect on the attitude of FHWs to vaccinate against SARS-CoV-2.
H5c: Perceived susceptibility has a substantial positive effect on the subjective norm of FHWs to vaccinate against SARS-CoV-2.

Finally, following the conceptual formwork developed by Yang and other it is also proposed in the current research model, that the anticipated regret, attitude, and subjective norm will mediate the relationships between perceived susceptibility (as an external stimuli) and the COVID-19 vaccination behavior (health behavioral change) of FHWs in Pakistan. Based on the extensive review of available literature in the subject matter, very scant researchers have analyzed that the relationship between perceived susceptibility and COVID-19 vaccination behavior is mediated by the mentioned variables (anticipated regret, attitude, and subjective norm). Thus, the following hypotheses were posed:

H6a: Perceived susceptibility has a potential positive and indirect association with COVID-19 vaccination behavior of FHWs, through anticipated regret.
H6b: Perceived susceptibility has a potential positive and indirect association with COVID-19 vaccination behavior of FHWs, through attitude.
H6c: Perceived susceptibility has a potential positive and indirect association with COVID-19 vaccination behavior of FHWs, through the subjective norm.

MATERIALS AND METHODS

Procedures and Participants

The proposed model was examined using a quantitative technique in the current study. The information was gathered using well-organized self-administered questionnaires that were physically distributed among Pakistani FHWs in the month of July and August 2021. The targeted population in the current research were those including doctors, health technicians, nurses, midwives, and community health workers in two cities (Peshawar and Mardan) of Khyber Pakhtunkhwa (KP) province, Pakistan. All of the responders were frontline workers who were at a greater risk of catching the new coronavirus SARS-CoV-2. Before participating in the study, written consent was signed by all the respondents. A brief instruction letter was provided to the healthcare workers to inform them about the purpose of the research. Due to the seriousness of the pandemic situation and an emergency health response system, a random sample procedure was used to directly reach the healthcare personnel.

A total of 680 FHWs working in 38 hospitals participated in the study. **Table 1** shows the demographic characteristics of the sample studied in the current study. The vast majority of the healthcare workers were those who have already been inoculated or had received at least one dose of COVID-19 vaccines. Out of the total participants, 607 (89.26%) were fully vaccinated, whereas, 73 (10.74%) were partially vaccinated. The healthcare workers from both government and private sectors were considered as the target population. As to gender distribution of the collected survey data, 412 (60.58%) were male, whereas, 268 (39.42%) were female healthcare workers. With regards to the age distribution of healthcare workers, 118 (17.35%) were under the age of 25, while 243 (35.73%) aged between 25 and 35 years, whereas, 206 (30.29%), and 113 (16.63%) were between the age of 36–45, and 46–55 years, respectively. Among the total number of healthcare workers, 231 (33.97%) were those who have been infected by SARS-CoV-2 before taking any type of COVID-19 vaccination.

Measures

The questionnaire presented measures of all the constructs used in current research including the TPB were those adopted by previous researches in the context of vaccine acceptance including influenza and HPV vaccination (e.g., Kok et al., 2011; Corace et al., 2016; Gallone et al., 2017; Squeri et al., 2017; Alhalaseh et al., 2020). All the constructs of the study presented in **Figure 1** were considered latent variables. There are two components to the questionnaire. The first part of the questionnaire includes the demographic information of the healthcare workers, the second part measures the actual behavior of FHWs to uptake COVID-19 vaccines available in the country. The four items taken from the studies of Kok et al. (2011) and Ng et al. (2020) measured the attitude of healthcare workers, whereas, SN was measured through five items adopted from Tickner et al. (2010) and Shmueli (2021). The PBC was measured using three items derived from Li and Li (2020) and Shmueli (2021). To measure the anticipated regret, four items were adopted from the studies conducted by Penţa et al. (2020) and Wolff (2021). Similarly, six items derived from the seminal work of Alhalaseh et al. (2020), Iacob et al. (2021), and Wijayanti et al. (2021) measured the COVID-19 vaccination behavior of healthcare workers. Finally, perceived susceptibility was also

TABLE 1 | Characteristics of participants ($n = 680$).

Demographics	Statistics		
	Specifications	Number	%
Gender	Male	412	60.58
	Female	268	39.42
Age	Under-25	118	17.35
	25–35	243	35.73
	36–45	206	30.29
	45–55	113	16.63
Infected with COVID-19	Yes	231	33.97
	No	449	66.02
Family infected with COVID-19	Yes	148	21.76
	No	532	78.23
Number of vaccinated FHWs	Fully	607	89.26
	Partially	73	10.74
Proportion of FHWs	Doctors	231	33.97
	Health technicians	201	29.55
	Nurses	127	18.58
	Midwives	63	9.37
	Community health workers	58	8.53

measured with four items adopted from the studies of Shmueli (2021) and Zampetakis and Melas (2021). All of the items in this study were assessed using a seven-point Likert Scale from 1 to 7, ranging from strongly disagree to strongly agree, respectively.

Common Method Bias

Because all of the data for both the dependent and independent variables (IV) were obtained from the same respondents to contribute to the current study, there is a risk of method bias. To limit the possibility of method bias, we ensure that all of the healthcare workers who took part in the study were appropriately briefed about the aim of the study, allowing them to truly understand the questionnaire (including the technical terminologies). The variance inflation factor (VIF) and tolerance (TOL) tests are two more common procedures used for this purpose. The final findings in **Table 2** show that the TOL values are greater than 0.1, whereas the observed VIF values are less than 10, indicating that the data is free of collinearity.

Data Analysis

The hypothesized link among the variables was turned into structural equation modeling (SEM), which consists of an outer and an inner model, for further evaluation of the current study model. Smart-PLS 3.3 was used to apply the partial least square structural equation modeling (PLS-SEM) approach. The current research opted for PLS-SEM, a wide range multivariate technique used to statistically examine the relatively complex models and the multivariate relationships among them. It can analyze complex models with a large number of latent variables even with a single item (Shmueli et al., 2019). In the fields of economics and management, the PLS-SEM has shown to be a helpful multivariate analytical approach. Many strategic management experts have acknowledged its flexibility and appropriateness in analyzing numerous interactions among variables (Shmueli et al., 2019).

RESULTS

This study took a two-step strategy evaluating the suggested research paradigm. The validity and reliability of the scale employed in the study were first verified by assessing the outer mode (measurement model). The inner model (structural model) evaluation was carried out next to test the model fitness as well as recommended relationships between variables. For the overall model evaluation, PLS-SEM version 3.3 was employed.

TABLE 2 | Collinearity assessment.

IV's	Tolerance	VIF
AR	0.517	1.916
ATT	0.418	3.486
PBC	0.521	2.459
PS	0.429	2.29
SN	0.498	2.096

IV's, independent variables; ATT, attitude; SN, subjective norm; PBC, perceived behavioral control; AR, anticipated regret; CVB, COVID-19 vaccination behavior; PS, perceived susceptibility; and VIF, variance inflation factor. Source: Estimated results based on the Collinearity assessment by Latan and Noonan (2017).

Assessment of Measurement Model

Initially, for assessment of the measurement model, this research considered the evaluation of convergent validity and discriminant validity. The specific results of the inner model assessment are depicted in **Tables 3**, **4**. According to Hair et al. (2013), convergent validity refers to how closely the items which measure the same constructs are related to each other. The convergent validity was evaluated *via* factor loadings, composite reliability (CR), and average variance extracted (AVE). Each item's factor loading ranged from 0.613 to 0.881, above the 0.7 cutoff value. The CR scores ranged from 0.814 to 0.932, indicating a high level of internal consistency (greater than 0.7). Finally, the item loading's AVE was investigated. The AVE values were between 0.562 and 0.693, over the threshold value of 0.5, indicating that the items explain a significant amount of variation (greater than 50%) in the constructs.

The Henseler heterotrait–monotrait (HTMT) criteria were used to assess discriminant validity. The findings of HTMT are shown in **Table 4**. The acquired values of HTMT ratios were lower than 0.85, which demonstrates good results for each of the constructs used in the proposed model, according to Henseler et al. (2015) criteria for discriminant validity testing.

Assessment of Structural Model

The values and dimensions of standardized path coefficients, as well as essential *t*-statistics, including the measurement of R^2 (coefficient of determination), were taken into account for the structural model assessment presented in this study (**Figure 2**). To measure path coefficients and their relative importance, the researchers used the bootstrapping approach (a resampling technique) to create 5,000 resamples. In addition, the assessment of effect sizes (f^2) for each structural route was evaluated, as proposed by Hair et al. (2017). The research also took Stone-Geisser's Q^2 into account while assessing the model's predictive performance.

Table 5 illustrates the results of β-coefficients, significance values, and effect sizes f^2 for each structural path obtained from the bootstrapping procedure. All of the hypothesized relationships were discovered to be significant. The effect of attitude (ATT→CVB, $\beta = 0.258$, $t = 6.512$, and $p \leq 0.01$) on FHWs' vaccination behavior against SARS-CoV-2 was found to be significant. Subjective norm (SN→CVB, $\beta = 0.129$, $t = 3.741$, and $p \leq 0.01$), as well as PBC (PBC→CVB, $\beta = 0.231$, $t = 3.230$, and $p \leq 0.01$), were both positively associated with FHWs' COVID-19 vaccination behavior. As a consequence, the given data supported H1, H2, and H3. Anticipated regret (AR→CVB, $\beta = 0.469$, $t = 13.310$, and $p \leq 0.01$) had a stronger effect on FHWs' COVID-19 vaccine uptake behavior than the TPB components, which sustained H4. With respect to the background factors, perceived susceptibility had a positive influence on AR (PS→AR, $\beta = 0.597$, $t = 22.546$, and $p \leq 0.01$), ATT (PS→ATT,

TABLE 3 | Assessment of convergent validity ($n = 680$).

Constructs and items	Items	CL	CR	AVE
Attitude				
Taking COVID-19 vaccine is a reasonable action for me.	ATT1	0.83	0.89	0.68
I feel safer after being vaccinated against SARS-CoV-2.	ATT2	0.82		
In my opinion, COVID-19 vaccines are effective.	ATT3	0.86		
I feel vaccines are protecting me from SARS-CoV-2.	ATT4	0.73		
Subjective norm				
My colleagues forced me to take COVID-19 vaccination.	SN1	0.66	0.85	0.56
My colleagues and family also took COVID-19 vaccines.	SN2	0.82		
COVID-19 vaccination allowed me to protect my patients.	SN3	0.82		
The government pressurized me to get vaccination against the SARS-CoV-2.	SN4	0.61		
I am not allowed to treat patients/work without COVID-19 vaccination card.	SN5	0.73		
Perceived behavioral control				
I have enough control to get COVID-19 vaccines.	PBC1	0.79	0.81	0.61
COVID-19 vaccines are easily available for FHCs.	PBC2	0.73		
I can get COVID19 vaccines in every center for vaccination.	PBC3	0.82		
Anticipated regret				
I anticipated regret if I did not get vaccination and later contract the SARS-CoV-2.	AR1	0.85	0.88	0.66
I anticipate worry if my friends/family did not get vaccination and later develop serious illness and hospitalization from virus.	AR2	0.84		
I feel less regret of being vaccinated than not vaccinated against SARS-CoV-2.	AR3	0.79		
After vaccination, I anticipate no worry that I can infect others.	AR4	0.75		
Perceived susceptibility				
Being a FHW, I considered myself at higher risk of getting infected with SARS-CoV-2.	PS1	0.82	0.91	0.63
I perceived myself more susceptible to experience serious illness and hospitalization if I do not get COVID-19 vaccines.	PS2	0.79		
Being a FHW, I feel my friends and family are at higher risk of getting infected.	PS3	0.81		
Being a FHW, I perceive myself as a source of infection for my patients, friends, and family.	PS4	0.75		
COVID-19 vaccination behavior				
I preferred to vaccinate against SARS-CoV-2.	CVB1	0.84	0.93	0.69
I was the earliest beneficiary of COVID-19 vaccine.	CVB2	0.88		
I am ready to take booster shots as well.	CVB3	0.80		

(Continued)

TABLE 3 | Continued

Constructs and items	Items	CL	CR	AVE
I am ready to take COVID-19 vaccines even if I have to pay for it.	CVB4	0.79		
I recommend COVID-19 vaccines to those who seek my advice.	CVB5	0.81		

CL, cross loadings; CR, composite reliability; and AVE, average variance extracted. ATT, attitude; SN, subjective norm; PBC, perceived behavioral control; AR, anticipated regret; CVB, COVID-19 vaccination behavior; and PS, perceived susceptibility.

$\beta = 0.605$, $t = 24.301$, and $p \leq 0.01$), and perceive pressure (PS→SN, $\beta = 0.559$, $t = 20.924$, and $p \leq 0.01$), which sustained H5a, H5b, and H5c.

To evaluate the measurement of effect sizes (f^2), the Cohen criteria of small, medium, and large size effects, that is, 0.02, 0.15, and 0.35, were utilized (Cohen, 1970). The effect sizes (small-to-large) of all the factors surpassed the minimal threshold criteria of 0.02, indicating that they had a significant impact on the dependent variables. The effect of perceived susceptibility on anticipated regret, attitude, and subjective norm to uptake COVID-19 vaccination was quite substantial.

Furthermore, the current research looked at the coefficient of determination (R^2) and predictive relevance (Q^2) of exogenous variables on endogenous variables. The adjusted R^2 value for the endogenous variable (COVID-19 vaccination behavior, CVB) was determined to be 0.635. This means that the exogenous factors in the current study (ATT, AR, SN, and PBC) account for 63.5 percent of the variance in the endogenous variable (CVB). The R^2 values for endogenous variables (AR, ATT, and SN) were determined to be 0.356, 0.366, and 0.312, respectively. Perceived susceptibility explains 35.6, 36.6, and 31.2 percent of differences in expected regret, attitude, and subjective norm, respectively.

We also performed the PLS predict based on the procedures recommended by Shmueli et al. (2019). The cross-validation approach with holdout sampling was used to evaluate the predictive validity of the research model. **Table 6** summarizes the overall findings of the assessment. To begin, the Q^2 values (i.e., the difference between the PLS path model and prediction of the simple mean) were calculated, and the results were 0.186, 0.197, 0.324, 0.122 for AR, ATT, CVB, and SN, respectively. The Q^2 findings indicate that the suggested model has a good predictive performance. Second, the linear regression model (LM) was used to create predictions, as recommended by Shmueli et al. (2019). Finally, the findings of the PLS and LM comparison show that the LM outcomes have smaller prediction errors in both root mean square error (RMSE) and mean absolute error (MAE), indicating that the model has strong predictive capacity.

Mediation Effect

The theoretical model of the current research also proposed the indirect effect of perceived susceptibility on the COVID-19 vaccination uptake behavior through anticipated regret, attitude, and subjective norm (H6a, H6b, and H6c). To assess the mediation impact, the bootstrapping approach was used to create 5,000 resamples, as recommended by Hair et al. (2019). The results obtained from all mediation routes in the proposed model were reported using the Smart-PLS function of specific indirect impact. **Table 7** summarizes the mediation effects of overall findings. The indirect impact of perceived susceptibility on COVID-19 vaccination behavior *via* the mediation of AR (PS→AR→CVB, $\beta = 0.282$, $t = 10.527$, and $p \leq 0.01$) was significant. Similarly, through the mediation of ATT (PS→ATT→CVB, $\beta = 0.156$, $t = 5.952$, and $p \leq 0.01$) and SN (PS→SN→CVB, $\beta = 0.072$, $t = 3.53$, and $p \leq 0.01$), the indirect impact of perceived susceptibility on COVID-19 vaccination behavior was shown to be significant. As a result of the current study's findings, we infer that perceived susceptibility influences COVID-19 vaccination behavior indirectly *via* the mediation of anticipated regret, attitude, and subjective norm.

DISCUSSION AND CONCLUSION

The ongoing pandemic has triggered new healthcare catastrophes since the number of COVID-19 infected patients has dramatically increased worldwide, the SARS-CoV-2 signs and symptoms were examined in combination with the quick development of a vaccine to combat this lethal disease. The WHO has made global efforts to control the transmission of illness and enhance treatment methods to reduce morbidity and mortality. The steps taken to contain the pandemic bought time for the creation of effective and safe COVID-19 vaccinations. Right now, numerous COVID-19 vaccines have been approved by WHO for emergency uses, while more than a hundred vaccines are being tested in various phases of development (GAVI The Vaccine Alliance, 2021). Recently, the COVID-19 vaccines have reached billions of individuals around the world, and the evidence is mounting that no matter which vaccine you decide to take, they still provide life-saving protection against the deadly virus. However, it is not a vaccine that will halt the pandemic, but vaccination. The excessive efforts for COVID-19 vaccines' availability cannot promise the end of the pandemic due to the ongoing vaccine hesitancy and anti-vaccine campaigns worldwide. Given the enormous role of inoculated healthcare workers in shaping the general population's willingness to vaccinate against a disease, the current research thus aims to investigate the actual behavior of FHWs in Pakistan to vaccinate against SARS-CoV-2. To the best of the authors' knowledge, this is the first study in Pakistan to examine theoretical and psychological factors in determining intended behavior using one of the most important socio-psychological frameworks, the TPB, as well as additional factors, such as anticipated regret and perceived susceptibility. The

findings exposed that TPB is a valuable framework for predicting numerous health-related behaviors and has significant explanatory power.

Initially, while investigating the direct relation among classical components of TPB, we found that attitude of FHWs toward COVID-19 vaccination predicts their behavioral intentions, consequently, up taking the vaccines to immunize against COVID-19, supporting H1. The results confirmed that this behavior is strongly supported by a positive attitude toward available vaccines. This result suggests that FHWs have strong beliefs about the perceived benefits and adverse effects of vaccinating and not vaccinating against SARS-CoV-2, respectively.

TABLE 4 | Assessment of discriminant validity ($n = 680$).

	Heterotrait–Monotrait ratio (HTMT)				
Anticipated regret					
Attitude	0.765				
COVID-19 vaccination behavior	0.779	0.837			
Perceived behavioral control	0.710	0.795	0.697		
Perceived susceptibility	0.767	0.740	0.804	0.660	
Subjective norm	0.731	0.812	0.764	0.660	0.735

Source: Estimated results based on Henseler et al. (2015) heterotrait–monotrait (HTMT) criterion.

Our findings are in line with those of Li et al. (2021), Verger et al. (2021), and Wang et al. (2021), who reported a favorable attitude among healthcare professionals to get COVID-19 vaccination in China, France, and Belgium, respectively.

Secondly, the perceived pressure from important others also affects the COVID-19 vaccination behavior of healthcare workers in Pakistan, which supports H2. The positive association between SN and the behavior to get COVID-19 vaccines reflect the discussions of the importance of the vaccines with friends and family, which influence their willingness to immunize against SARS-CoV-2. In addition, the pressure from health authorities and NCOC also affect the willingness of FHWs in Pakistan to take COVID-19 vaccination at priority bases. Our findings are in line with those of Wolff (2021), who discovered subjective norm to be an important predictor of COVID-19 vaccination intentions.

Thirdly, our results also provided support for H3, which suggests that the FHWs in Pakistan have significant behavioral control to get the required doses of COVID-19 vaccines. This suggests that the availability of COVID-19 vaccines is not an obstacle for FHWs in Pakistan. The NCOC of Pakistan has approved several COVID vaccines which have been rolled out in different phases. Considering the seriousness of the pandemic situation in Pakistan and the significant role of healthcare workers in the success of the national immunization program against SARS-CoV-2, the FHWs were scheduled to be the first beneficiaries of the vaccination program. At the moment, COVID-19 vaccines are freely available for all citizens (12 years old and above) of Pakistan at their nearest health facility. Our findings are in confirmatory with the recently published work of Harapan et al. (2020) and Qattan et al. (2021).

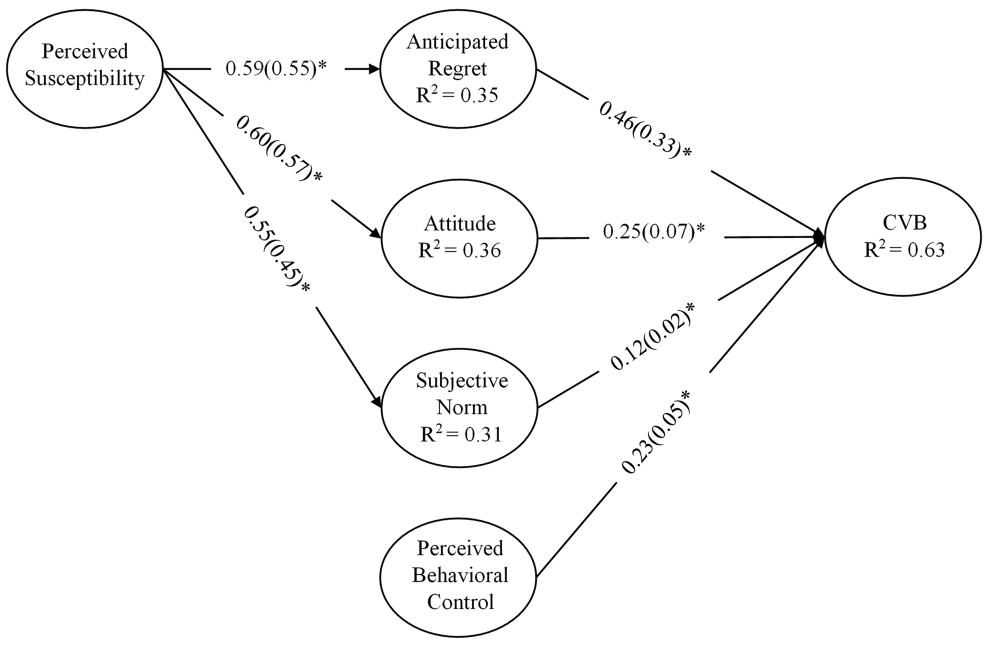

FIGURE 2 | Structural equation modeling (SEM) results of complete data ($n = 680$), CVB: COVID-19 vaccination behavior. The * indicates p-values less than 0.01. The figure presents the effect sizes (f^2) in the parentheses next to each path coefficient (β).

TABLE 5 | Structural paths assessment (Hypothesis testing).

Structural paths	β-value	*t*-value	f^2	LL	UL	Results
ATT → CVB	0.258	6.512	0.075	0.184	0.331	Supporting H1
SN → CVB	0.129	3.741	0.027	0.061	0.197	Supporting H2
PBC → CVB	0.231	3.230	0.057	0.041	0.174	Supporting H3
AR → CVB	0.469	13.310	0.337	0.404	0.537	Supporting H4
PS → AR	0.597	22.546	0.555	0.541	0.644	Supporting H5a
PS → ATT	0.605	24.301	0.579	0.554	0.653	Supporting H5b
PS → SN	0.559	20.924	0.455	0.510	0.614	Supporting H5c

In current study, the vaccination behavior of frontline health workers against Coronavirus disease 2019 pandemic in Pakistan was measured. ATT, attitude; SN, subjective norm; PBC, perceived behavioral control; CVB, COVID-19 vaccination behavior; AR, anticipated regret; and PS, perceived susceptibility. LL, lower limit, UL, upper limit at 99 percent CI.

TABLE 6 | PLS predict assessment.

PLS prediction summary

	Q^2
AR	0.186
ATT	0.197
CVB	0.324
SN	0.122

PLS prediction summary

	PLS			LM			PLS-LM		
	RMSE	MAE	Q^2 predict	RMSE	MAE	Q^2 predict	RMSE	MAE	Q^2 predict
AR3	1.657	1.34	0.159	1.651	1.321	0.166	0.006	0.019	−0.007
AR2	1.654	1.321	0.201	1.658	1.323	0.198	−0.004	−0.002	0.003
AR4	1.614	1.293	0.162	1.562	1.242	0.214	0.052	0.051	−0.052
AR1	1.556	1.238	0.222	1.544	1.205	0.234	0.012	0.033	−0.012
Att1	1.777	1.381	0.167	1.547	1.08	0.367	0.23	0.301	−0.2
Att3	1.656	1.306	0.241	1.599	1.232	0.291	0.057	0.074	−0.05
Att4	1.761	1.448	0.194	1.726	1.394	0.225	0.035	0.054	−0.031
Att2	1.698	1.336	0.188	1.591	1.181	0.287	0.107	0.155	−0.099
CVB1	1.605	1.286	0.235	1.587	1.221	0.251	0.018	0.065	−0.016
CVB6	1.579	1.239	0.216	1.564	1.206	0.23	0.015	0.033	−0.014
CVB5	1.616	1.325	0.225	1.604	1.273	0.236	0.012	0.052	−0.011
CVB3	1.587	1.266	0.262	1.555	1.178	0.291	0.032	0.088	−0.029
CVB4	1.569	1.263	0.258	1.553	1.195	0.273	0.016	0.068	−0.015
CVB2	1.651	1.326	0.225	1.648	1.284	0.228	0.003	0.042	−0.003
SN2	1.784	1.488	0.152	1.791	1.485	0.146	−0.007	0.003	0.006
SN5	1.803	1.493	0.09	1.795	1.483	0.099	0.008	0.01	−0.009
SN4	1.907	1.597	0.015	1.882	1.567	0.041	0.025	0.03	−0.026
SN1	1.667	1.313	0.171	1.59	1.214	0.246	0.077	0.099	−0.075
SN3	1.721	1.409	0.176	1.724	1.399	0.173	−0.003	0.01	0.003

ATT, attitude; SN, subjective norm; PBC, perceived behavioral control; AR, anticipated regret; CVB, COVID-19 vaccination behavior; PS, perceived susceptibility; LM, linear regression model; RMSE, root mean square error; and MAE, mean absolute error.

Finally, H4 received strong support which suggests that the FHWs in Pakistan have less anticipated regret to vaccinate against SARS-CoV-2 than the anticipated regret from not vaccinating. Our results further suggest that anticipated regret is the most prominent predictor of healthcare workers getting COVID-19 vaccines. The results of the present study are consistent with previous research conducted by Brewer et al. (2016), Iacob et al. (2021), and Wolff (2021) about the anticipated regret and administering vaccines. As discussed earlier, this could be attributed to the fact that individuals anticipate less regret for easily admissible decisions than for less admissible ones. Based on the constant exposure to the infected COVID-19 patients, the FHWs in the country are well aware that the disadvantages of not vaccinating themselves are greater than vaccinating.

With regards to the background variable, H5a received support suggesting that the healthcare workers are perceived as being at higher risk to get infected by SARS-CoV-2, affecting their anticipated regret, which further reflects higher rates of COVID-19 vaccination. Brewer et al. (2016) and Penţa et al. (2020) discovered similar considerations in the context of HPV vaccinations. Furthermore, H5b got widespread support since perceived susceptibility was found to be associated with attitude, confirming previous research (Gallone et al., 2017; Squeri et al., 2017; Taebi et al., 2019). For instance, only those medical students in Italy who perceive themselves at higher risk to catch flu have positive attitudes to get influenza vaccines (Gallone et al., 2017). Similarly, the Iranian population who perceive themselves as at higher risk to contract HPV believes that getting HPV

TABLE 7 | Mediation effect.

Structural paths	*β*-value	*t*-value	*p*-values	LL	LL	Status
PS → AR → CVB	0.282	10.527	0.00	0.229	0.333	Supporting H6a
PS → ATT → CVB	0.156	5.952	0.00	0.112	0.208	Supporting H6b
PS → SN → CVB	0.072	3.53	0.00	0.034	0.112	Supporting H6c

Significance at $p \leq 0.01$. ATT, attitude; SN, subjective norm; PBC, perceived behavioral control; CVB, COVID-19 vaccination behavior; AR, anticipated regret; and PS, perceived susceptibility. LL, lower limit, UL, upper limit at 99% CI.

vaccination is important for them (Taebi et al., 2019). In addition, Squeri et al. (2017) explored the healthcare workers with a higher perceived susceptibility to getting infected with a specific disease have positive evaluation toward vaccination. Moreover, our results highlighted that perceived susceptibility has an association with SN to uptake COVID-19 vaccines, resultantly supporting H5c. The positive effect of perceived susceptibility on SN articulates higher concerns regarding COVID-19 vaccination. Considering the seriousness of the ongoing pandemic, the Pakistani FHWs believe themselves at higher risk of contracting the virus, therefore they are more inclined to follow the opinions of important referents and instructions from health authorities. Our findings support findings of Li and Li (2020) that interpersonal interaction with key others about the danger connected with HPV vaccination positively improves the SN's willingness to adopt the HPV vaccine.

Finally, we checked whether anticipated regret, attitude, and subjective norm lead to the mediation between perceived susceptibility and COVID-19 vaccination behavior of FHWs in Pakistan. The results revealed that perceived susceptibility is associated with the COVID-19 vaccination behavior of Pakistani FHWs through its substantial effect on anticipated regret (H6a), attitude (H6b), and subjective norm (H6c), which accepted the overall mediation hypothesis. The results further suggest that the FHWs as being more susceptible to SARS-CoV-2 are taking COVID-19 vaccination because they have lower anticipated regret, having favorable evaluation of vaccines, and thus listing to the suggestions from their important referents.

The proposed vaccination model, which used the standard TPB framework to incorporate anticipated regret and perceived susceptibility, produced reliable findings in explaining the COVID-19 vaccination behavior of FHWs in Pakistan. However, the additional variables were added to the classical TPB model to assess their role in shaping the behavior of FHWs to uptake COVDI-19 vaccination, which can be considered as an operationalization within the original framework, and has never been applied nor validated by previous researches. We believe that our study is novel in comparison to the existing COVID-19 vaccines' literature for three reasons. Firstly, in our study, a self-reported actual vaccination behavior is assessed, while the existing research on COVID-19 vaccination is limited to the intention phase only. Secondly, the data was collected through well-organized self-administered questionnaires with a brief instructions letter physically distributed among FHWs which increased the predictive power of the hypothesized model. Thirdly, in the case of COVID-19 vaccination, the role of anticipated regret and perceived susceptibility was questioned, given its heuristic role within the cognitive process existing behind behavioral execution.

Regardless of its strength, the current research also has a few caveats. Firstly, due to Pakistan's epidemic control policies, lockdowns, and restrictions on interprovincial movement, in particular, the data was collected in one province, thus the generalizability of the results to entire healthcare workers in the country is questionable. Secondly, the data was collected from only those healthcare workers who have been fully vaccinated or have received at least one shot of the vaccine having a vaccination certificate from the national database and registration authority (NADRA) Pakistan. Thus, the generalization of willingness to uptake COVID vaccines among entire healthcare workers in Pakistan is also questionable. Thirdly, some additional factors like perceived severity, cost of vaccination, and perceived threat can also be considered to accompany the proposed relationships in current research. Lastly, the current research investigated the vaccination behavior of healthcare workers regardless of the type, safety, and efficacy of the vaccine they have inoculated, which can be investigated by future research.

IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS

The current study's findings contribute to the limited literature on COVID-19 vaccination behavior in a variety of ways. To begin with, it has added to the little study on vaccination behavior among Pakistan's frontline HCWs in terms of expected regret and perceived susceptibility during the pandemic. Second, the TPB was used to explore the antecedents of FHWs choice to uptake COVID-19 immunization in order to combat the virus' spread and prevent Pakistan's healthcare system from collapsing. Third, the association between perceived susceptibility and COVID-19 vaccination behavior was presented through the mediation of anticipated regret, attitude, and subjective norm, which has never been tested nor applied in previous researches.

The current findings of our research have several implications as well. The results confirmed the importance of perceived risk and anticipated regret in taking COVID-19 vaccination among healthcare workers. The results of current research should be used as a potential source of inspiration to reduce hesitancy and build vaccination confidence among the general population. Based on their own experience, these FHWc should educate their family, friends, patients, as well as the general population regarding the benefits of COVID vaccines and the potential negative health

consequences of illness they can experience. Secondly, the health communication agents including health authorities, social media, and non-profit organizations should endorse/consider these healthcare workers as ambassadors to communicate the vaccination benefits, apply more positive social norms, and build confidence among the general population in taking COVID-19 vaccination to get herd immunity. The FHWs' recommendations that are widely visible for the general population can effectively promote the COVID-19 vaccination process.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the ethics committee at China University of Geosciences, Wuhan, China. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MK and SC conceived and designed the study. MK, RA, and HA collected the data. MK and SC developed the theoretical framework. MK and NK performed the data analysis. SC, AN, and JA verified the analytical methods. MK wrote the first draft. SC, MI, and MAS substantially revised the manuscript. All authors discussed the results and contributed to the final manuscript.

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A Study on the Effectiveness of Rumor Control *via* Social Media Networks to Alleviate Public Panic About COVID-19

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The COVID-19 outbreak triggered a massive spread of unverified news on social media and has become a source of rumors. This paper studies the impact of a virtual rumor control center (RCC) on Weibo user behavior. The collected COVID-19 breaking news stories were divided into positive, negative, and neutral categories, while the moderating effect model was used to analyze the influence of anti-rumor on user behavior (forwarding, liking, and commenting). Our research found that rumor refuting does not directly affect user behavior but does have an indirect moderating effect. Rumor refuting has a profound impact on user forwarding behavior in cases of positive and negative news. Specifically, when the epidemic becomes more serious, the role of rumor refuting becomes critical, and vice versa. Refuting rumors reduces user willingness to forward positive or negative news, with more impact on negative news. Time lag analysis shows a significant moderation of unverified news within 72 h of refuting rumors but indicated an apparent weakening trend over time. Furthermore, we discovered non-linear feature and counter-cyclical phenomena in the moderating effect of rumor refutation.

Keywords: COVID-19, behavior, social network, Weibo, rumor control

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INTRODUCTION

The COVID-19 pandemic has exerted unprecedented and devastating effects on human societies. Unlike previous pandemics such as the H1N1 flu in 1918, COVID-19 is spreading rapidly through an interconnected world. As countries adopt strict physical distancing and other measures to control the virus, people increasingly depend on global digital social media networks such as Facebook, Twitter, and Weibo. These platforms help users sustain contact with others, enhance interpersonal interactions, and share virus-related information. However, these digital social networks also serve to promote a different type of virus, misinformation. The viral dissemination of inaccurate scientific information *via* digital social media may be used as a political weapon to destroy public trust in governments (1, 2). The WHO uses the term "infodemic" for the wide distribution of large amounts of misinformation through social networks (3, 4). Infodemics must be controlled because of the potential harm they inflict on human societies. Some administrations have sought to limit COVID-19-related misinformation dissemination on social media by pressuring corporations such as Facebook, Weibo, and Twitter to take appropriate actions (5). Social media has enormous power to manage rumors and is considered a potential rumor control center (RCC).

COVID-19 has been a continuous hot topic on social networks since early 2020, with massive news generated every moment. An information cascade begins when a user asserts news in a tweet (6). RCC is an authority whose goal is to minimize the spread of fake news by generating a positive cascade (7). However, fake news is not simply false information. It may also be polarized content, satire, misreporting, commentary, persuasive information, and citizen journalism (8). In most instances, the sharer either does not know or does not suspect the news they are sharing is fake. Because sharing fake news may negatively impact relationships, in the presence of RCC, users may be more inclined to share positive information (9). McIntyre and Gibson (10) found that valence plays a significant role in readers' affect, in that positive news makes readers feel good. In theory, positive news has a beneficial effect on restraining the speed of spreading rumors (11), but a lack of empirical analysis exists on the role of RCC in this process. Unlike previous research that focused on true or false news, this study looks at the impact of RCC on social network user behavior from the perspective of positive and negative information to help us understand how RCC works. Classification of news according to positive, negative, and neutral allows us to provide a new path for the design of RCC strategies. Existing research often aims at the short-term impact of a single or separate news cascade. Fortunately, COVID-19, as a continuous event with a series of information cascades, creates a natural experiment for us to study the mid-to-long-term impacts of RCC on user social network behavior. This article examines how RCC changes user behavior from the vantage of positive, negative, and neutral news.

This study first collected breaking news data and rumor-refuting information on social media during the first round of COVID-19 outbreak in China in 2020, then classified them according to the valency of news, and used regression models to analyze the impact of rumor-refuting on user behavior. The marginal contribution of this paper is to analyze the impact of RCC on the spread of rumors in the early stage of COVID-19, which provides valuable insights for improving RCC's strategies in responding to sudden disease disasters. Further, this paper studies a series of epidemic news events, which can reveal the law of RCC's effect on rumors more completely than only focusing on the impact of a single event. The research results explain how RCC changes the news cascade and provides guidance for designing social media anti-rumor strategies. Rumors may be real or fake news, but since this article is based on the RCC perspective, it needs to be clarified that the rumor mentioned in this article refers to fake news.

Hypothesis Development

Online media is the site of information propagation and the persistent discussions surrounding such information. When an individual receives news about COVID-19, for instance a rumor, he may turn to other sources to understand, evaluate, debunk, or verify the information, often depending on their prior beliefs (12). Users will also use RCC as an important source for assessing the credibility of the information. There are currently two ways to control fake news on social networks: one is to tag misinformation so that users can identify suspicious information (13, 14), the way Twitter does; the other is to continuously broadcast rumor-defending information through RCC accounts, such as Weibo. Both approaches have benefits, and glaring limitations. The first approach allows users to see the suspicious information tag, but flaws in the algorithm may miss some potential rumor seeds, such as puns or ironic expressions. The second approach uses an "anti-rumor" process, akin to the way rumors are spread (15, 16), but this process has a lag effect and uncertainty. Existing studies on the effectiveness of rebuttals have reached mixed findings. Some studies showed that rebuttals help reduce belief in rumors (17–19), while other studies revealed opposite results. For instance, there is the "backfire effect" where corrections actually increase the belief in rumors (20). Opposing views on the role of RCC may signify undiscovered mechanisms.

Like Twitter, Weibo is a platform for users to share, distribute, and obtain information based on their associations. Users can receive all information about COVID-19, including official announcements, news, rumors, and anti-rumors. Weibo publishes relevant messages related to COVID-19 in real-time in a prominent location, informing users of details such as the current number of infections and deaths, etc. The platform also established an official rumor-defying account to control the spread of rumors (Weibo RCC). As of 26 July 2020, this account had about 2.33 million registered followers and a total of 9,607 messages.

User behaviors on Weibo include clicking, forwarding, liking, and commenting. Clicking signifies user interest, forwarding represents user action to disseminate information, liking represents positive user attitude, and commenting indicates user interest in public discourse on a topic. Weibo builds a real-time Hot Topic Ranking (HTR) list based on the above data and makes recommendations on the user's homepage. The HTR is a structured news cascade, composed of the 50 most popular news at the time. After clicking on one of the news items, users see a summary and the most popular user comments right below it. Although HTR uses an objective way to describe news, the news itself may be positive, negative, or neural, which is a crucial factor affecting user behavior (9, 11).

The definition of positive and negative news is the basis of this research. Harcup and O'Neill (21) defined good news as "stories with particularly positive overtones such as rescues and cures" and bad news as "stories with particularly negative overtones, such as conflict or tragedy." McIntyre and Gibson (10) defined a positive news as one that focuses on the benefits of an event or issue and a negative news as one that focuses on the harmful outcomes of an event or issue. The definition of positive and negative news in this study is based on the previous research and the characteristics of COVID-19 news. Positive news is good for building public confidence in the fight against the epidemic. These news include posts on medical staff actively treating patients, online charity concerts held by celebrities, public donations of medical supplies, and signs of improvement in the epidemic, such as zero new confirmed cases in a region, reopening of closed roads, or active development of a new vaccine. Negative news, on the other hand, can harm public sentiment. These posts include government announcements of city closures and delays in the opening of schools. News items

that were neither positive nor negative were collectively classified as neutral.

There is a growing body of work suggesting that responses to positive and negative information are asymmetric—that negative information has a much greater impact on individuals' attitudes than does positive information (22). Scholars who focus on information diffusion have suggested that people might be more likely to share positive rather than negative messages in an effort to signal their identity or enhance their self-presentation (23, 24). In contrast to their findings, Hansen et al. (25) found that negative news messages were shared more than positive news messages on Twitter. Soroka and McAdams (26) conducted a psychophysiological experiment showing that negative news elicits stronger and more sustained reactions than does positive news. When the news content is negative, it produces a stronger reaction and/or higher attention, which may be due to the framing effect caused by the mediating role of user emotions (27). Emotion is the regulator of people's social behavior (28), and the content characteristics of social media will be regulated by emotions and affect people's engagement (29), and even trigger aggressive behaviors (30). In the face of disease risk, it has also been proven that emotional variables such as fear and anger can generate positive preventive behaviors through the use of social media (31). In the process of dispelling rumors, users' social media behaviors will probably be affected by the valence of news. In order to quantify this impact, this article uses the frequency of rumor refuting to measure the intensity of rumor refuting, and proposes the following hypotheses:

H1. The intensity of anti-rumor affects users' behaviors with different impacts on positive, negative and neutral news.

H2. The intensity of anti-rumor plays a moderating role between public panic and user behaviors with different impacts on positive, negative and neutral news.

METHODS

Model Setting

A linear regression model was used for empirical analysis, where the dependent variable was the user social behavior on COVID-19 news. The online user behavior regarding COVID-19 information resulted from the combined effects of receiving varied information during the study. Therefore, the data related to user behavior can effectively measure the public response to rumor rebuttals. This study collected public comments on Weibo as the basis of the analysis, but no patient and public participated in the experiment.

The social media panic is closely related to the spread of the pandemic and media reports (32). Therefore, we used the reported incidence of infections to measure public panic. Furthermore, the peak time of the epidemic (5 February 2020) also exerted a powerful impact on public panic; thus, a peak dummy variable was introduced.

To test H1, the main effect model is as follows:

$$behavior_t = \alpha_0 + \alpha_1 \times anti\_rumor_t + \alpha_2 \times panic_t + \alpha_3 \times peak\_dum_t + \varepsilon_t$$

To test H2, the moderating effect model was postulated in the following manner:

$$behavior_{t+T} = \alpha_0 + \alpha_1 \times anti\_rumor_t + \alpha_2 \times panic_t + \alpha_3 \times peak\_dum_t + \alpha_4 \times panic_t \times anti\_rumor_t + \varepsilon_t$$

where $behavior_t$ represents user behavior, $anti\_rumor_t$ and $panic_t$ represents the intensity of rumor rebuttals and the degree of public panic, respectively. The dummy variable $peak\_dum_t$ represents the epidemic peak (before or after the peak). $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$ are coefficients. T reflects lag time and $panic_t \times anti\_rumor_t$ represents the interaction effect.

Data

This study collected epidemic-related data on Weibo, China's largest social networking platform, from 1 January 2020 to 31 March 2020, including 4,004 COVID-19-related news and 1,150 RCC anti-rumor information. The daily number of infections comes from official disclosures. Data collection date is 23 April 2020. COVID-19 news items were filtered and classified manually into three categories according to content attributes: positive, negative, or neutral. Furthermore, since the collected data were cross–sectional, we restructured it by the hour according to the "48-h allocation" method described below. Finally, 1,657 time-series samples were obtained. The calculation method of each variable is outlined below:

$behavior_t$: Around 4,004 news items on COVID-19 were obtained after manual screening, and the number of clicks, forwards, likes, and comments of each post were also collated. The calculation was accomplished by counting the number of clicks, forwards, and comments according to the hour. We subsequently computed the value of forwards/clicks, likes/clicks, comments/clicks for every hour to use as dependent variables. Finally, $behavior_t$ was recalculated according to a "48-h allocation" approach.

$anti\_rumor_t$: The data were extracted from Weibo's RCC and yielded a total of 1,150 records of effective anti-rumors. The rumor refutation was carried out by Weibo RCC at different times every day, and we counted its release frequency every hour. The number of RCC releases per hour was used as an indicator of rumor refutation intensity after being processed through the "48-h allocation."

$panic_t$: China's official daily release of newly confirmed COVID-19 cases (*confirm_add*), fresh suspected infections (*suspect_add*), and current COVID-19 related deaths (*dead_add*) were compiled to measure public panic. Since the number of suspected cases had a great impact on the Chinese public in the early stage of the epidemic, the model used *suspect_add* as the main indicator. For the sake of robustness, we used *confirm_add* and *dead_add* as alternative indicators (see **Supplementary Material**).

$panic\_dummy_t$: Public panic may differ significantly before and after the peak of the pandemic. Therefore, it was recorded as 0 before 5 February 2020, and as 1 after that date.

Forty-eight-hour allocation: The power of information dissemination on social networks shows the characteristics of non-linear decline. According to Kwak et al. (33) on the spread of

TABLE 1 | Variable definitions and statistical description.

Variables	Definition	Indicators	Positive					Neutral					Negative				
			N	Mean	Sd	Min	Max	*N*	Mean	Sd	Min	Max	*N*	Mean	Sd	Min	Max
$behavior_t$	Forwards/hits	Forward_d_clicks	1,657	−5.079	0.773	−9.781	−1.221	1,640	−4.952	0.972	−11.84	−2.249	1,657	−5.381	0.841	−9.216	2.112
	Likes/hits	Like_d_clicks	1,657	−1.384	0.704	−6.072	1.649	1,640	−1.312	0.897	−8.167	2.381	1,657	−1.534	0.663	−6.247	1.39
	Comments/hits	Comment_d_clicks	1,657	−4.811	0.604	−8.833	−1.973	1,640	−4.592	0.815	−12.02	−1.85	1,657	−4.778	0.588	−9.204	−2.344
	New confirmed daily	Confirm_add	1,657	5.655	1.933	2.079	9.626	1,640	5.669	1.935	2.079	9.626	1,657	5.655	1.933	2.079	9.626
$panic_t$	New deaths daily	Dead_add	1,657	3.317	1.198	0	5.537	1,640	3.336	1.182	0	5.537	1,657	3.317	1.198	0	5.537
	New suspected daily	Suspect_add	1,657	5.848	1.988	2.833	8.581	1,640	5.865	1.988	2.833	8.581	1,657	5.848	1.988	2.833	8.581
$anti\_rumor_t$	Number of anti–rumors released by RCC	Anti_rumor	1,657	−1.186	1.495	−4.522	1.738	1,640	−1.175	1.493	−4.522	1.738	1,657	−1.186	1.495	−4.522	1.738
$peak\_dummy_t$	Peak day	Peak_dum	1,657	0.809	0.393	0	1	1,640	0.807	0.395	0	1	1,657	0.809	0.393	0	1

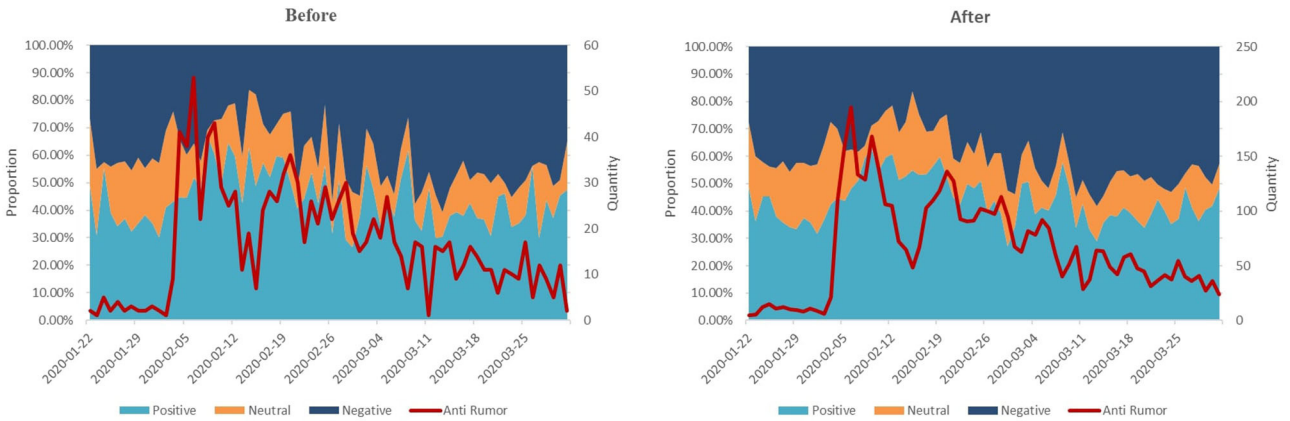

FIGURE 1 | Daily accumulation graph of positive, negative, and neutral news and the number of anti-rumors before (left) and after (right) the "48-h allocation." The primary vertical axis represents the proportion of positive, neutral and negative rumors, while the secondary vertical axis represents the strength of the rumor-refuting information.

Twitter information, more than 50% of the forwarding behavior occurred within 1 h of the posting an item, and more than 75% of the forwarding behavior occurred within 1 day. Based on the above research, we used the weight allocation method to simulate the characteristics of social network information dissemination within 48 h, and its weight will continue to decrease over time, which is the so-called "48-h allocation." Then, $behavior_t$ and $anti_rumor_t$ were processed according to the "48-h allocation." The specific processing method entailed starting from the release time of the entry. 50% weight was allocated for the first hour, 25%/23 for the following 23 h, and 25%/24 for the next 24 h. For example, if an entry was listed at 0:00 on 1 January 2020, it was recorded as 50% × (number of clicks, forwards, comments, likes) from 0:00 to 1:00 on 1 January 2020, as 25%/23 × (number of clicks, forwards, comments, likes) from 1:00 to 23:00, and as 25% /24×(number of clicks, forwards, comments, likes) from 0:00 to 23:00 on 2 January 2020. **Table 1** outlines the variable definitions. The statistical description and correlation coefficient after data processing are exhibited in **Table 1**. **Figure 1** shows the daily accumulation of positive, negative, and neutral news and the number of anti-rumors before (left) and after (right) the "48-h allocation."

RESULTS

Main Effect and Moderating Effect

According to model (1), the main effect regression was performed on positive news, negative news, and neutral news, with

$behavior_t$ as the dependent variable, and $anti\_rumor_t$, $panic_t$, and $panic\_dum_t$ as explanatory variables. Then, according to the model (2), the moderating effect variable $panic_t \times anti\_rumor_t$ was added, and finally, 18 regression models were established. To reduce collinearity, $panic_t$, *and* $anti\_rumor_t$ are mean-centered. The regression results show that rumor refuting has a complex impact on user behavior with different news types (as shown in the **Table 2**).

Positive News

The number of new suspected cases (*suspect_add*) significantly affected user forwarding and commenting behavior *via* moderating effect. Before the moderating effect was added, the intensity of rumor rejection did not affect the spread of positive news, rejecting H1). However, there was an interaction effect between the anti-rumor intensity (*anti_rumor*) and the number of new suspected cases (*suspect_add*) ($\beta = 0.0320$, $p < 0.001$), and H2 cannot be rejected. β is the non–standard coefficient. The simple slope graph shows that with the increase of new suspected cases, refuting rumors stimulated user enthusiasm for forwarding positive news (**Figure 2**). The dummy variable peak epidemic time (*peak_dum*) was negatively significant in all regressions, proving the impact of the epidemic peak time on user behavior. After the peak of the epidemic, there was a decline in reposting, liking, and commenting on positive news.

Negative News

The number of new suspected cases (*suspect_add*) also significantly affected user forwarding and commenting behavior *via* both main and moderating effect. Anti-rumors can significantly inhibit the spread of negative news: the regression coefficients of the variable *anti_rumor* for forwarding (*forward_d_clicks*) and comments (*comment_d_clicks*) were ($\beta = -0.0606$, $p < 0.001$) and ($\beta = -0.0309$, $p < 0.05$), respectively, and H1 cannot be rejected. Furthermore, the model also had a significant moderating effect on forwarding behavior, consistent with the positive news results. However, the dummy variable *peak_dum* was only negatively significant for the forwarding behavior. This shows that, compared to positive and neutral news, users still maintained strong enthusiasm for negative news even after the peak.

Neutral News

The number of new suspected cases (*suspect_add*) will also significantly affect user forwarding and commenting behavior through only moderating effect. Before we added the moderation effect, the intensity of rumor rejection had no significant impact on the forwarding and comments on positive news. Although it was significant for liking ($\beta = 0.0374$, $p < 0.05$), it became insignificant after the moderation effect was added. The moderating effect for commenting is significant ($\beta = -0.0274$, $p < 0.001$).

To further analyze the meaning of the moderating effect, a simple slope test was conducted (34) (see the **Figure 2**). **Figure 2** shows that varying intensities of anti-rumor exercised significant differences in the moderating effect of public behavior (high, median, and low mode represents high, middle and low level,

TABLE 2 | Main effect and moderating effect regressions.

	Positive				Negative				Neutral			
Variables	**Forward_d_clicks**	**Like_d_clicks**	**Comment_d_clicks**		**Forward_d_clicks**	**Like_d_clicks**	**Comment_d_clicks**		**Forward_d_clicks**	**Like_d_clicks**	**Comment_d_clicks**	
Suspect_add	0.0251*	0.0187	0.0268**	0.0286**	0.0600***	0.0273*	0.0161	0.0117	0.0121 (1.23)	0.0551***	0.0551***	0.137***	0.140***	−0.00435	−0.00395	0.0681***	0.0733***
	(2.33)	(1.73)	(2.65)	(2.81)	(6.95)	(2.27)	(1.35)	(1.20)		(6.45)	(6.40)	(10.63)	(10.73)	(−0.35)	(−0.31)	(5.87)	(6.30)
Peak_dum	−0.596***	−0.719***	−0.347***	−0.312***	−0.163**	−0.148*	−0.347***	−0.562***	−0.0992	−0.0908	0.0092	0.00892	−0.636***	−0.590***	−0.820***	−0.812***	−0.371***	−0.269***
	(−8.82)	(−10.01)	(−5.47)	(−4.60)	(−3.02)	(−2.56)	(−4.60)	(−7.08)	(−1.62)	(−1.38)	(0.17)	(0.16)	(−7.82)	(−6.80)	(−10.34)	(−9.59)	(−5.09)	(−3.47)
Anti_rumor	−0.00276	−0.00592	−0.0127	−0.0118	−0.0079	−0.00751	−0.0551**	−0.0606***	−0.0218	−0.0216	−0.0309*	−0.0309*	0.0294	0.0309	0.0372*	0.0374*	0.0137	0.017
	(−0.17)	(−0.37)	(−0.84)	(−0.78)	(−0.62)	(−0.58)	(−3.07)	(−3.43)	(−1.50)	(−1.49)	(−2.43)	(−2.43)	(1.52)	(1.59)	(1.96)	(1.97)	(0.78)	(0.98)
Suspect_add _anti_rumor		0.0320***		−0.00903		−0.00398		0.0559***		−0.00218		0.0000718		−0.0122		−0.00211		−0.0274***
		(4.80)		(−1.43)		(−0.74)		(7.57)		(−0.36)		(0.01)		(−1.50)		(−0.27)		(−3.78)
_cons	−4.747***	−4.499***	−1.275***	−1.131***	−5.039***	−4.691***	−5.326***	−4.930***	−1.548***	−1.460***	−5.145***	−4.786***	−5.210***	−4.475***	−0.581***	−0.657***	−4.676***	−4.374***
	(−40.49)	(−74.16)	(−11.61)	(−19.77)	(−53.68)	(−95.92)	(−40.66)	(−73.49)	(−14.57)	(−26.38)	(−55.39)	(−98.88)	(−37.03)	(−61.17)	(−4.24)	(−9.20)	(−37.06)	(−66.91)
N	1,657	1,657	1,657	1,657	1,657	1,657	1,657	1,657	1,657	1,657	1,657	1,657	1,640	1,640	1,640	1,640	1,640	1,640
R^2	0.115	0.127	0.063	0.064	0.071	0.071	0.067	0.099	0.012	0.012	0.039	0.039	0.196	0.197	0.104	0.104	0.081	0.089
adj. R^2	0.113	0.125	0.061	0.061	0.069	0.069	0.066	0.096	0.01	0.01	0.037	0.036	0.195	0.196	0.103	0.102	0.079	0.087
F	71.38	60	36.75	28.09	42.1	31.7	39.84	45.2	6.809	5.136	22.18	16.63	133.3	100.6	63.42	47.56	48.03	39.88
df_m	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4	3	4
df_r	1,653	1,652	1,653	1,652	1,653	1,652	1,653	1,652	1,653	1,652	1,653	1,652	1,636	1,635	1,636	1,635	1,636	1,635

t statistics in parentheses.
$^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

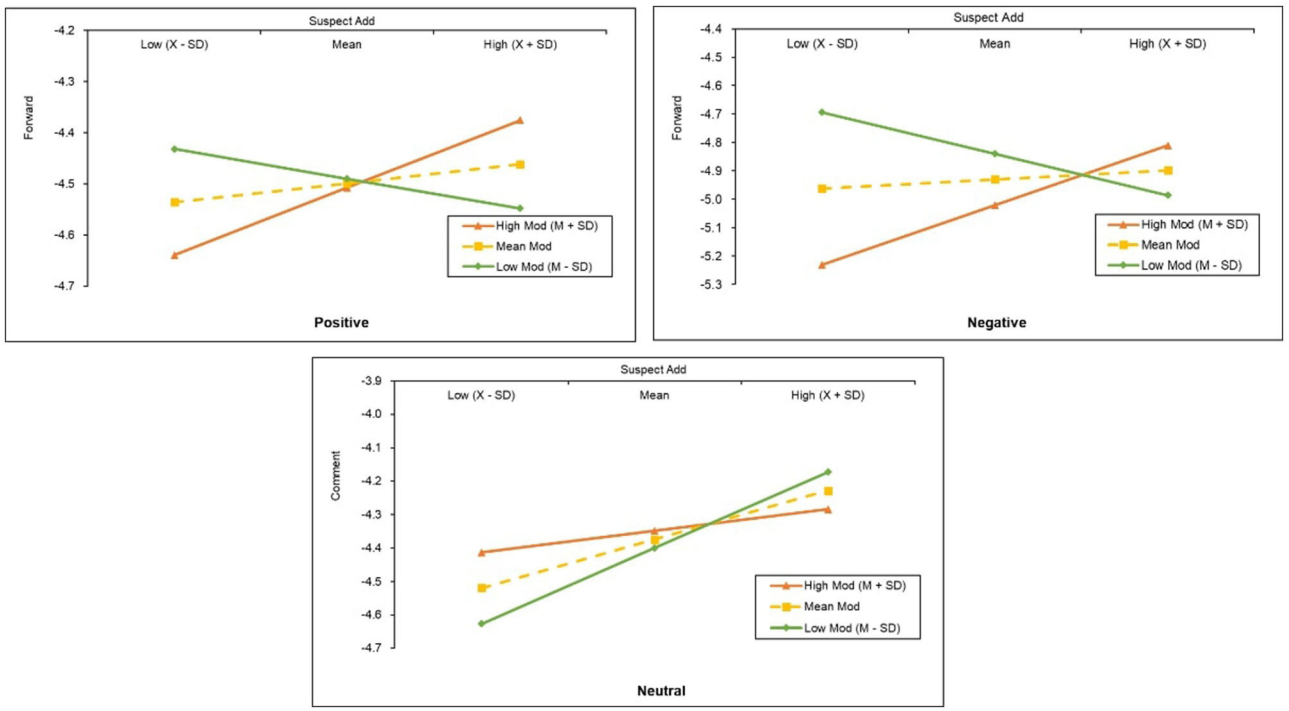

FIGURE 2 | Simple slope test graphs. A simple slope plot represents the direction and strength of the moderating effect.

respectively). For positive and negative news, the moderating effect had a non–linear feature. When the intensity of anti-rumor was higher than a certain critical value, the greater the intensity, the stronger the influence on user behavior, and vice versa. There was no similar rule for neutral news, but as the intensity of rumor refuting increased, user enthusiasm for neutral news declined precipitously.

Hysteresis Analysis

The dissemination of rumor refutation information takes a certain amount of time; thus, a lag effect may exist. Therefore, the explanatory variable $behavior_{t+T}$ was used as a lag item to test the moderating effects of anti- rumor messages released within 72 h. The results evinced the significant moderating effect of rumor refutation within 72 h but indicated an apparent weakening trend over time (see the **Figure 3A**). Specifically, the impact of rumor rebuttal on negative news peaked within 12 h and then continued to decline until reduced to half after 32 h. The moderating effect of positive news remained consistent within a relatively stable range and fluctuated. For neutral news, the mediating effect was no longer significant after 36 h.

After further analyzing the change trend of the coefficients of anti-rumor and moderating effect, the results revealed a clear counter-cyclical relationship between them, which was especially obvious for positive news (see the **Figures 3B–D**). When the anti-rumor effect decreased, the moderating effect began to rise. A reasonable explanation for this phenomenon is that the role of anti-rumor has a certain lead time. After it reaches a peak, the moderating effect starts to work, and the lead time is estimated at 16–20 h.

DISCUSSION

This study reveals the complicated mechanism of rumor refuting on user behavior using RCC broadcast methods. Refuting rumors does not directly affect user behavior, but indirectly changes it through a moderating effect. For both positive and negative news, rumor refuting has a positive impact on user forwarding behavior through interactive effects. When the epidemic becomes more serious, the role of rumor refuting intensifies, and vice versa. Further, there is a counter-cyclical phenomenon between the main effect of refuting rumors and the moderating effect. When the main effect begins to weaken, the moderating effect increases instead. This shows that RCC directly affects the spread of rumors first, and then further affects the wider social behavior of users. This shows that refuting rumors can not only reduce the spread of rumors, but also affect users' reactions to negative news more widely, which further reduces the environment for the spread of rumors. This finding has not received sufficient attention in past research. As far as neutral information is concerned, a fascinating discovery has emerged from our data. We found that dispelling rumors stimulates users to be more expressive and opinionated as the epidemic worsened. This finding indicates that neutral news is more likely to originate rumors, because users interpret uncertainty in a variety of ways, often promoting the appearance of hearsay.

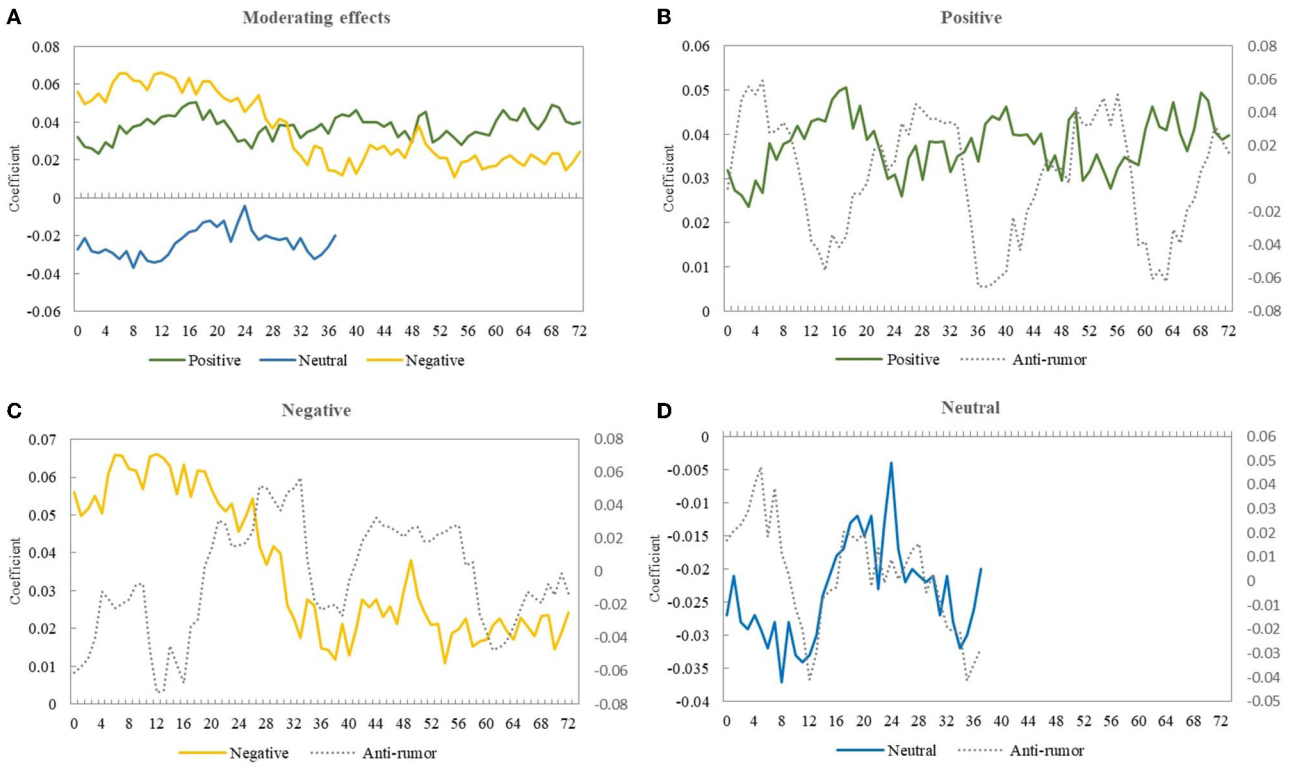

FIGURE 3 | The moderating effect of rumor refutation over time. **(A)** Represents the trend of the moderating effect of positive, neutral and negative information over time. **(B–D)** Represent the comparison of the three types of information and the corresponding moderating effects of refuting rumors.

From the vantage of user behavior, rumor refuting reduces user willingness to forward positive and negative news simultaneously, with a deeper impact on negative news, which is consistent with previous researches (23, 24). However, refuting rumors will not alter user liking and commenting behavior, proving that RCC only impacts the spread of information but hardly affects user enthusiasm for participating in discussions. Further examination is needed of the non–linear feature in the mediation effect of rumor refuting. If it exists, greater flexibility is necessary to design rumor-refuting strategies. In any case, categorizing news into positive, negative, and neutral and then formulating targeted strategies to dispel rumors can effectively improve the efficiency of RCC. It is much cheaper to classify news in advance than to identify rumors after the fact. Furthermore, the peak time of the epidemic was found to exercise a significant impact on user behavior. After the epidemic peaked, user enthusiasm for all types of news dropped significantly. These findings suggest that RCC can break the framing effect produced by public sentiment (27), thereby alleviating public panic caused by COVID-19, but it requires sophisticated intervention strategies.

The main contribution of this study is to find that RCC can not only suppress the spread of rumors, but also can further affect the wider behavior of users, thereby helping to dispel rumors. This finding helps to optimize the design of RCC strategies. For example, targeting technology can be used to broadcast rumor-refuting information to specific groups of people based on the valence of news. But the research also has some limitations. First, its conclusions are limited and applicable to China's cultural environment because Weibo data were used for the investigation. Therefore, it is necessary to conduct a cross-cultural comparative study of user behavior. Second, the timing of this study was limited to the outbreak stage of the epidemic in China. However, the global transmission characteristics of COVID-19 have undergone significant changes, and the user psychology may have changed. Finally, this study uses behavioral data for correlation analysis, which cannot fully reveal the operating mechanism of RCC.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding authors.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Central University of Finance and Economics. Written informed consent for participation was not required for

this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

BL: writing and editing of the paper. JS and BC: literature review and methodological design. QW: data collection and processing. QT: discussion part of the paper. All authors contributed to the article and approved the submitted version.

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COMMUNITY CASE STUDY
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Engaging Remote Aboriginal Communities in COVID-19 Public Health Messaging *via* Crowdsourcing

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Health comunication is a critical component of pandemic mitigation, but mainstream prevention messaging often lacks social, cultural and linguistic relevance to vulnerable populations. This community case study presents a novel, highly participatory pandemic prevention communication campaign that engaged individuals in remote Aboriginal communities of the Northern Territory of Australia directly in prevention messaging via crowdsourcing, and distributed videos to remote area post-codes via targeted Facebook advertising. Facebook metrics, administrative campaign data and national statistics are used to assess campaign reach and engagement. The case study discusses lessons learned from the campaign, including how seeking unscripted COVID-19 prevention video messaging can support community ownership of pandemic messaging, rapid content generation, and a high level of Facebook user engagement. It also discusses the effectiveness of targeting remote area post-codes *via* Facebook advertising both to reach the target audience, and to support quality improvement assessments to inform health communication decision-making in a low resource setting.

Keywords: crowdsourcing, remote Aboriginal communities, health communication, COVID-19, social media, Indigenous language

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INTRODUCTION

Aboriginal and Torres Strait Islander Australians are at higher risk of morbidity and mortality associated with pandemics than other Australians due to a range of factors associated with limited access to health care and high rates of non-communicable disease. During the 2009 H1N1 pandemic, indigenous communities in Australia, New Zealand and Canada were over-represented in the number of severe cases requiring hospitalization and among fatal cases (1). In the Northern Territory (NT) of Australia, Aboriginal and Torres Strait Islander Australians were hospitalized at a much higher rate than in other parts of Australia (2). In remote Aboriginal communities, factors associated with limited access to health care and basic essentials together with substandard housing, overcrowding, and racism compound this risk (3).

Prevention information is a critical component of pandemic mitigation, especially for groups who are at high risk such as Aborignal and Torres Strait Islander populations. Prevention messaging should be rapid and explicit with clear information that aligns with local culture and values, and that reflects day to day community life, and presents health information in local Aboriginal languages (4–6).

Driven by an aim to facilitate community ownership of pandemic messaging, rapidly generate localized content, and faced with remote Aboriginal community closures and travel restrictions, *One Disease* -an NT based, health-related non-profit that works with remote Aboriginal communities- undertook a novel pandemic prevention messaging campaign. The organization partnered with a local music production company, *Skinnyfish,* to conduct a crowdsourcing campaign that sought COVID-19 prevention videos directly from individuals in remote communities. Accepted videos were then distributed to remote area post-codes via targeted Facebook advertising.

This community case study draws on Facebook metrics, administrative data from the campaign, copies of the videos posted on the *One Disease* and *Skinnyfish* public Facebook pages, and national population statistics to assess campaign reach and user engagement at both campaign and individual ad levels. It discusses the lessons learned from this analysis, which was designed to inform continuous improvement processes at *One Disease*, and may support health communication planning in comparable organizations and/or contexts.

This paper presents the context of the campaign before outlining the rationale for the campaign in light of contextual factors. It then describes the design and implementation of the campaign before analyzing its results in terms of reach and engagement. Lessons learned are then discussed before concluding with study limitations.

CONTEXT

The Northern Territory of Australia covers >1.3 million square kilometers of central northern Australia. It has a population of 247,000 of which ∼30% are Aboriginal and Torres Straight Islanders, compared with ∼3% of the total Australian population (ABS unpublished census statistics). There are hundreds of small Aboriginal communities in remote regions of the NT, ranging in population size from a few thousand to less than one hundred, and over 100 Aboriginal languages are spoken (7).

A history of colonization and discrimination against Aboriginal and Torres Strait Islander Australians has impacted the social determinants of health and contributed to higher rates of communicable and non-communicable diseases, and reduced life expectancy, which is more than 5 years lower than in non-Indigenous populations (8). Fifty percent of Aboriginal and Torres Strait Islander adults have a chronic disease and a quarter have co-morbidities, particularly among those aged over fifty. In remote communities, factors associated with limited access to health care and basic essentials together with substandard housing and overcrowding underpin elevated health risk (9). Many remote communities are hundreds of kilometers from healthcare facilities.

A network of Aboriginal Community Controlled Health Organisations (ACCHOs) provide primary healthcare to Aboriginal and Torres Strait Islander Australians throughout the NT, including in remote Aboriginal communities. Early in the COVID-19 pandemic, Indigenous leaders and ACCHOs took swift action to call for remote community closures to limit the flow of people in and out, and to work with government to establish a strategic response and workforce preparedness. Throughout the pandemic, Australia's international borders have remained largely closed, as have many state and territory borders to internal movement. The NT has had some of the strictest border control policies in the country.

The pandemic prevention messaging communicated by the Australian Federal government in early stages of the pandemic was English language only, and lacked cultural relevance and practical applicability in Aboriginal and Torres Strait Islander communities. It was this public health communication gap that *One Disease* sought to address with its crowdsourced social media campaign.

RATIONALE FOR THE CAMPAIGN

Public health communication campaigns have often drawn on relatively superficial community engagement through focus groups or interviews, and typically require long consultation periods (10, 11). The COVID-19 pandemic spurred innovation in methods of public health communication, as neither in-person community engagement nor extended co-design or consultation processes have been feasible given the urgency of the information need, limitations on travel and social distancing requirements. In the NT, many community based ACCHOs have been active in rapidly developing Indigenous language COVID-19 prevention communications in partnership with local communities (6, 12).

One Disease sought to trial another participatory approach to Indigenous language prevention messaging, that is suitable for rapid content generation, by seeking unscripted videos directly from individuals in remote communities via a crowdsourcing campaign. *One Disease* is a not-for-profit health organization that aims to eliminate crusted scabies, a communicable skin disease prevalent in remote Aboriginal communities, as a public health concern. Following the outbreak of COVID-19 in Australia, *One Disease* was unable to continue its physical outreach work in remote communities due to travel restrictions and community lock-downs. As a result, the organization decided to direct some funds toward a crowdsourcing campaign for COVID-19 pandemic prevention. The organization wanted to continue to contribute to the health of the communities with which it works and to maintain its relationship with remote communities when unable to travel. *One Disease* also saw an opportunity to trial a new approach to participatory health promotion that, if effective, could be used in future work on communicable skin disease.

Crowdsourcing, which involves the outsourcing of an organizational function or task to a crowd, is increasingly popular in health service delivery, as involving individuals from the intended audience of a health initiative in problem solving and solution ideation can generate more relevant and acceptable content (12–14). In health, the most common uses of crowdsourcing are for creating collaborative communities and accessing a dispersed labor force (15). Healthcare organizations may turn to crowds when seeking input from a group of individuals defined by specific health or demographic characteristics, or by specific skills (e.g., technical, information

processing). The effectiveness of crowdsourcing has been evidenced in many areas of health research and practice, including diagnosis, surveillance, and study recruitment (14–17), and crowdsourced health promotion videos have been found equally as effective as healthcare provider generated videos (18).

Crowdsourcing has been used widely during the COVID-19 pandemic, in particular for engaging the public in large scale surveillance, and for engaging dispersed health experts in collective problem solving (19, 20). There is no known research on crowdsourcing in Aboriginal and Torres Strait Islander communities for pandemic mitigation specifically, or health promotion more generally. Crowdsourcing has, however, been used in other settings to engage indigenous peoples in collaborative communities–for example the collation of threatened language databases, or cultural heritage collections (21–23), as well as in more transactional, labor market crowdsourcing such as ecotourism mapping (24).

Beyond establishing a method for supporting locally generated, language content, *One Disease* needed a medium to distribute video content to the target audience. Facebook is used widely by Aboriginal and Torres Strait Islander Australians, and many health services, including ACCHOs and other non-profit organizations use Facebook to disseminate health promotion material to Aboriginal and Torres Strait Islander communities (25, 26). However, existing studies of health promotion campaigns distributed *via* Facebook have reported on content being posted on a health service organisation's profile page, not distributed via advertising.

One limitation of relying on profile page posts to disseminate health promotion information is that it relies on the online social network of the healthcare organization, which can limit reach. Facebook advertising can reach a much larger population, is relatively low cost and can support the targeting of specific populations using user data. *One Disease* also saw value in Facebook advertising from a quality improvement perspective, as it allows for easier and more granular evaluation than other forms of media advertising such as TV; the latter generates only aggregate, estimated reach data, while Facebook generates granular data on reach to unique users, total number of views, as well as length of view for video content.

One means through which populations can be targeted in Facebook advertising is via the post-code in which a user is located. In areas in which ethnic groups are concentrated geographically, post-code can be a proxy for ethnic background. In the US, post-code (zip-code) targeting has been used to target African Americans and Latinos with tailored health promotion content (27). There is no known research on post-code targeted Facebook advertising in remote Aboriginal communities. The targeting approach was selected for this campaign on the basis of its potential to reach users in remote communities.

CAMPAIGN IMPLEMENTATION

The crowdsourcing campaign was funded by *One Disease* and facilitated on a pro bono basis by *Skinnyfish*–a local music production company that works with Aboriginal and Torres Strait Islander artists. Both organizations have extensive social networks and working relationships in remote Aboriginal communities in the NT. Two crowdsourcing rounds were conducted, each with 2 week crowdsourcing periods and 3 week advertising periods during the peak of the first wave of COVID-19 in Australia.

Distribution of an invitation to script, design and produce COVID-19 prevention videos in local Aboriginal languages was facilitated via phone contact by *Skinnyfish* on behalf of *One Disease*. The director of *Skinnyfish* initially invited groups or individuals living in remote communities who had experience generating community messaging or experience in the entertainment industry. A strategy for contacting others in the community was developed in accordance with cultural ways, including communicating with and extending the invitation to females.

The brief given to potential contributors was to generate a video presenting a clear and simple message in a local Aboriginal language to regularly wash hands for at least 20 s (first campaign), or to maintain 1.5 m physical distancing (second campaign). No scripting was provided. To maintain authenticity and respect for the contributors, no post-production editing was conducted, so contributors knew that their work would not be modified. Videos were required to be at least 30 s long, and could be submitted for consideration via WhatsApp message to the director of *Skinnyfish*.

The acceptability criteria for videos were a clear message about one or both of the two COVID-19 hygiene topics, and an acceptable video length (i.e., minimum 30 s). Imperfect videography was expected and accepted. All videos were filmed on mobile phones. Videos were assessed by a panel of *One Disease* staff, all public health nurses, to ensure that demonstrations and/or examples presented were accurate from a public health perspective. If deemed inaccurate, contributors were provided feedback and given the opportunity to submit a revised video. Upon confirmation of acceptance, contributors were paid the equivalent of one full day's work.

A total of 19 videos were received, of which 18 were accepted. One video was rejected on the basis that it did not present a clear COVID-19 prevention message. Of the 18 accepted videos, there were nine videos about handwashing, six about physical distancing and three about both. Six Aboriginal languages were spoken across the video collection, with many videos repeating the key message in English. All accepted videos were produced by local musicians, entertainers or known community figures.

The accepted videos involved either a demonstration or description of COVID-19 prevention practices applied to the local community setting. Handwashing demonstrations were presented in local community settings such as a home, recreation center or outdoor communal space. Physical distancing demonstrations were either in commercial settings (e.g., bank, taxi), or social community settings (e.g., an informal contact free drop-off grocery shopping, and not sharing drinks or handshakes).

On completion of the crowdsourcing campaign, *One Disease* contracted a local advertising firm to distribute the videos via Facebook paid advertising. Australian Bureau of Statistics [ABS]

TABLE 1 | Postcodes and populations.

Postcode	Region	Languages	Population	% ATSI
0822	NT top end central	Djambarrpuyngu, Kunwinjku, Ndjébbana	25,558	70%
0880	NT top end west	Djambarrpuyngu	5,212	43%
0872	NT south and nearby WA	Western Arrente	15,468	80%
0852	NT central	Kriol, Anindilyakwa	8,300	72%

TABLE 2 | Facebook metrics.

Metric	Result
Reach	91,295
Impressions	638,294
ThruPlays	75,591
Post engagement	233,535
Cost per Thruplay	$0.03
Cost per post engagement	$0.01

data was used to identify postcodes relevant to the languages spoken in the videos; the advertising campaign was then set up to target these postcodes. The campaign was set up to prioritize ThruPlays–the term used by Facebook to describe video views of 15 s or more; ThruPlays were prioritized to maximize the likelihood of the videos being viewed in full, and subsequently maximizing exposure to the videos' key message.

The remote postcodes targeted in the distribution strategy, along with the relevant languages from the campaign, the population size and the percentage of the population from Aboriginal or Torres Straight Island (ATSI) backgrounds [compared with ∼3% in total Australian population (ABS unpublished census data)] are presented in **Table 1**.

For the first week of the handwashing campaign, and for two of the commercial setting physical distancing clips, videos were also distributed in Darwin (the capital city). At the end of the second campaign, one edited music video clip about handwashing was made in English by one of the first campaign contributors and *Skinnyfish*, and distributed across the NT and area of Western Australia with shared postcode.

RESULTS

Reach

Campaign level Facebook metrics are presented in **Table 2**. Campaign reach was assessed using Facebook's 'Reach' measure, which captures the number of unique users exposed to the ad. The campaign reached 91,295 Facebook users in a population (aged 15+) of 167,277 in the NT plus part of WA. On the assumption that each Facebook user is an individual, this represents 55% of the population.

Impressions is a Facebook measure of the number of times a video has been displayed. Over the 2 x 3 week distribution periods, a campaign video was displayed to a user 638,294 times. Although it is not possible to disaggregate to individual users, as an indication of frequency of exposure, with a reach of 91,295 individual users, this represents 6.99 impressions per user. ThruPlays of 75,591 represent 0.83 full video views per user. In reality, Impression and ThruPlay numbers may be much higher for some users than others, but these aggregate numbers provide an overall indication of exposure.

In comparison to a study assessing the reach of health promotion posts on the Facebook profile page of ACCHOs in comparable communities, the reach achieved via Facebook advertising appears much higher. Hefler et al. (26) reported an average reach of 248 users per post in their study, while the average reach for each video in the targeted Facebook advertising campaign reported in this study was 5,370. That this high level of reach can be achieved at relatively a low cost of $0.01 per engagement (view or reaction) suggests that post-code targeted Facebook advertising may be a useful distribution strategy for stand alone campaigns in low resource settings.

Engagement

To compliment campaign level analysis, Reach and ThruPlay metrics were analyzed for individual ads to identify which video features may support user engagement and support quality improvement in *One Disease* public health communication. Engagement with individual ads was assessed by the number of ThruPlays as a percentage of the number of users reached; this figure was used to rank the engagement levels for individual videos. Content analysis was conducted to identify features on individual videos; this involved coding based on visual observation of videos for presenter age category (child, youth, adult, older adult) and gender, video setting, activities, other features such as music or humor. Video language and postcode(s) distributed to were also recorded. These details are presented in **Table 3** presents.

Overall, content involving multiple activities or a storyline generated more engagement than spoken word alone, or straightforward demonstration (like washing hands). Videos in outdoor or commercial (shops, banks etc.) settings generated more engagement than those in homes or with no obvious setting.

Of the five most popular videos, four involved groups of children and/or young people participating in activities or demonstration in a fun or funny way. The handwashing music clip, which involved children and young people singing and dancing, had the highest number of ThruPlays of all videos in the ad campaign. It was also posted on the *Skinnyfish* public Facebook profile page; as at September 2020 it has 100,800 ThruPlays. Analysis of user comments revealed a number of

TABLE 3 | Individual ad content, language, postcode, reach and ThruPlays.

Language	Postcode(s)	Content	Reach	Thru-Plays	Thru-Plays (% Reach)
Handwashing					
Ndjébbana	0822	Female local band members demonstrating hand washing	6,458	1374	21%
Djambarrpuyngu	0822, 0800	Male local band member talking about handwashing	654	174	27%
Djambarrpuyngu	0822, 0800	Male local band member demonstrating handwashing with kids to music	6,602	2290	35%
Djambarrpuyngu	0822, 0800	Humor and local well-known community member and also musician	724	94	13%
Djambarrpuyngu	0822, 0800	Older male clear message and direct message	1,723	269	16%
Kriol	0852	Male demonstrating and working with kids	3,277	905	28%
Western Arrente	0872	Older male well known musician clear message and direct message	1,766	304	17%
Anindilayka	0852	Local musician clear message	1,413	264	19%
Kunwinku	0822	Older local musician clear message and direct message also using local environment.	6,614	915	14%
English	Statewide	Local musician singing and kids dancing	53,758	18,192	34%
		Skinnyfish profile page	10,800		
Physical distancing					
Djambarrpuyngu	0822, 0800	Woman with kids demonstrating shopping drop-off to older man and humor	18,488	5,287	29%
Djambarrpuyngu	0822, 0800	Male talking about physical distancing no setting	3,277	911	28%
Djambarrpuyngu	0822, 0800	Older male talking about physical distancing in taxi	10,452	2,993	29%
Djambarrpuyngu	0822, 0800	Older male talking about physical distancing in home	6,168	1,669	27%
Djambarrpuyngu	0822, 0800	Older male talking about physical distancing at ATM	9,038	2,236	25%
Djambarrpuyngu	0822, 0800 +Darwin	Older male talking about physical distancing in bank	37,088	11,844	32%
Kriol	0852	Local band demonstrating with young people	2,159	905	42%
Kunwinku	0822	Older local musician clear message and direct message also using local environment.	4,436	789	18%
Western Arrente	0872	Local band singing	3,697	721	20%

individuals stating that they would share the video with children or young people in their classrooms or youth groups, which suggests the videos may be able to generate engagement beyond direct to users in Facebook.

DISCUSSION

These findings show that crowdsourcing can be an effective method for involving individuals in remote Aboriginal communities in public health communication. In particular, seeking unscripted COVID-19 prevention video messaging supported community ownership of pandemic messaging, and generated a high level of Facebook user engagement. The findings also show that public health messages can be distributed to individuals in remote Aboriginal communities via post-code targeted Facebook advertising at very low cost ($0.03 per ThruPlay). In campaigns seeking high levels of reach and exposure, post-code targeted advertising may represent an effective alternative to Facebook profile page posts, with the *One Disease* campaign achieving a reach many multiples higher than those reported in a comparable study (26). In seeking to understand video characteristics supportive of user engagement, Facebook advertising also facilitates more accurate and granular evaluation than traditional advertising mediums such as TV or radio. The capacity to use campaign metrics to undertake a post-campaign quality improvement study can support health communication decision-making in resource scarce settings such as non-profits.

The most viewed campaign videos displayed features known to improve engagement levels in health communication, such as a clear and simple message that holds practical value, and that is presented by an individual or group who hold social currency in the community (28). The finding that videos involving children and/or young people were amongst the most popular would require primary research to assess whether young people were the drivers of the higher view numbers, whether adult users showed videos to young people (as suggested by some teachers and youth workers in comment data), or that their involvement simply made for more engaging videos. The NT, and remote Aboriginal communities in particular, have larger youth populations than the rest of Australia (ABS unpublished statistics). Young people have been posed as conduits of information in health promotion (29) and disaster preparedness (30), and as potential change agents in households (31), but the evidence base is limited. Further research is needed to understand the role of young people as both producers and users of COVID-19 prevention messages.

The campaign also provides further evidence that community based non-profit organizations can play a valuable role in the

translation of mainstream health communication through deep social networks in underserved communities (32). Although remote Aboriginal communities are serviced by a network of community controlled health organizations, this is not the case in many underserved communities internationally. This community case study shows how the strength and social currency of community based organisation's social network can support community engagement with public health campaigns, and as such, the potential benefit of involving these actors in mainstream public health communication initiatives.

LIMITATIONS AND AREAS FOR IMPROVEMENT

The high rate of acceptability in videos (18 accepted of the 19 videos submitted) and positive findings around engagement with crowdsourced videos may not be replicable with other populations. All accepted videos were generated by local musicians, entertainers or community figures who had experience with creative and/or public performance. These local figures are illustrative of the creative talent present in even small Aboriginal communities with populations in the hundreds. However, access to this creative talent was facilitated via partnership with a local music production company, which may not be present in all settings. Video quality may be lower if generated by the general population, and user engagement may be lower for videos not involving a known community figure.

The main area for improvement in campaign implementation is more balanced gender representation in videos; 17 of the 18 videos consisted solely of male presenters, or a male lead presenter. It was not appropriate for the Director of the music production company, as a male from outside the community, to make direct phone contact with women in the community; as such, invitations to participate were transmitted via male community members. Future campaigns may benefit from implementation partnerships with multiple community organizations to ensure that invitations to participate can be communicated directly to both male and female community members.

This quality improvement study of reach and engagement is limited to Facebook metrics; primary data would be needed to improve campaign evaluation and to understand engagement statistics. In the available format of Facebook metrics, it is not possible to attribute ThruPlays to specific users, meaning it is not possible to identify whether most users viewed one ad of the many they were shown, or a smaller percentage of users viewed multiple ads. This distinction would be important to accurately assess exposure and engagement. Furthermore, in examining only campaign media metrics, the study is also unable to assess whether exposure had any impact on individual or community behavior.

DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/restrictions: the Facebook analytics data accessed for this research are held in a commercial in confidence agreement by a digital marketing firm. Aggregate statistics were shared for the purpose of quality improvement at *One Disease*.

AUTHOR CONTRIBUTIONS

MGl was involved in literature review, data extraction and analysis, and led manuscript preparation. MD was involved in campaign conceptualization, design and implementation, data interpretation, and manuscript preparation. MGr was involved in campaign design and implementation and manuscript preparation. MS was involved in campaign implementation and manuscript preparation. AS was involved in campaign implementation and manuscript approval. KG was involved in literature review, data interpretation, and manuscript preparation. All authors contributed to the article and approved the submitted version.

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Using Humor to Promote Social Distancing on Tiktok During the COVID-19 Pandemic

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Background: During the COVID-19 pandemic, many humorous videos on how to practice social distancing appeared on social media. However, the effect of using humor as a crisis communication strategy to persuade people to conform to social distancing rules is not known.

Objective: Drawing on the literature on humorous message framing and crisis communication, this research explores the effectiveness of a humorous message in communicating social distancing rules in two crisis severity phases (low vs. high severity) and also evaluates how humor affects individuals' online and offline engagement intentions during the COVID-19 pandemic.

Methods: A 2 (message framing: humorous vs. non-humorous) x 2 (crisis severity phase: low vs. high) between-subjects design experiment was conducted to test the research questions during the first weeks of the COVID-19 pandemic in China from January 30 to February 2, 2020.

Results: The results showed that the severity of the phase of a health crisis can significantly affect stakeholders' online and offline responses toward the disease. More specifically, in a low severity phase, humor led to increased source likability for the message, and more online and offline engagement intentions. However, no differences between a humorous and non-humorous message in perceived risk were observed. Whereas, in a high severity crisis phase, humor reduced individuals' offline engagement intentions and a decrease in perceived risk, no significant difference was found between a humorous and non-humorous message on source likeability.

Conclusion: Humor can motivate both more online engagement and offline protective action intention when the crisis severity phase is low, while when crisis severity soars, a non-humorous message should be more desirable. More specifically, using humor in communicating information about an infectious disease can enhance the spokesperson's likeability in a low severity phase, and also helps to spread health information to a larger audience. While, the negative side of using humor in communicating an infectious disease appears in severe crisis phases, as it then decreased the public's perception of risk, and triggers less protective actions. Going beyond previous research, this study recognized that crisis severity changes in different phases of the spread of infectious disease, thereby providing actionable strategy selections for crisis practitioners in a dynamic communication environment.

Keywords: humor, health communication, COVID-19, risk perception, RAMS

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INTRODUCTION

To combat the spread of the coronavirus, many village leaders in China and mayors in Italy used multiple media channels to communicate the importance of social distancing and remind citizens to stay at home. TikTok has become an emerging social media platform to communicate public health messages (Basch et al., 2020). For example, Chinese village leaders' TikTok micro-videos and Italian mayors' Facebook Live video clips about enforcing coronavirus quarantine rules became global viral hits. Some won unexpected celebrity status after furiously shouting at and scolding people who flouted quarantine laws in an aggressively humorous manner. Leaders revealed the most absurd stories and justifications used by citizens to explain their breaches of the rules, like playing ping-pong at the beach, pretending to go for a run, or calling hairdressers to their homes to have their hair done. For instance, a video about the mayor of Reggio Calabria told a virus-lockdown dodger that he is not a Will Smith character: "I saw a fellow citizen amiably jog up and down the street accompanied by a dog that was visibly worn out. I stopped and told him, look this is not a movie. You are not Will Smith in *I Am Legend*. Go home!" The mayor of Lucera raged at citizens calling hairdressers to their homes: "What is the damn point? Do you understand that coffins are closed? Who will see all these beautiful hairstyles in the coffins?"

The use of humor has previously been found effective in promoting health communication engagement, reducing the public's defensive responses, and ultimately increasing the effectiveness of health information (Hendriks and Janssen, 2018). For instance, humorously framed public service announcements help motivate more cancer detection behaviors as they reduce anxiety about self-exams (Nabi, 2015). Humor also performs well in preventive health communication (e.g., regarding alcohol, tobacco, and obesity) through prolonged attention and better-recognized content (Blanc and Brigaud, 2014). When using humor in communicating climate change, a humorous appeal produces greater climate change activism intentions than a non-humorous message (Skurka et al., 2018)—though the humor was also found to decrease perceived climate change risk to humans through reduced anger and fear.

Although previous research suggested that positive emotions were important coping mechanisms during a crisis (Fredrickson et al., 2003), the effect of humorous framing during a crisis on an individual's online and offline engagement intentions may differ. For instance, in 2011, the Center for Disease Control and Prevention in the US launched a campaign called "Preparedness 101: Zombie Apocalypse" on social media. Follow-up research revealed that humorous messages help to motivate more online engagement by quickly spreading the information, while weakening the individual's intention to take protective action offline (Faustino and Ma, 2015).

Using humor to communicate risk and crisis events has long been regarded as a double-edged sword because the effect varies with crisis severity. People were found less likely to engage with humorous content on Twitter when crisis severity increases, as in the outbreak of the H1N1 flu pandemic in 2009 (Chew and Eysenbach, 2010). Xiao et al. (2018) found that humor works differently in two stages of a rumor. They found that humor decreases the perceived severity of a crisis when the rumor is not confirmed but reduces a spokesperson's sincerity when the rumor is confirmed. However, the mechanism by which the effect of humorous framing varies with the crisis stage remains unknown.

To address this question, this research also investigates the interaction effect of humorous appeal and crisis severity on source likeability and perceived risk (see **Figure 1**). Unlike the CDC's "Zombie Apocalypse" campaign, the current research explores the effectiveness of a humorous message in communicating social distancing in two phases of crisis severity (low vs. high severity) and evaluates how humor affects an individual's online and offline engagement intentions, source likeability, and perceived risk during the COVID-19 pandemic. This will also help suggest how humorous framing can be used as an effective crisis communication strategy on social media.

THEORETICAL FRAMEWORK AND HYPOTHESES

RAMS aims to explain the process of media influence on risk perceptions among the general public. Based on Risk Amplification through Media Spread Framework (Vijaykumar et al., 2015), a risk event is defined as a real or perceived threat that poses to the public's health once a public health community confirmed an infectious disease case or outbreak (IDO) has the potential to spread through a social system. According to Vijaykumar et al. (2015), IDO information can influence the amplification, attenuation, or maintenance of the public's risk perceptions, and in general, contains fact-based or opinion messages about any scientific, social, physical, or mental aspect of an infectious disease. Instead of the linear risk amplification process of Social Amplification of Risk Framework (SARF), RAMS demonstrates the complexity of using different media channels (face-to-face, traditional media, online media, and social media) in promoting and disseminating IDO information to different targeted audiences (individuals who exposed to an infectious disease, the local population or community, and the broader public), revealing the dynamics of the risk amplification process in the current media landscape (Jin et al., 2018). RAMS also highlights the role of social media in diffusing IDO information through its multimodal nature and "going viral" magic that enables instantaneous sharing of messages through online social networks.

Additionally, RAMS divides four stages of an IDO, from preparedness, initial case(s), increasing number of cases, and "outbreak" (many cases in many places) to "recovery" (significant decrease in the number of cases). Vijaykumar et al. (2015) provide tailored communication strategies according to different IDO stages, for instance providing background information on the disease and its transmission for traditional media, while proving accurate information as soon as possible for online media in the phase of the initial case. However, the recommendations for communication priorities only focus on what to communicate

for an online and offline media channel, little attention has been paid to how to make the IDO information visible or "going viral" during the stages of an infectious disease outbreak.

Social media has served as a key source for diffusing time-sensitive information during the COVID-19 pandemic. Research shows more than 86% of African countries' national health ministries disseminated COVID-19-related information through their social media accounts (Asubiaro et al., 2021). Ohme et al. (2020) found during the first weeks of the COVID-19 pandemic, people in Belgium spent 74% more time than usual on social media apps to stay informed, in sync, and in touch with society. Messages on social media platforms rapidly reach the public and connect people to their broader social networks, while humorous framing helps messages further disseminate at a large scale through thousands of online sharing and liking behaviors (Fraustino and Ma, 2015). Papapicco and Mininni (2020) found humor on social media may be a strategy of commitment in maintaining preventive behavior through its specific communication function of "emotion sharing" in the context of Ph.D. memes. Vicari and Murru (2020) revealed that social media in Italy thrived with humorous content during the early weeks of the COVID-19 pandemic in that country, through memes, multimedia remixes, and jokes. However, the humorous content was mostly in the form of traditional political satire, mocking people in Northern Italy and China, not offering information on appropriate preventive behaviors. The different timing of the pandemic's peak in geographically distinct locations creates a short window of response opportunity (Nesbitt et al., 2020). If healthcare officials can rapidly disseminate humorous information on preventive behavior instead of mere satirical content about early affected areas to later ones, it may improve the situation in areas affected later.

The Moderation Role of Severity IDO Phase on Citizen's Engagement Intention

A humorous message can be defined as a message intentionally, semantically, or structurally manipulated in relation to humorous elements to evoke amusement for both sender and receiver (Speck, 1991; Martin et al., 2003). A message can be perceived as humorous based on shared sets of social norms and knowledge (Meyer, 2000). A case study from China revealed that humorous crisis communication may be particularly valuable on social media—a platform known as interpersonal and less serious and informal than some others (Kim et al., 2016). Kim et al. (2016) found a self-mockery humorous message strategy employed by Alibaba effectively lessened the bad effects of a false advertising scandal benefiting from its informal language tricks on social media. Xiao et al. (2018) also confirmed the effectiveness of humor on social media in decreasing perceived crisis severity during the unconfirmed rumor stage, though they also noted humor might not a good choice when the rumor was confirmed. In the context of crisis communication regarding infectious disease, we expect that the effectiveness of humor in communicating social distancing may also differ in different phases of crisis severity.

Crisis severity is determined by objective criteria related to the event, such as the number of victims, number of injuries, and physical damage (Laufer et al., 2005). A substantial body of research has found a positive association between crisis severity and the public's attribution of responsibility to the organization involved (Hwang and Cameron, 2008). Coombs and Holladay (1996) suggest that the more severe a crisis is, the more accommodative a response strategy an organization should use. Previous research has shown that in a severe crisis, the public prefers more rational messages that highlight factual information, regardless of the framing style (Xiao et al., 2018, 2019)—consumers in this phase may care more about informative and useful content (Claeys et al., 2013). Thus, we expect humor may be effective in promoting social distancing in low severity IDO phases (e.g., preparedness and recovery phases), while in high severity phases (e.g., outbreak phase), a non-humorous message should work better.

> *H1*: For the low severity IDO phase (vs. high severity IDO phase), humorous messages will lead to higher online and offline engagement intention. However, for the high severity condition, such difference vanishes.

The Moderation Role of Severity IDO Phase on Source Likability

Source likability is defined as an affective evaluation linked to a source (Ewoldsen and Fazio, 1992; Roskos-Ewoldsen et al., 2002). For example, a person who says pleasant things may be perceived as likable (Eagly and Chaiken, 1975). The previous literature on advertising gives strong support for increased source likability through the use of humor (Weinberger and Gulas, 1992). Humor is a key dimension of spokes-characters' likability (Callcott and Phillips, 1996). Humorous messages also enhance ad likability and brand likability (Speck, 1991), and individuals' likability toward a scientist can obviously increases when they perceive a scientific message as more humorous (Yeo et al., 2020). Strick et al. (2012) suggest that humor can break resistance to influence because humor can impede the development of negative associations and create positive associations through positive emotional responses (*via* emotional conditioning or feelings transfer).

However, we expect the severity phase will moderate the effect of humor on source likability. For example, an individual's online engagement toward humorous content tends to decrease on social media when a pandemic becomes an outbreak situation (Chew and Eysenbach, 2010). In the context of crisis communication, when the severity is high (e.g., high death toll/rate), individuals' latitude of acceptance is likely to be narrow. Therefore, people will pay more attention to key factual information about the crisis (e.g., how fast the disease spreads). Furthermore, a higher level of severity tends to associate with more victims, injuries, and deaths. As a result, humor may not be considered to be appropriate in a severe phase of the crisis. However, when the severity is low, people are more likely to associate humor with the trait of the spokesperson and transfer positive emotional responses to the spokesperson. People tend to follow advice from those they like. Thus, source likability can increase persuasion power by serving as a cue for judgment (Ewoldsen and Fazio, 1992).

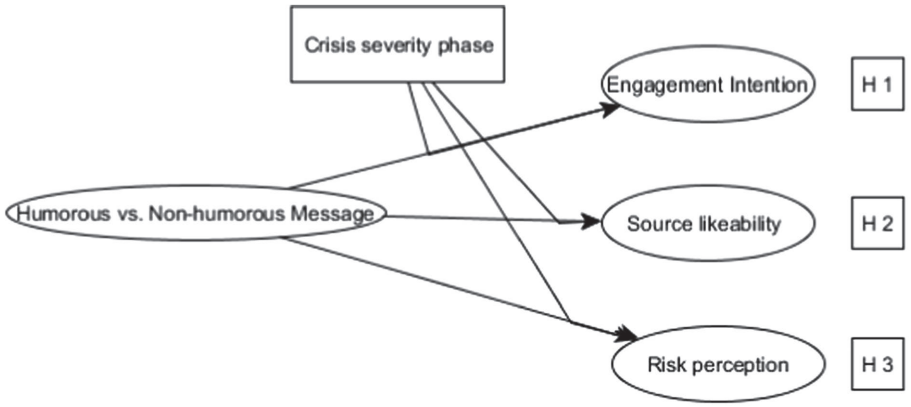

FIGURE 1 | Hypothesized model of the effectiveness of message framing on individuals' engagement intention, source likability, and risk perception.

H2: For the low severity IDO phase (vs. high severity IDO phase), humorous messages will lead to individual's higher source likability. However, for the high severity condition, such difference vanishes.

The Moderation Role of Severity IDO Phase on Risk Perception

Apart from source likability, we expect humor works through another route: perceived risk. More specifically, we propose individual's risk assessment of an infectious disease outbreak (IDO) can be affected by the IDO information framed humorously or not. A survey study conducted in India showed traditional media have tended to calm the public down by broadcasting positive news during the COVID-19 pandemic, while the content on social media platforms has tended to make individuals more fearful (Musa et al., 2020). Mass media now works as a "social amplification station" to shape the public's perception of risk by either amplifying or attenuating public risk perception (Kasperson et al., 1988). According to the Risk Amplification through Media Spread Framework (RAMS), messages go viral or not based on a range of message characteristics, including IDO information's valence and ability to evoke an individual's positive or negative arousal, information virality can indirectly affect social conversations and in the process, shape publics' risk beliefs and perceptions of the disease. This means that not only what the media says matters, but how they frame risk issues also affects the public's sense-making of events or subsequent behaviors (Oh et al., 2020). For instance, humorously framed announcement message decreases individuals' perceptions of climate change risk by reducing anger and fear (Skurka et al., 2018), while fear-arousing sensational Facebook messages led to more user engagement *via* enhanced risk perception during the 2016 Zika virus outbreak (Ali et al., 2019). Oh et al. (2020) revealed social media use during the MERS outbreak can elicit higher individuals' anger and fear, resulting in enhanced risk perception and more preventive behaviors. However, when crisis severity is high, communicating crisis in a humorous way may leave an impression that the situation is not very serious, because the playful manipulation of humor may function as a psychological coping strategy, temporarily distracting individuals' attention from the fear of pandemic's outbreak to amusement, leading them to interpret the risk as less severe (Meyer, 2000). Therefore, we expect the use of humor on social media in the high severity IDO phase (e.g., Outbreak phase of an infectious disease) will lead to lower perceived risk.

H3: For the high severity IDO phase (vs. low severity IDO phase), humorous messages will lead to individual's lower level of perceived risk. However, for the low severity condition, such difference vanishes.

MATERIALS AND METHODS

Recruitment

An experiment was designed to test the research questions during the COVID-19 crisis in China from January 30 to February 2, 2020. The experiment employed a 2 (message framing: humorous vs. non-humorous) × 2 (crisis severity phase: low vs. high) between-subjects design. We recruited participants using the SoJump online sample panel.

Stimuli and Procedure

For the manipulation of the crisis severity IDO phase, we used a news report about a video going viral on the TikTok video-sharing platform. The video was from the party secretary of a fictional small village with a population of 600; the content was his audiotaped speech communicating the need for social distancing and appealing to everyone to stay at home (screenshots and scripts of the video news see **Supplementary Material**). For the low-level crisis severity phase, the video reported no confirmed COVID-19 case was found yesterday in that village ("preparedness phase," see Vijaykumar et al., 2015), while the video for the high severity phase reported 49 COVID-19 cases increased compared to the previous day in that village ("outbreak phase," many cases continuously reported, see Vijaykumar et al., 2015).

For the manipulation of the message frame, we used two videos (screenshots and scripts of the video see **Supplementary Material**) adapted from the initial (fictional) post on the TikTok video-sharing platform. The videos were edited to the same length and re-recorded using a Henan dialect accent (an accent that can be understood by people who speak Chinese). Furthermore, a picture of a loudspeaker was displayed as the background, and the same type of subtitle of the audiotape was presented in both videos.

To manipulate the level of humor, we applied the affective humor mechanism (arousal-safety). This humor mechanism is defined as a break from emotional strain, creating the perception that the message is funny (Rothbart, 1977). In the humorous video, the spokesperson used aggressive humor to denigrate people who attempted to go outdoors and gather in groups, then asked everyone to stay at home. In the non-humorous video, the spokesperson appealed to everyone to stay at home through a factual message (see **Supplementary Material** for scripts).

For the pre-test, we recruited 88 participants (72% males, Mean age = 27.20 years, SD = 5.54) from the SoJump online sample panel. The test suggested successful manipulation of message framing; participants in the humorous message condition (M = 5.26, SD = 1.39) rated the message more humorous than those in the non-humorous message condition [M = 3.73, SD = 1.41; t (86) = 5.04, $p < 0.001$]. Participants in the non-humorous message condition (M = 4.84, SD = 1.34) rated the message more rational than the humorous message condition [M = 3.16, SD = 1.26; t (86) = 6.02, $p < 0.001$].

For the manipulation of crisis severity phase, participants in the high severity phase (M = 5.35, SD = 1.38) rated the situation as more severe than those in the low severity phase [M = 3.04, SD = 1.42; t (86) = 7.64, $p < 0.001$].

All participants answered manipulation check questions and then completed the rest of the questions (e.g., gender and age). The whole procedure took about 5 min.

Measures

To check the message framing manipulation, an established four-item 7-degree scale of perceived humor (funny/humorous/amusing/entertaining, Cronbach's $\alpha = 0.85$; Nabi et al., 2007) and a two-item 7-degree scale of perceived rationalness (serious/rational, Cronbach's $\alpha = 0.83$) were tested. The manipulation of crisis severity was measured using a two-item 7-degree scale from Arpan and Pompper (2003) which asked "how severe/serious do you consider the bad effects caused by the virus in the village to be?" (Cronbach's $\alpha = 0.93$).

Online engagement intentions are the public's willingness to participate in public affairs through computer-mediated actions, including positive E-Word-of-Mouth and their intentions to spread the message online (e.g., like, repost, forward, and comment, see Chen et al., 2020), while offline engagement intention is the public's tendency to take actual protective actions and face-to-face communication (Fraustino and Ma, 2015). The online engagement intention was measured using a three-item 7-degree scale that asked "to what extent will you like the video/forward (retweet) it to your family and friends/leave a positive message after watching the video?" (Cronbach's $\alpha = 0.94$). Offline engagement intention was measured using a three-item 7-degree scale that asked "to what extent will you follow the quarantine rules/stay at home and not hang out/persuade your family and friends to follow the quarantine rules offline?" (adopted from Fraustino and Ma, 2015, Cronbach's $\alpha = 0.79$).

Source likeability toward the spokesperson was measured using a three-item 7-degree scale that asked to what extent the participant agreed, "I have a good feeling about the spokesperson/I think the spokesperson has a good overall reputation/The spokesperson is likable" (Cronbach's $\alpha = 0.90$), based on an emotional evaluation for organizations from Arpan and Pompper (Ponzi et al., 2011).

Risk perception of the virus was measured using a four-item 7-degree scale that asked "to what extent do you think the COVID-19 virus is dangerous to yourself/the probability that I will get infected the COVID-19 disease is high/the COVID-19 pandemic situation is quite severe/there will be an outbreak of the virus in the near future?" (Cronbach's $\alpha = 0.75$).

The perceived threat of the COVID-19 situation in an individual's city of residence was measured with a 7-degree scale by asking to what extent do you think the severity of the COVID-19 situation in your city of residence.

Procedure

Participants were asked to rate the perceived threat of the COVID-19 situation in the city of residence and then randomly assigned to one of four conditions. The video news report about the COVID-19 situation (high vs. low severity phase) in the village was presented first, followed by an attentional multiple-choice question asking how many confirmed cases were reported in the village. Participants who gave the wrong answer to this question were automatically excluded ($n = 38$).

Then, another video (with humorous vs. non-humorous message) was presented, followed by an attention filter (a multiple-choice question) asking for the exact code presented at the very end of each video to ensure participants watched the video. Participants who gave the wrong answer were automatically excluded ($n = 23$). This was followed by a multiple-choice question asking if they had watched the video clip before; participants who responded "yes" were automatically excluded ($n = 0$).

A total of 139 valid responses were collected (48% males, Mean age = 27.27, SD = 5.80).

RESULTS

Manipulation Checks

Testing suggested a successful manipulation of message framing; participants in the humorous message condition ($M = 5.09$, $SD = 1.29$) rated the message as more humorous than those in the rational message condition [$M = 3.98$, $SD = 1.53$; t (137) = 4.64, $p < 0.001$]. Meanwhile, participants in the rational message condition ($M = 4.81$, $SD = 1.29$) rated the message more

rational than the humorous message condition [$M = 3.12$, $SD = 1.13$; t (137) = 8.17, $p < 0.001$].

For the manipulation of crisis severity, participants in the high severity condition ($M = 5.17$, $SD = 1.45$) rated the situation of that village more severe than those in the low severity condition [$M = 3.01$, $SD = 1.87$; t (137) = 7.51, $p < 0.001$].

Correlation Analysis

Risk perception and source likeability are both positively correlated with an individual's engagement intention (**Table 1**). This implies that when participants have a higher perception of the risk of the disease and feel the spokesperson is more likable, they are more likely to engage with the message.

Main Effects

A t-test was conducted to test the main effect of humorous framing on online engagement intention; the results revealed no significant difference between a humorous message ($M = 4.80$, $SD = 1.33$) and a rational one [$M = 4.66$, $SD = 1.44$; $t(137) = 0.61$, $p = 0.49$]. Another t-test tested the main effect of humorous framing on offline engagement intention; the results revealed no significant differences between the humorous message ($M = 5.59$, $SD = 1.48$) and rational message [$M = 5.73$, $SD = 1.29$; t (137) = 0.59, $p = 0.34$].

An additional t-test was tested the main effect of humorous framing on source likability; the results revealed a significant difference between a humorous message ($M = 5.55$, $SD = 1.22$) and a rational one [$M = 5.10$, $SD = 1.23$; $t(137) = 2.18$, $p = 0.03$]. Another t-test tested the main effect of humorous framing on risk perception; the results revealed a significant differences between the humorous message ($M = 4.84$, $SD = 1.47$) and rational message [$M = 5.46$, $SD = 1.39$; t (137) = 2.56, $p = 0.01$].

Moderation Effects

An ANOVA analysis was conducted to test the moderation effect of humorous framing and IDO severity phase on online and offline engagement intentions controlling for participants' gender and age; the results revealed a significant moderation effect of a humorous message and severity phase on online engagement intention [F (1,133) = 6.93, p = 0.009, η^2 = 0.052, power = 0.79] and also a marginal significant moderation effect of a humorous message and severity phase on offline engagement intention [F (1,133) = 3.08, p = 0.082, η^2 = 0.023, power = 0.43].

More specifically, a Post-Hoc analysis showed that using humor (M = 5.05 SD = 0.21) led to more online engagement intention than the non-humorous message (M = 4.37 SD = 0.22) in a low-level crisis severity phase ($p = 0.03$). However, when participants were told the video was from a high severity crisis scenario, no significant difference was found between a humorous and non-humorous message online engagement intention ($p = 0.12$, see **Figure 2**).

However, using humor (M = 5.57, SD = 0.24) led to less offline engagement intention than the non-humorous message (M = 6.18

TABLE 1 | Correlation matrix and descriptive statistics.

Measures	Risk perception	Source likeability	Offline engagement	Online engagement	*M*	*SD*
Risk perception	/	0.32**	0.46**	0.49**	5.15	1.47
Source likeability	0.32**	/	0.37**	0.44**	5.33	1.24
Offline engagement	0.46**	0.37**	/	0.49**	5.66	1.38
Online engagement	0.49**	0.44**	0.49**	/	4.73	1.38

***Correlation significant at the 0.01 level.*

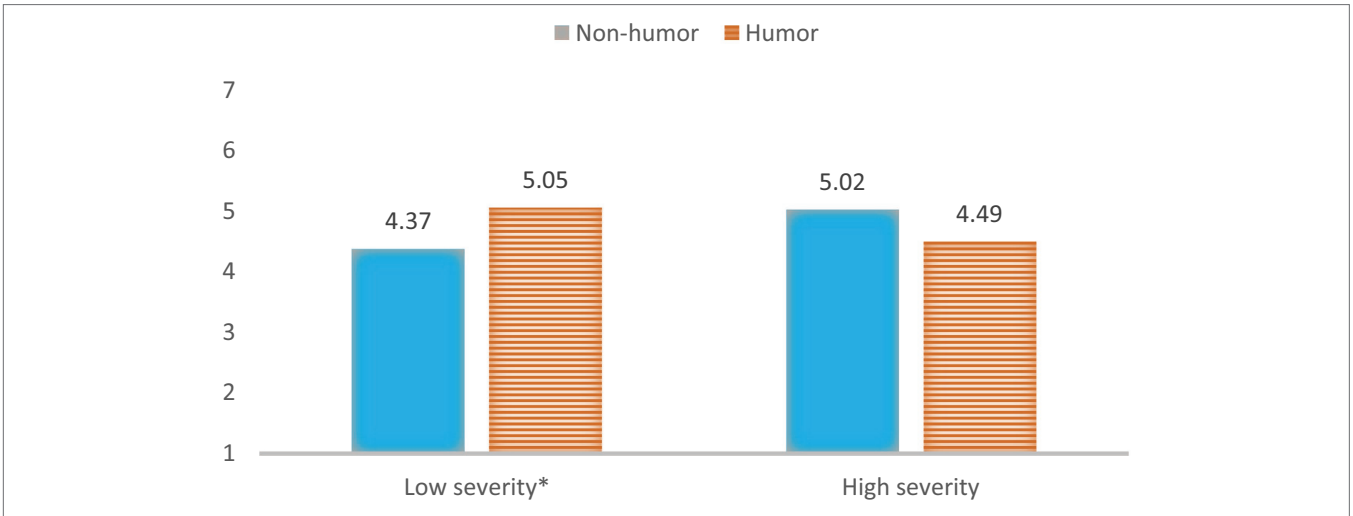

FIGURE 2 | Interaction of message framing and crisis severity phase on online engagement intention.

SD = 0.24) in a high-level crisis severity phase ($p = 0.08$). However, when participants were told the video was from a low severity crisis scenario, no significant difference was found ($p = 0.50$, see **Figure 3**).

Additionally, an ANOVA analysis was also conducted to test the moderation effect of humorous framing and IDO severity phase on source likability controlling for participants' gender and age. The results revealed a significant moderation effect of a humorous message and severity phase on source likeability [F (1,133) = 4.38, p = 0.004, η^2 = 0.032, power = 0.57, see **Figure 4**]. Specifically, the humorous message (M = 5.67, SD = 0.20) led to higher source likeability than the non-humorous message (M = 54.81, SD = 0.20) in a low severity condition ($p < 0.01$, see **Figure 4**). However, in the high severity condition, no significant difference in offline engagement was found between a humorous and a non-humorous message on source likability ($p = 0.93$).

And also a significant moderation effect of a humorous message and severity phase on perceived risk [F (1,133) = 5.45, p = 0.021, η^2 = 0.039, power = 0.65, see **Figure 5**]. The test suggested that the humorous message (M = 4.65, SD = 0.24) decreased perceived risk more than the non-humorous message (M = 5.90, SD = 0.24) in a high severity condition ($p < 0.001$). However, in the low-level crisis severity condition, we observed no significant effect of a humorous (vs. non-humorous) message on perceived risk ($p = 0.61$).

DISCUSSION

Principal Results

The current study revealed the effectiveness of using humor on social media to communicate the need for social distancing for infectious disease, and how the effects of humor are

FIGURE 3 | Interaction of message framing and crisis severity phase on offline engagement intention.

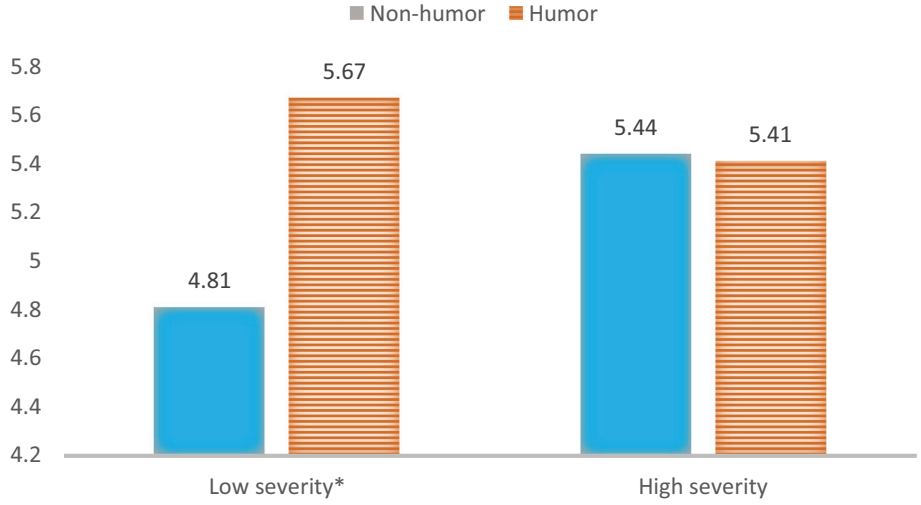

FIGURE 4 | Interaction of message framing and crisis severity phase on source likability.

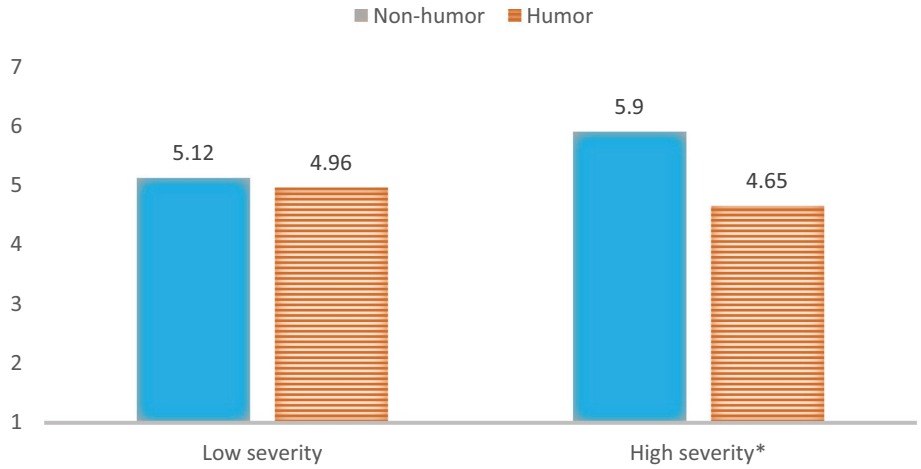

FIGURE 5 | Interaction of message framing and crisis severity phase on risk perception.

moderated by the phase of the crisis. The results of this experimental study conducted during the first weeks of the COVID-19 pandemic in China demonstrated that the severity of the current phase of a health crisis can significantly affect stakeholders' online and offline responses to the disease on social media.

More specifically, in a low severity phase, a humorous (vs. non-humorous) message leads to increased individual's online intentions, and no significant interaction effect was found in a high severity phase. Whereas in a high severity phase, humor reduced individual's offline engagement intentions. Through a decrease in perceived risk, no significant interaction effect was found in a low severity phase, which means H1 is partially supported.

Additionally, in a low severity phase, a humorous (vs. non-humorous) message leads to increased source likability toward the message, and no significant interaction effect was found in a high severity phase (H2 supported). Whereas in a high severity phase, humor reduced individual's perceived risk, and no significant interaction effect was found in a low severity phase (H3 supported).

Theoretical Contributions

The current research makes several contributions to the research on the use of humor in crisis and risk communication. First, we considered the dynamics of the infectious disease severity phase when discussing the use of humor in communicating about an infectious disease. The results illustrate the boundary conditions for the effects of a humorous message on individuals' online and offline engagement. The CDC's "Zombie Apocalypse" campaign on social media showed humor only has limited effectiveness in spurring online engagement such as liking and sharing behaviors to help quickly spread the medical information, and it did nothing to help motivate more protective action offline (Fraustino and Ma, 2015), while Skurka et al. (2018) demonstrated that a humorous video can help to produce greater offline climate change mitigation behavioral intentions through increased perceived humorousness. We revealed that in line with Fraustino and Ma (2015), humor can motivate both more online engagement intention, however, it works only when the crisis severity phase is low. When crisis severity soars, a humorous message would decrease an individual's offline protective action. This is consistent with previous research that suggests humor is more desirable in crisis communication when the crisis is not severe (Vigsø, 2013; Kim et al., 2016; Xiao et al., 2018). When the crisis becomes severe, the public prefers objective facts and information, rather than emotion-arousal manipulations of the message (Claeys et al., 2013; Xiao et al., 2018, 2019). Going beyond previous research, this study recognized that crisis severity changes in different phases of the spread of an infectious disease (Jin et al., 2018), thereby providing actionable strategy selections for crisis practitioners in a dynamic communication environment.

Second, we revealed using humor in communicating information about an infectious disease can enhance the spokesperson's likeability in a low severity phase. This is in line with the results of past research that individuals tend to associate peripheral humor with the spokesperson and transfer positive emotional responses to the spokesperson when they are only marginally involved in an event (Zhang and Zinkhan, 1991). Social media channels are known to be a relatively interpersonal and informal mode that provides a more natural context to speak with a conversational human voice (Kelleher, 2009). Humorous responses may confer more likeability because presenting the information in a playful manner shows the public a more human side of an organization.

Third, the negative side of using humor in communicating an infectious disease appears in severe crisis phases, as it then decreased the public's perception of risk. This confirms the findings of Skurka et al. (2018) that humorous public announcement messages decrease individuals' perceived risk through reduced anger and fear. Unfortunately, individuals' anger and fear are essential in increasing risk perception and

preventive behaviors (Oh et al., 2020). Therefore, the relief function of humor plays an undesirable role in this situation, and a non-humorous message without any emotion-arousal manipulation is more favorable for this period.

Managerial Implications

The findings of this research also have several managerial implications. According to the RAMS model, specific response planning and communication priorities should be integrated based on the current phase of an infectious disease (Vijaykumar et al., 2015; Jin et al., 2018). There is the potential to fruitfully use humor in the preparedness and recovery phases of an infectious disease outbreak. The different timing of the peak of a widespread pandemic in geographically distinct locations creates a short window of response opportunity for late-affected areas (Nesbitt et al., 2020). For those areas that are in a less severe stage, humor may help to spread the message regarding the correct protective action rapidly and thus save lives. Similarly, after the outbreak of the disease, humor may help to remind the public how to live with the virus in the recovery phase. Public health information officers and communication practitioners need to timely communicate the accurate IDO information and meanwhile be prepared with framing strategies that can help the information widely spread at each IDO phase.

In addition, scientists and professionals working in health departments (e.g., CDC and state health department) face limits when an infectious disease hits (Jin et al., 2018). Scientists and experts have found that using humor can help them to elicit more engagement through enhancing perceived expertise, but not likeability (Yeo et al., 2020). However, based on this research, non-professionals (e.g., mayors, village/community leaders, and popstars) can potentially use humor for likeability and use that to call for more effective engagement in a low severity phase.

Third, as social media continues to play an increasingly important role as a "social amplification station" to shape the public's perception of risk (Kasperson et al., 1988), humor should be used cautiously when the risk threat of a crisis event must be amplified—for instance when an infectious disease outbreak becomes severe. In such cases, the provision of objective facts without a humorous slant should be more favorable.

Limitations

Although this study provides both theoretical and practical implications on the effectiveness of humor in communicating an infectious disease, it is not without limitations.

Firstly, we tested only one humorous framing style (aggressive humor) and one intensity level of humor in our stimuli. Given that different humor framing styles and intensities may affect the effectiveness of a message (Meyer, 2000), future research should examine more humor styles (e.g., self-deprecating) and compare the effects of different intensities of humor.

We also conducted the experiment during the COVID-19 pandemic, so individuals' actual experience of the risk in different places may have affected their sense-making of the humorous message. Future research should conduct a field experiment and include more participants from different places with different risk threat levels, and discuss how different risk levels affect the effectiveness of humor in communicating about an infectious disease.

Thirdly, in this study, we manipulated severity by presenting different numbers of cases, which was not in accordance with previous severity manipulations (e.g., Xiao et al., 2018). Note that this study was conducted 2 weeks after the outbreak in Wuhan. At that time, the number of cases could suggest how serious the situation was. However, the number of cases can also imply susceptibility. Therefore, future studies may manipulate severity in different ways to if such effects exist when susceptibility is controlled for.

Last but not least, the sample size of this study is relatively small. This may result in increases the likelihood of a Type II error and produce inconclusive results. Therefore, this study may serve as a pilot study to examine the effect of humor in health-related crisis communication. Future studies are needed to see if the findings obtained from the current study could be replicated.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Tianjing University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

YX and SY contributed to conception and design of the study and wrote the manuscript together. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.887744/full#supplementary-material

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The Role of Denial in Vaccine Skeptics and "Anti-vax" Blame: A Psychodynamic Approach

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In this paper, we propose to account for the blame addressed to vaccine skeptics and "anti-vax" (VS and AV) by considering their attitude as the result of the psychological mechanism of denial, understood in a psychodynamic manner. To that effect, we draw on a secondary account of our clinical experience in two hospital units (psychiatry and intensive care unit), and on openly available media material. First, we lay out how VS and AV can be understood as the result from fetishist risk denial, a specific psychological transaction with an object by which VS and AV people feel intimately protected; this object is viewed as so powerful that its protection makes the vaccine appear irrelevant. Second, we show how this mechanism can explain the specific content of the blame frequently addressed to VS and AV, who are reproached with being selfish by vaccinated people and caregivers. We contend that, contrary to common belief, they are thus blamed because they force others (and especially caregivers) to compensate their lack of self-protection and preservation, which derives from their exclusive relation to an almighty object. While such a relation accounts for the unwillingness to consider vaccination, it also explains the harshness of the blame voiced by caregivers, who feel helpless in most situations as they cannot effectively force VS and AV to take care of themselves and others.

Keywords: denial, vaccine skepticism, anti-vax, COVID-19, fetishism, risk perception, selfishness, self-preservation

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INTRODUCTION

One of the most frequently blamed groups during the COVID pandemics is the heterogeneous set referred to as vaccine skeptics and "anti-vax" (hereafter VS and AV). Amongst vaccinated people and caregivers, many feel that this blame is justified: their attitude increases the risk of contagion, while overburdening the healthcare system. Yet, as Bouguettaya et al. (2022) have stressed, blame in a context of pandemics affects relationships, promotes devaluation of caregivers, and prompts discrimination: it is thus necessary to account for the emergence of blame, in order to devise alternate responses to vaccine refusal. This is crucial in France where vaccine acceptance rates have been very low (Sallam, 2021).

Blame could thus be fruitfully understood and circumvented by understanding vaccine refusal. Schmitz et al. (2022) have recently explored vaccination motivation. Correspondingly, research has

shown lower socio-economic status, education, distance with the government (Paul et al., 2021) and political affiliation (Fridman et al., 2021) to predict vaccine refusal. Some the most important determinants of uncertainty and unwillingness to vaccinate appear to be strong mistrust of vaccine benefit and concerns about unforeseen side effects (Paul et al., 2021).

While Goldberg (2021) has stressed the importance of a psychiatric approach to anti-vax attitudes, a specifically psychodynamic perspective hasn't yet been explored. The goal of such an approach would be to flesh out be a non-informational, non-cognitive process underlying vaccine refusal (Hornsey et al., 2018). We thus propose to address vaccine skepticism and refusal through the psychological mechanism which we believe underlies it: denial. We believe it can shed light on the blame often addressed to VS and AV, and especially on its content (that of "being selfish"). To that effect, we draw on clinical practice in the Psychiatry and Intensive Care Units of a French University Hospital during the COVID-19 pandemics, and on media posts and declarations. Our data did not need ethical clearance, as it was a secondary account of our experiences in healthcare.

Denial as a Psychological Determinant of Vaccine Skeptics and Anti-vax Attitudes

One empirical feature in the attitude and behavior of VS and AV people encountered in our hospital units is particularly recurrent. Generally, when discussing vaccination status, they explained that they (or their children) didn't need the vaccine because something else was already protecting them so effectively that it made the vaccine irrelevant. This is consistent with the correlation between COVID-19 vaccination willingness and perceived vaccine effectiveness (Wake, 2021).

Some felt protected by their religious faith or spirituality; that is, by a close relationship with an almighty figure. In the Intensive Care Unit (ICU), the pious family of a deceased young man were astonished that he had died in spite of his strong faith–as though faith was a protection from contagion. A patient in the psychiatry unit said that as a healer, her contact with the energies of life protected her from catching the virus, thereby making vaccination irrelevant.

Most of these people presented no additional signs of delusional behavior or beliefs; this is not to say that their belief in a stronger protection is in itself delusional, or the sign of a delusion. Correspondingly, they knew perfectly well where to find medical information about the disease; most were well aware that many had died from it. Thus access to and knowledgeability about medically relevant information was not the explanation for their vaccine attitude, which is consistent with research showing that vaccine attitude isn't influenced by medical information availability (Fridman et al., 2021). They had no problem acknowledging the severity of the disease, but felt they were protected from the virus by their connection with a stronger force; they behaved as though carrying a charm-laden talisman.

A psychodynamic approach to denial (Freud, 1940; Fain, 1971; Braunschweig and Fain, 1975) sheds light on such attitudes: we contend that they display a fetishist stance (Fain, 1971), which aims to enable the individual to deny that he is at risk. The word "fetish" comes from Portuguese language, and was initially used by colons referring to practices witnessed in African tribes, where a specific item was used as a protection against bad spells and dangerous encounters. The item is endowed with magical powers coming from a particular source (spirit, etc.), with which the fetish connects the individual, who becomes protected in return by the source. In a psychodynamic approach, fetishism refers to a specific psychological mechanism drawn upon by the individual presented with, or envisioning, traumatic events (harm, death, etc.) which trigger anxiety. Faced with a traumatic perspective, some individuals engage in fetishism. Fetishism is a specific psychological transaction, akin to a pact (Braunschweig and Fain, 1975 talks about a "community of denial"). Its terms are the following: if the individual unconditionally and exclusively acknowledges the power of a specific object (cause, group, deity, etc.) which presents itself as an absolute protection against harm, then the object will share with him in return some of its protective power, through a fetish that represents this power. This pact will allow the individual to deny that the initially perceived risk should be a source of anxiety. For example, in the example above, which displays a fetishist stance with respect to faith, the acknowledgment of God's power is rewarded by His protection–a fraction of His power is granted to the individual. Engaging in fetishist denial creates a splitting in one's mind (Freud, 1940; Fain, 1975): the risk is both initially perceived, and subsequently dismissed on grounds of the object's acknowledged power. Thus, as opposed to "COVID-phobia" (Dilbaz et al., 2020; Nazlı et al., 2022), or "Fear of COVID" (Ahorsu et al., 2020), denial will not result in strong emotional reactions as its goal is precisely to silence the initial perception of anxiety which caused them.

It should thus be borne in mind that:

1. The psychological function of the fetish is to protect the individual against the anxiety triggered by the perception of potential harm or risk (contagion, death, etc.), by enabling the denial of this perception. [Denial is a defense mechanism–on the relevance of defense mechanisms (cf., Malan, 1982; Plutchik, 1995)];
2. The acknowledgment of the object's power needs to be exclusive and without restriction. Ignoring this condition will lift off the object's protection.

Importantly, the object which appears powerful or almighty is referred to in such abstract terms in psychodynamic theory because, as mentioned earlier, it doesn't have to resemble a person–as could be the case with, say, an object of worship. Truth, as an object of knowledge or conviction, can be the object to which the individual believes he is intimately connected. Being convinced of this connection, he feels he can recognize as evidence of his belief signs overlooked by people who lack his conviction. Such signs function like fetishes, assuring him that his belief ("I am protected") is true, and that his knowledge helps him see through dubious discourse. The fetishist relation to the object thus feeds denial by legitimizing the ignorance of facts that run contrary to the individual's belief (such as "the virus exists, and it has killed X thousand people"). The individual engaged in fetishism takes people who hold these facts true to simply lack his privileged access to truth, which makes those facts appear dubious in contrast. In cases when the object

is truth, almightiness takes the form of infallibility. Fetishism thus provides a potential psychological mechanism underlying many versions of explicitly "anti-vax" conspiracy theory speech, which frequently displays a conviction of absolute certainty; it also accounts for the oft-highlighted connection (Poupart and Bouscail, 2021), and even prediction, of VS or AV attitudes in the presence of prior adhesion to conspiracy theories (Al-Jayyousi et al., 2021; Nazlı et al., 2022).

This psychodynamic approach to denial sheds light on the claim, voiced by many VS and AV (even on their deathbed!), according to which the vaccine isn't safe enough. At first, it sounds paradoxical: statistically speaking, refusing vaccination is much more risky, in spite of the very rare potential secondary effects of the vaccine (upon which VS and AV are often well-versed). But this benefit-risk ratio approach misses the point of the fetishist attitude, which is to enable the denial of any risk of contagion and its consequences. Considering vaccination entails that one has acknowledged the risk of contagion, and foregone the belief in an almighty protection instead of denying the risk and the subsequent need for protection. Therefore from a fetishist standpoint, considering vaccination triggers an anxiety specifically associated with the absence of an almighty protection: it is this anxiety which the fetishist seeks to deny by relying on his fetish.

Understanding the VS and AV attitude as a fetishist choice enabling the denial of COVID-19-related risks could account for the content of lots of the blame directed toward the VS and AV: they are often reproached with being selfish.

Vaccine Skeptics and Anti-vax Fetishist Risk Denial Accounts for the Social Blame of Selfishness

A psychodynamic approach allows to understand the blame of selfishness as an effect of the VS and AV fetishist risk denial on vaccinated people, and especially caregivers.

A brief examination of samples of empirical material, such as media coverage (including blogs, op-ed columns, etc.), shows that VS and AV are quite often blamed with being selfish. French writer and blogger Sagalovitsch chose to name a 2021 Slate blog post "The selfishness of non-vaccinated people will long be remembered" (Sagalovitsch, 2021). British TV host Piers Morgan went for a slanderous Twitter comment: anti-vaxxers are "selfish pr*cks" (Evans, 2021). Even always-diplomat Spanish tennis champion R. Nadal said that AV seem "a bit selfish" (Kershaw, 2021). This blame always follows the same initial statement: they only think about themselves (Deray, 2021; Evans, 2021; Sagalovitsch, 2021), in that they do not seem to realize that their behavior puts others at risk.

Their behavior was deemed selfish for another reason. Past the contagion stage, COVID-19 patients prevented many vaccinated people in need of medical care from accessing it, either in specific hospital services re-allocated to COVID patients (e.g., neurology units becoming temporary COVID units) or in ICUs, where COVID patients had an almost systematic priority over other patients. As a consequence, lots of vaccinated people whose medical care was hindered by the pandemics considered that VS and AV should face the consequences, for example, with direct financial penalties (Green, 2022). It is this perceived lack of responsibility for their non-vaccination that triggered the blame of selfishness amongst vaccinated people: in essence, VS and AV were experienced to behave in a non-reciprocal, unfair manner.

This perception of selfishness is echoed by doctors, who frequently view VS and AV as selfish and irresponsible. Deray calls them a symptom of a disease of selfishness (Deray, 2021). French diabetologist Grimaldi has stated that VS and AV should be consistent with their vaccine refusal, and state in their advance directives whether they wish to be medically revived in case of severe forms of COVID-19 (Grimaldi, 2022). Both stressed that VS and AV represent a threat to social justice and fairness, by forcing to prioritize which patients should taken care of first, especially in ICUs. In spite of official information displayed at the beginning of the pandemics, COVID-19 patients whose condition worsened and required intensive care had a *de facto* priority over patients requiring ICU admission for other reasons. They would also have a longer ICU stay (at least a few weeks). Patient selection became a pressing concern (Lecouvé and Zagdoun, 2022), and relations between hospital units became more tense: ICUs had to refuse many admissions because of a COVID-19 overload. In this context, ICU caretakers have often said that, in spite of the Hippocratic Oath, it was very hard for them not to perceive VS and AV as selfish: not only do they ask for the same medical care as people who do get a vaccine (while they don't)–they also have ICU priority over vaccinated people in need of care for other reasons, when their condition worsens because of a COVID infection.

Additionally, at a time where the medical caretaking system was close to breaking point, imposing an extra burden on it was perceived in a particularly negative manner by both caretakers and vaccinated people in general, with the latter publicly expressing a deep identification and gratitude to the former.

While "media framing" of the blame is a reality (Court et al., 2021; Bouguettaya et al., 2022), it is the inconsistency of VS and AV that vaccinated people and doctors put forward when explaining the blame of selfishness. They perceive VS and AV to rely heavily on the responsibility of vaccinated people to protect themselves and others, while at the same time denying the relevance of the vaccine. It's as though they said to vaccinated people "if others are doing it, why should I"?

A psychodynamic standpoint on denial can account for this perceived inconsistency, which is at the root of the blame of selfishness. Contrary to what vaccinated people believe, a person engaged in fetishistic denial does not avoid vaccination because they intimately know or hope that, in the end, they will be taken care of by others. This would entail that the fetishist does not really believe in the almightiness of their object–that is, in its absolute protection. It is quite the contrary: fetishists feel so deeply bound to their object that they genuinely believe it fully protects them. Hence their surprise when being contaminated, and their reactions to the care provided by ICU teams: they often say that it is, e.g., their belief that saved them, not the doctors; or that they see no reason to get a vaccine, even after their stay in the ICU.

While this attitude is more consistent than vaccinated people and caretakers believe, it also shows that VS and AV are not selfish, in the usual sense of the term–i.e., egoistically

thinking of their own interests first (safety, etc.), or anticipating subsequent external help. On the contrary, the main effect of the fetishist denial used to avoid anxiety is a perverse effect, of which they are the first victim: their prior acknowledgment of the object's almightiness effectively put them at risk of contagion, while preventing them to realize it (doing so would question its unquestionable almightiness). In other words, a direct implication of fetishist denial is the lack of any action ensuring effective self-protection by means external to the almighty object (cf. part 1); this is shown in the post-ICU above statement that there still is no reason to get a vaccine. If the fetishist conviction is that the object requires display of belief in exchange for protection, then they will engage in effective ritual practices; but they will do nothing referring to another source of protection. While this attitude does result in exposing third parties to contagion and adds constraints to the healthcare system, it is essential to understand that the person engaged in fetishist denial is the first potential victim of his effective lack of self-preservation.

This understanding rules out blaming VS and AV for being selfish in the usual sense of the term, but it accounts for the blame of selfishness voiced by vaccinated people. The fetishistic lack of self-preservation out of the perimeter of the requirements of the pact with the object forces vaccinated people and caregivers to decide whether or not to compensate this lack by effectively protecting the VS and AV, when faced with their risk-taking behavior–or to partake in their denial of the actual risk. We believe that the blame of selfishness is a psychological effect of the VS and AV's lack of self-preservation and unwillingness to protect themselves, on the vaccinated people and the caregivers–who are engaged in the protection of themselves and others. VS and AV are felt to be selfish because their risk-taking attitude forces others to decide whether to care for them, while displaying an open disbelief in medical protection (which differs from that of their specific object).

The harsh tone of the blame of selfishness could come from the helplessness of vaccinated people and caregivers. While such risk-taking behavior forces them to decide whether to compensate the lack of self-preservation, they are put in a position of double-bind (Bateson et al., 1956) or paradoxical injunction (Racamier, 1973; Anzieu, 1975): it is neither in their power nor in their rights to enforce vaccination (at least in France). And since caregivers in such situations obviously cannot either, for ethical reasons, enforce vaccination by threatening to condition access to care, they are left without any external means of pressure to steer VS and AV toward a safer behavior [In this light, Grimaldi's (2022) request for explicit advance directives can be understood as a reaction to this helplessness].

CONCLUSION

Blame isn't the solution to address VS and AV rhetoric and concerns. The WHO has underlined the need to deconstruct the strategy of vocal vaccine deniers when facing them, in particular by telling the truth and not denying the limits of medical knowledge and care (World Health Organization, Regional Office for Europe, 2017).

We believe that the above considerations could contribute to interactions between caregivers and VS and AV patients, and to social interactions during a pandemics. By specifying the type of anxiety against which VS and AV want to protect themselves at the individual level, this research can help devise non-stigmatizing, blame-free responses at the institutional level. It could thus contribute to psychodynamic approaches to health policy and implementation which address how to respond to social anxiety on public health issues (Walsh et al., 2016).

To that effect, our psychodynamic hypothesis regarding the origin of the blame in individual fetishist denial (which we believe is partly confirmed by the blame of selfishness) should be tested within a more systematic, qualitative empirical research. The main question of this research would be: what individual factors trigger denial in the context of vaccination in certain people, but not in others–in both one's life history and one's actual environment? This research could provide different types of life trajectories of VS and AV, combining individual, social, and political (Ward et al., 2020) factors into typical profiles of denial.

AUTHOR CONTRIBUTIONS

OP conceived the manuscript structure, devised the argument, provided the clinical material, and wrote the manuscript. JH contributed to the manuscript structure and to the argument and provided the clinical material. Both authors contributed to the article and approved the submitted version.

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Communication Mechanisms and Implications of the COVID-19 Risk Event in Chinese Online Communities

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Based on the context of communication and use of online communities in China, this study explored the characteristics and defects of risk communication of the government and official media in the event of COVID-19, as well as the factors that affected people's perception of the risk and protective behavior. The following results were found: (1) The government and official (mainstream) media accounts suffered from information lag in the early stage of COVID-19, while self-media accounts played the role of risk sensors, which caused people to have less trust in the government and the authorities and turn to the truth on self-media accounts. However, the low accessibility of self-media accounts and the imperfect check mechanism provided a hotbed for rumors, which further led to more fear and worry about risks. (2) During the middle and later periods of COVID-19, the government and the official media began to pay attention to the influence of self-media on peoples' emotions and behavior, and gradually improved the supervision of online information and the operation of official media accounts. This is intended to achieve information consistently and link mechanisms between official media and self-media to prevent and correct mistakes, as well as to achieve effective risk communication of information transparency, opinion exchange, and public sentiment stabilization.

Keywords: uncertainty, risk communication, risk perception, COVID-19, propagation mechanisms

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BACKGROUND

On 30 January 2020, the WHO declared COVID-19 a public health emergency of international concern (1), and the global community continues to struggle with the risk today as the virus continues to mutate. This risk event has had far-reaching health and economic impacts across the globe, resulting not only in a severe death toll but also a range of social and psychological responses (2).

It is indisputable that the public's risk perception cannot be separated from the media's construction and discourse of risk issues. The most important media include traditional media, social media, and interpersonal communication channels. However, the media's reporting and communication frameworks are inevitably affected by the values, organizational constraints, or degrees of expertise of the communicators, which may lead to a lack of objectivity and accuracy, thus affecting the risk perceptions of the people receiving the information. When sudden risks and crises occur, timely news coverage is crucial. People rely on the media to obtain timely, up-to-date, and important risk information to prevent exposure to risks (3). A study by Frewer et al. (4) points out that professional news reporting may also trigger associated secondary risks during risk communication, but governments responsible

for risk management and communication often fail to recognize or properly address the problem. This can lead to increased reporting of risk events and the resulting public outrage without providing any support for risk resolution.

The Internet and social media have quickly become a major source of public information for risk and behavioral response. Any organization or individual can take advantage of the rapid dissemination and imperfect censorship of the Internet to publish their observations and opinions with the intention of gaining more recognition, attention, and even benefits. As Beck (5) argues regarding the nature of communication in modern risk societies, no one can claim to be an expert on the characteristics and hazards of risk, but everyone can assume expertise by constructing and interpreting risk based on their own experience and understanding.

Based on the communication characteristics of different media, governments have the responsibility to release risk warnings, assessments, and prevention information to the public in a timely manner when a risk event occurs, to prevent or correct wrong information to ensure the effective and accurate dissemination of risk information and social stability, and to avoid social panic and overreactions by the public. Huang (6) found that when the government takes a proactive response and conducts effective risk communication with the public when a crisis event occurs, it can effectively reduce the occurrence of unnecessary risks. The same conclusion was obtained by Su and Chen (7). Fetzer et al. (8) confirms that a government's response to risks and coping strategies can affect people's risk perception and feelings. If a government's response to risks is insufficient, it will cause a more negative emotional response from the people, which hinders risk management and response and even make the scope of influence of the risk event wider and more harmful.

Considering that the public is the direct victim of risk events, their risk perceptions often show more complex dynamics in the diverse discussions of experts, governments, and media, and the perceived risk attributes and risk hazards will affect its behavioral responsiveness and risk management measures.

From this background, this research proposes the following research questions:

Research question 1: What was the risk communication role of official media accounts vs. self-media accounts in the early stages of the COVID-19, and what were the characteristics and differences?

Research question 2: What were the omissions and remedial measures in risk communication and management by the official media during the risk event?

Research question 3: What are the characteristics of public perceptions of risk emergencies and what factors influence them?

In response to these questions, this study argues that reflections on the early communication mechanism and mid- and late-stage management practices of risk events can provide important reference points for effective risk management and public communication in the future.

RISK COMMUNICATION AND PERCEPTION

Risk is a complex concept with multiple attributes, with uncertainty as its main characteristic (Beck, 1992). Uncertainty represents a sense of possibility or likelihood (9), which refers to the probability of occurrence, the time of occurrence, the consequences of risk, the scope and magnitude of impact (10), and the factors that cause it (11, 12) and the uncertainty of people's ability to cope with the risk (11, 13). These can include natural, social, political, economic, and technological risks.

Beck (1992) sees risk as a part of social culture, which represents not only a cognitive system but also a high degree of uncertainty and artificial constructs, representing a potential threat and disaster. Babrow et al. stated in their problematic integration theory that people will experience uncertainty, and the related awareness and behavior will be biased when the details of a problem situation are vague, complex, unpredictable, or presented as probabilistic events when there is a lack of necessary cognitive information or inconsistent information content, and when people feel unstable and unbalanced about their knowledge state or the overall knowledge state (14). Therefore, the communication and management of risk must be based on the premise that these uncertainties can be effectively assessed and managed (15).

Moreover, common people's perception of risk and their behavioral decision paths are often different from those of scientists, who are not only guided by the framework of media reports, or influenced by more subjective aspects, such as values, psychology, emotions, and interpersonal communication. At the media level, the media-system dependency theory states that in times of risk crises with high uncertainty, the public increases its reliance on the media and tends to use media they perceive as trustworthy for risk assessment and risk response advice (16) and that the degree of trust people place in different media can significantly influence people's emotions and risk perceptions.

Although previous studies have generally confirmed the influence of traditional media (17) and interpersonal communication (18), including television, newspapers, and magazines, on people's risk perception, the popularity of the Internet and the rapid development of social media have become an important channel for people to obtain risk information (19). Previous studies showed that during the MERS outbreak in Korea, social media became the main channel through which people obtained information about the risk. The more often they were exposed to social media, the more they perceived the risk as having high threat and susceptibility (20).

Similarly, in the COVID-19 outbreak, the Lancet (2020) reported that social media was one of the main sources of timely COVID-19 risk information for the population. However, it has also been shown that during the epidemic, the public's trust in traditional media, especially television, rebounded and they were particularly inclined to obtain risk information from traditional media (21).

Ning et al. (2) stated that, in unexpected risk events like COVID-19, the consistency of risk information disseminated by

different media channels is crucial for people to correctly perceive and respond to risks. However, during the COVID-19 pandemic, due to the novelty of the risk and the slow pace of scientific research on its causes and prevention, there has been an influx of (sometimes contradictory) risk information and misleading news in traditional and social media (22, 23). Misinformation on how to prevent and combat misinformation about this risk is also proliferating, posing a serious obstacle to individual health management and social risk governance (24). The analyses and studies of the health status of the population during this risk event in different countries have confirmed that, due to the lack of knowledge about the new risks (25), the reduced social connectedness (26–28), and other factors, people generally show negative emotions such as fear, anxiety, and worry (29).

In terms of the correlation between emotion, risk perception, and behavior, the risk as feeling hypothesis suggests that people follow both cognitive (rational system) and emotional (empirical system) paths when making risk assessments and that emotions generally exert more influence on subsequent attitude formation and behavioral decisions (30). Risk communication has long used fear appeals to arouse people's attention to specific risks in order to guide them to adopt the right behaviors to reduce risk harm.

Risk communication scholars have further examined the dialectical relationship between fear emotions and people's risk perceptions and behaviors and found that, on the one hand, fear can raise the importance of risk issues (29) and help motivate risk-responsive behaviors (31), while on the other hand, if fear is too strong or persistent for a longer period of time, people tend to lose control over managing risk or tend to question the effectiveness of preventive behaviors (32, 33).

Ramkissoon and Smith (34) and Van Bavel et al. (35) suggest that fear appeals are effective in motivating risk coping behaviors only when people are given a strong sense of efficacy (e.g., their ability to reduce or combat risk). Ramkissoon (26–28) also demonstrated that discussions among friends and family about issues related to the risk of a COVID-19 can alleviate people's negative emotions caused by risk uncertainty. In addition, a stable or positive emotional state is more likely to facilitate individual and collective action to ultimately reduce the risk of harm. Therefore, instead of discussing whether negative emotions can stimulate people's risk perceptions and behaviors, we should instead explore the information dissemination mechanisms that influence people's emotions or risk perceptions, and how to stabilize people's emotions to achieve effective risk communication and management.

Given the complexity of common people's risk perception and behavior, some scholars suggest that all stakeholders must, based on a full understanding of the characteristics of risk and the characteristics of the public's risk perception, communicate and interact promptly and effectively with each other regarding the existence, nature, formation, severity, affordability, and other relevant messages of risk. The aim is to inform people about the characteristics of risks and any preventive measures and increase their awareness, thereby reducing the negative psychology of fear, powerlessness, or numbness (36–38). Stabilizing people's emotions to guide their individual or collective actions to mitigate risks requires mediating conflicts between stakeholders and developing more specific and effective risk management strategies (37). In other words, effective risk communication should present all risk-related information and share it promptly with participants in all aspects of risk communication to correct the knowledge and bridge the experience gaps between experts and the general public's risk perceptions (39).

It is important to understand the media's risk communication mechanism and how the general public perceives risk. Zhang et al. (40) adopted a "risk message-centered" approach to observe and discuss the relationship between the government, media, and the public during the COVID-19, and found that the government and media disseminated risk messages with ambiguous rhetoric and reporting at the early stage of the epidemic, which influenced the public's correct perception of risk facts and, to a certain extent, contributed to the spread of rumors thus increasing panic.

Malecki et al. (41) use perceptions of the general public as a starting point to explore effective risk communication strategies and principles in the modern social media era from the perspective of "danger plus anger". Christensen and Lægreid (42) analyzed the Norwegian government's communication practices and reputation management performance in the context of the fight against the epidemic from a "crisis communication" perspective. Studies that analyze risk transmission processes and effects through a social trust approach generally confirm that, when individuals trust the government or risk management units, they have lower risk perceptions and are calmer about risk, therefore tending to perceive the risk as manageable (43). In this case, the public is more likely to comply with relevant prevention measures (44).

Conversely, when individuals have less trust in government, scientific reports, and medical professionals, they perceive the risk as highly threatening and are prone to more negative emotions, and may refuse to comply with risk prevention and control measures (45). The "individual perception-action" path (e.g., mental models), which focuses on the factors that influence individual risk perceptions and their behaviors, as well as their influence on the process and effectiveness of risk communication, aims to emphasize the need to fully understand the psychological, emotional, and behavioral dimensions of the public in the risk communication process. The "cultural identity" path (e.g., social network infection), is intended to show that people's risk perception, assessment, communication, and behavioral responses are potentially and profoundly influenced by sociocultural factors such as ideology, values, and ethical norms of the society they live in Huang (46) and Zhang and Ran (47).

With reference to the above-mentioned literature and research paths, this study analyzes the early risk communication mechanisms of COVID-19 by official media accounts and self-media (In China, self-media refers to independently operated social media accounts - on platforms such as WeChat, Weibo, and other smaller ones - usually run by individual users.) accounts in Chinese online communities, investigate the factors that influence people's risk perceptions and preventive behaviors toward COVID-19, and compare the risk communication mechanisms with those of other countries in order to draw more comprehensive and generally applicable effective risk

communication experiences, and thus improve the ability of the Chinese government and media to respond to unexpected risk events and subsequent risk communication and management.

RESEARCH DESIGN

This study aims to analyze the communication performance and role of the Chinese official media in the risk event from the perspective of the characteristics of the risk event and the public's perception pathways, to understand what factors influenced the Chinese public's attitude and behavior during the risk event, and what communication role they played in the process. Based on these issues, this study takes the case study of the COVID-19 in China by first conducting an online text analysis, using the social media platforms Sina Weibo and WeChat as the survey method.

Semi-structured interviews were conducted with Chinese social media users to explore the factors that influenced public perceptions and behaviors during the outbreak. In this way, we explored the role of government, media, and listeners in the risk communication process of COVID-19, and provided references for future outbreaks or potential risk communication.

Method

Sina Weibo is currently the most popular social media and information-sharing platform in China (48). Sina Weibo reaches 523 million active users, with more than 25 million posts per day (Sina Weibo Data Report, 2021), and many official media outlets have set up Weibo accounts to connect effectively with the public. Its usage pattern is similar to that of Twitter in the United States with information mostly disseminated in one direction, and the relationships between users do not start from interpersonal relationships.

WeChat, which has grown and developed based on social relationships, has also increasingly penetrated the daily lives of Chinese people (49). According to official reports, WeChat has over 1.1 billion active accounts (50). Based on its roots in familiar and relatively stable and reliable social relationships, the content posted or shared on the WeChat platform is more easily accepted, trusted, and diffused by the public (51, 52). As China's Xinhua Finance's "Zero Data" monitoring system shows, WeChat groups and WeChat friend circles were the first channels for Chinese people to learn about the COVID-19 (53). On the other hand, Sina Weibo and WeChat are both characterized by their "writing culture" texts, and the strength of their research lies in the authenticity and self-reflexivity of the field, and through the observation of the field, social phenomena and facts can be described in greater depth (54, 55).

Based on the above, the researcher used the early and mid-late stages of the COVID-19 (December 30, 2019, to June 30, 2020; a total of 182 days) as the observation time to collect, organize, and analyze the timing, characteristics, and issues of information released about COVID-19 in the Sina Weibo and WeChat fields. The study then used semi-structured interviews to examine people's perceptions of the COVID-19 and the government's media performance in the online communities with the aim of clarifying the aforementioned online observations and complementing the phenomena and issues not captured by the online observations to enhance the credibility of the study's inferences. Prior to the formal interviews, three respondents were invited to take a test to understand the suitability of the interview protocol and to enhance the sensitivity of the researcher on this topic.

Research Subjects

In this study, Sina Weibo and WeChat were chosen as the fields of investigation. Sina Weibo mainly used the information on the COVID-19 released by the regional health care committees and 18 mainstream media accounts recognized by the CPC Central Committee, including People's Daily, Xinhua News Agency, Quyi, PLA Daily, Guangming Daily, Economic Daily, China Daily, Central People's Broadcasting Station, CCTV, China Radio International, Science, and Technology Daily, China Discipline Inspection and Supervision Daily, Workers' Daily, China Youth Daily, China Women's Daily, Farmers' Daily, Legal Daily, and China News Agency, as the observation sample, in order to obtain the broadcasting and dissemination characteristics of the government and official media on the COVID-19.

WeChat, on the other hand, used three self-media accounts with high visibility, professionalism, and public trust, namely "Ding Xiang Yuan," "Fruit Shell," and "Paperclip," and five self-media accounts with more than 100,000 subscribers, namely "Magic Girl," "Mr. Dennis," "Uncle Guo," "Listen to the Wind," and "Koi Youth," as observation samples to compile the characteristics of social media communication about the epidemic, and to ensure the validity of the information obtained through subsequent interviews with WeChat users.

In terms of recruiting respondents, previous studies have suggested that sociodemographic variables such as gender, education, occupation, and socioeconomic status can have varying degrees of influence on individual risk perceptions and behaviors (50, 56–59). In order to obtain more complete and diverse survey data, the researchers did not restrict the socio-demographic variables of Internet users in the recruitment information. Also, based on ethical considerations, the researcher stated in the recruitment information the identity of the individual, the research question, a summary of the content, the purpose of the study, and the length of the interview required, and stated the measures related to privacy protection. After obtaining respondents' voluntary participation in the interview and signing an informed consent form, a total of 30 respondents were interviewed, of whom 12 were male and 18 were female. Their education level consisted of six completed junior high school, 11 completed high school, and 13 completed university and above. Ages ranged from 20 to 50. Their occupations were University undergraduate and master's degree students (10), teachers (7), housewives (4), media and art workers (6), and industrial and commercial workers (7). Monthly disposable income ranged from 2,500 to 7,000 RMB, and cities of residence were Wuhan (10), Beijing (8), Dalian (7), and Harbin (9).

In the processing and analysis of the interview data, in order to obtain more objective and valid information, after the interviews were processed verbatim, the researcher hired two other researchers to conduct the data coding and analysis, and

triangulation was used to analyze and test the data to increase the reliability of the results (60).

The specific steps to analyze the data by the thematic analysis were: (1) word-by-word key concept extraction, i.e., conceptualization based on the relevance of the interview content to the research questions; (2) primary coding, i.e., grouping the interview data into words/phrases/sentences that have substantive meaning and discussion value, in order to derive further conceptualized information; and (3) spindle coding, i.e., to observe, summarize, and classify the categorized contents again to obtain the recurring core concepts.

RESEARCH ANALYSIS

Communication Performance and Risk Communication Role of Media

The "Information Lag" of Official Media Information Release and the Risk Perception and Warning of Self-Media

From the communicator's perspective, the media, as an important source of information and knowledge broker in the risk communication and management process (61), can be an important channel for the public to obtain information about the outbreak, and for the public to connect with scientific findings, arguments, and recommendations (62). The media not only transmits the basic definition and appearance of risk events, but also participates in the construction, negotiation, and transfer of risks (63), and filters and edits the content of information through the rhetorical and reproductive frameworks of epidemic information and news value principles (64) so that it can be amplified during the interactive communication and feedback processes of different communities (65). This affects the original appearance of the risk event and influences the risk perception of the audience (65).

Based on the statistical data of "Knowing Microdata" and the analytical results of the COVID-19 risk transmission life cycle by Zhang (66), the early transmission development stages of COVID-19 can be divided into five stages: latent period, outbreak period, spread period, dissipation period and reignition period. Focusing on the communication performance and risk communication roles of the government and official media, first of all, during the initial period of the outbreak, from December 30, 2019, to January 15, 2020, the regional health committees and 18 official media on Sina Weibo accounts and self-publishing members in WeChat did not show any information related to the COVID-19, but more regular and positive reports in favor of political achievements. The reports were more routine, with a positive performance and praise types of information. The reason for this is that, on the one hand, China's government and official media have always adhered to a top-down "technical model" of technical risks (8, 37, 67), in which the government and official media tend to take a conservative approach in order to avoid causing panic among the population before scientific facts and responses are known, such as the causes of the risk, specific symptoms, modes of transmission, the scope of impact, preventive measures, and related consequences.

On the other hand, the local government hides the risk for the protection of its own interests or political status, while the official media fails to investigate and understand in a timely manner, and generally follows a state of silence in the face of public opinion. The loss of public opinion monitoring and information verification functions not only results in the failure to disclose information about the COVID-19 to the general public in a timely manner but also causes a serious lack of early warning links in the management of risk emergencies, which damage and lower the general public's trust in the official media and cause a series of public opinion incidents, laying the groundwork for subsequent effective risk management.

For example, in the afternoon of December 30, 2019, the "Wuhan WeChat Group" (pseudonym) began to circulate the internal notice of the Wuhan Health Commission about the discovery of a "pneumonia of unknown origin." The internal notice of the Wuhan Health Commission on the discovery of "pneumonia of unknown origin" was a screenshot of the SARS coronavirus. A WeChat group appeared that night, and the message was forwarded by the self-publishing account "Uncle Guo." Immediately afterward, the first personal microblog about the epidemic appeared on Sina Weibo which warned, "Don't believe in rumors, don't create rumors, don't spread rumors! But because I don't know if it's true or not, I'd like to try my best to prove it, and I hope it won't cause any anxiety to anyone. But the 'Wuhan WeChat group' has gone crazy, so I hope the people who know can come out! Is there really such 'pneumonia' in Wuhan?"

Immediately afterward, two more personal microblogs posted articles to verify the authenticity of the "SARS" outbreak, and WeChat self-media accounts such as "Magic Girl," "Listen to the Wind Wanderer," and "Mr. Dennis" posted information about disease protection. "Listen to the Wind Wanderer" reported on the "recently appeared about the Wuhan infectious disease news, the official has not yet confirmed[…]but to 2003 SARS as a warning, please pay attention to personal protection, reduce cross-city mobility[…]waiting for official confirmation." It was not until the afternoon of the next day (December 31) that the official Sina Weibo account of the Wuhan Health and Wellness Commission released the first information about the pneumonia epidemic, confirming its existence of the epidemic. This was followed by dozens of official media accounts, including China Youth Daily, Beijing Daily, People's Daily, Xinhua News Agency, and Quyi, forwarding the news content. This was the official start of risk information dissemination and management.

In summary, the government and official media failed to provide accurate and clear explanations and reports on the risk event at the early stage of the outbreak, failed to give full play to their active role in risk management and communication, and were in a state of information deficiency and lag, which led to the growth and rapid spread of online rumors. In contrast to self-published accounts, which follow a technological model and attempt to achieve a top-down transmission of technical risk information (8, 37, 67), their dominant function and role in active management and dissemination were undermined by the more timely, transparent and comprehensive self-published reports.

However, the dominant function of proactive management and communication is undermined by more timely, transparent, and comprehensive self-published reporting. From the perspective of individual-organizational relationships and individual cognition-action, as scientists follow the principle of pursuing objective evidence and continuously verifying research results, they publish risk information with a relative lag, which inevitably generates inconsistencies in information or arguments before and after. The public's trust in the government and the official media is subsequently reduced because scientists are pursuing objective evidence and constantly verifying research results. With the public's proximity to online media and the diversified ways of communication and evidence seeking, the relevant informants through their perception of risk factors change their communication role from being passive information receivers set by the government and the media to active risk communicators, alerting possible risk information on social platforms or self-media accounts and quickly spreading and diffusing it in order to draw the attention of the official media from the bottom up, while the official media, in turn, change their role to that of public opinion receivers and passive communicators.

The Linkage of Risk Information Dissemination and Management Between Official Media and Self-Media

On January 20, 2020, the official microblogs of CCTV News, Xinhua Viewpoint, Headline News, People's Daily, and China Daily broadcasted real-time epidemic information in accordance with the instructions of national and local government health and wellness committees, with cases of infection appearing one after another in Zhejiang and Guangdong. That night, CCTV's News 1+1 interviewed Chinese medical scientist and academician of the Chinese Academy of Engineering, Zhong Nanshan, who confirmed that the epidemic was "human-to-human," a statement which contradicted previous statements made by the Wuhan Health Care Commission, which immediately sparked public outrage. On January 21, Zhong Nanshan held the first press conference on the COVID-19 outbreak in Guangdong and clearly pointed out that there is no effective drug against the virus. On January 23, Wuhan was "closed," which led to the global community's attention to the outbreak. On January 21, rumors started to spread on online media platforms, mixing true with false information. On January 28, the official microblog of the Supreme People's Court took the lead in vindicating the eight "rumor-mongers," stating that "if the law is applied mechanically, it is indeed possible to conclude that, given that COVID-19 is not SARS, the Wuhan SARS epidemic has been reported. The emergence of SARS in Wuhan is a fabrication of false information, and the information has caused social disorder, which is in line with the act of fabricating and spreading false information as stipulated by law, and it is justified to give administrative punishment or even criminal punishment. However, it has been proven that although COVID-19 is not SARS, what the information publisher posted was not a complete fabrication. Had the public listened to this 'rumor' at the time and taken measures such as wearing masks, strict disinfection, and avoiding further visits to wildlife markets based on their fear of SARS, it might have helped citizens of Wuhan to better prevent and control COVID-19 today. However, the inconsistency of such statements led to the public's search for the "truth" and the vindication of public opinion across the Internet reached a peak. On January 30, the Hubei Provincial COVID-19 Prevention and Control Command held a press conference in which Jiang Chaoliang, then secretary of the provincial party committee and head of the provincial COVID-19 and Control Command, answered reporters' questions. When asked by a CCTV reporter about the shortage of medical supplies at the Union Hospital, Jiang Chaoliang provided a scripted answer prepared in advance, further stirring up public anger, the online media also scrambled to discuss the matter. On February 3, the Political Bureau of the CPC Central Committee began to punish officials for dereliction of duty, focusing on problems such as "telling lies and reporting false information," "eagerly painting slogans, shouting slogans, and making statements," "reporting good news to superiors but not to the public," "responding passively and ignoring human lives," replacing personnel in relevant positions, and vigorously managing the management ecology of the officialdom.

At around 10:00 p.m. on February 6, a statement from Wuhan Central Hospital reported that Dr. Wenliang Li, who had tried to warn the public about COVID-19, died of the disease. News of his death began to circulate on WeChat's "Ding Xiang Yuan," "Paperclip," and "Fruit Shell" public accounts, as well as several WeChat groups and personal circles of friends. In the early morning of February 7, People's Daily, CCTV News, China News Network, and the official Weibo account of Yao Chen, a well-known film and television actress on the mainland, posted a message: "Expect a miracle," but at around 4 a.m. on February 7, the Wuhan Health Care Commission announced on its official website that Dr. Li had died. The incident immediately ignited public sorrow and anger, inspiring people to "accuse" officials of negligence and dereliction of duty. Subsequently, China's National Supervisory Commission sent an investigation team to Wuhan to "conduct a comprehensive investigation into the issues related to Dr. Li Wenliang as reflected by the public. At the same time, videos of the medical environment of Wuhan Hospital and the admission of cases began to appear on WeChat, TikTok, Weibo, and other platforms, deepening people's fears and causing chaos around the country as they snapped up medical supplies and medicines.

Statistics from "Zhiwei Data" show that between February and March 2020, official media and self-media risk information content on Weibo and WeChat aimed to broadcast the incidence of infections, medical treatments, and the construction of related medical supply and temporary treatment facilities in various regions. At the same time, the platforms also began to focus on the management of online rumors and the establishment of fact-checking platforms.

In summary, it can be seen that the government's management and communication strategy, under the influence of media opinion, gradually became took a corrective direction, accountable to relevant managers, unified in information on various platforms, and unified in content. The government's management and communication strategy, under the influence of media opinion, gradually became a mechanism and management role to correct the direction, hold accountable the relevant

managers, unify the information on various platforms, stabilize public sentiment, and strengthen and improve effective risk management. Even though there are still cases of infection and the epidemic has not yet been truly quelled due to the continuous mutations of the virus and global population movements, media platforms such as TV, official online media accounts, microblogs, WeChat, and other government risk management units can learn from the previous experience of risk communication by broadcasting timely, open, and transparent reports on the risk situation, prevention measures, and management effectiveness, and form a joint online and offline broadcast to correct the content of wrong news.

In general, the government and official media accounts showed a "lag-broadcast-correction-accountability-unification" communication mechanism in the early dissemination and management of outbreaks. The technical model of communication management has led to inconsistencies in the official media's presentation of information about the epidemic, which has reduced public trust and led to a rise in collective negative emotions. However, due to the characteristics of social media, which are highly usable, low barriers to professional entry, immediate, decentralized, dynamic, and fast dissemination, and the ability to break through the qualitative model of traditional media production, dissemination, and control, social media became the main channel for public access and dissemination of epidemic information.

Throughout the COVID-19 pandemic, personal and niche media microblogs and WeChat accounts (especially WeChat) dominated in various aspects of risk warning, risk dissemination, and public opinion guidance (68). In other words, the official media's original active communication and message control shifted to social media, and the official voice and an active communication role also shifted to social platforms and the public, resulting in the proliferation of fake news and unstable public sentiment at the beginning of the epidemic, as well as chaotic incidents such as drug and mask grabs and police beatings. The specific communication mechanism of this risk event in the self-media can be summarized into three stages. First of all, the social media "awareness, early warning, and diffusion" outbreak information, "from the bottom up" to attract the attention of mainstream media, reports, and official notification; Secondly, using the scientist (Zhong Nanshan)'s speech and risk contrast (SARS) and the strategy of "fear appeal," the intention is to stimulate people's risk perception and emotional reaction, and then enhance interpersonal communication, discussion, and network forwarding effect. Finally, with the epidemic slowing down and the government's flexible use of risk management and risk information delivery forms and channels, the self-media and the official media formed a dynamic cycle of "interaction-union-error correction," and completed a complete closed-loop of risk information dissemination. As Hua and Shaw (2020) found from an analysis of data on outbreak-related information in Chinese newspapers, social media, and other online platforms, despite China's late response to the outbreak, risk management units and media were able to identify communication and management gaps and by effectively combining the advantages of big data and online platforms strengthen online information censorship and regulation, and promote the responsibility and effectiveness of individual action and the effectiveness of collective protest through the Internet, thereby calling on the public to comply with individual and collective rules for epidemic prevention and contributing to effective risk management.

Public Communication Roles and Their Risk Perceptions and Behaviors

Risk Similarity and Spatial Proximity Affect People's Risk Perception and Behavior (Communication, Risk Protection)

The risk perceptions and risk judgments of the general public are easily influenced by the memorability of past events and the imaginability of future events (69). During the spread of the new epidemic, people were more likely to associate themselves with the SARS risk event in 2003, and because of the initial uncertainties and information gaps in this risk event, people were more likely to overreact and rush to buy medical supplies, forward related information to friends and relatives without checking or ignore risks, and other wrong risk perceptions and inappropriate behaviors. For example, Mr. Zhang (male, 37 years old, interview time: 2020.02.14), an architect living in Wuhan, said:

> "Discussions and photos of COVID-19 in the hospital appeared in the WeChat group. I didn't believe it at first, so I went to Weibo to check...ask friends who work in the hospital...and then forward relevant information to friends, just like during the SARS before. If you really wait for the official notification, nothing will be left..."

Ms. Ye (female, 42 years old, interview time: 2020.02.17), a housewife living in Beijing, said:

> "When I heard that there were suspected cases in Wuhan, I immediately thought of SARS in 2003. I was a little scared, so I bought masks regardless of whether it was true or not..."

Ms. Li (female, 48 years old, interview time: 2020.01.22), a University teacher living in Dalian, said:

> "I first saw SARS in Wuhan in the WeChat group. Although I felt that Wuhan was far away from here, I might not be affected, but I still bought three packs of masks and then told my friends to buy some, too. Everyone would rather believe it and don't be like before (SARS). When it really comes, I can't find masks again."

There are also people who initially considered that the distance between their place of residence and the place where the risk occurred was far, and so ignored the existence of the risk. They did not take any preventive measures and believed that they were less susceptible to infection. The "third-party effect" provides a good explanation for the emergence of this phenomenon, that is, people believe that risk has more influence on others than on themselves. In other words, others are more likely to be infected through risk-taking. For example, Ms. Li (female, 33 years old, interview time: 2020.02.20), a freelancer living in Harbin, said:

> "There are a lot of fake news on the Internet now, even if Covid-19 is true, it may not reach Harbin. Like SARS, it is too cold here, the virus came and froze to death, so i really didn't take it seriously at the beginning"

Fear Appeals Tend to Weaken the Efficacy of Risk of People

While the public needs to be informed about risks, the presentation of risk messages can lead to fear and pessimism. The mere mention of the adverse effects of risk issues (no matter how small the probability of their occurrence) by communication agencies or personnel in the risk communication process can increase people's perception of the probability of risk and increase their fear of risk (71). In other words, while the use of fear appeals to disseminate risk information may enhance risk prevention and protection behaviors to a certain extent, it also tends to increase negative emotions and psychological stress due to misinformation overload and loss of efficacy (72). For example, Ms. Li (female, 29 years old, interview time: 2020.03.01), who lives in Beijing and works in the business service industry, said:

> "I often read relevant information on TikTok, WeChat, and Weibo. The information about COVID-19 on TikTok scared me, and they used that kind of scary soundtrack, you know...On the map, the cities and the number of cases gradually turned into dark red, which was terrifying...Sometimes I was really desperate. I felt that the earth was about to be destroyed. No matter how much we did, it would not help."

Mr. Jia (male, 24 years old, interview time: 2020.02.19), a college student living in Wuhan, said:

> "I usually learn about the COVID-19 information through online forums, games, Weibo, WeChat, and TikTok. I have been depressed for a long time..."

Ms. Wang (female, 21 years old, interview time: 2020.03.07), a college student in Harbin, also said:

> "Every day I turned on my mobile phone and computer, and there were more infections and deaths. Horrifying pictures and music are everywhere. The school start date was always uncertain, and it was very annoying..."

And Ms. Guan (female, 46 years old, interview time: 2020.02.19), a university teacher living in Beijing, said:

> "I usually learn about the COVID-19 information on Toutiao, Sina News, or on TV. I don't really believe the content on social media, even though the information was updated quickly. It will inevitably be one-sided or even wrong. On TV and some news apps, the news was relatively objective, and it can be seen that the country put efforts into the pandemic and what specific work and results have been done. On the one hand, I can understand the immediate information, and on the other hand, I can understand what needs to be done to prevent it. Therefore, during this period of time, I could not say I was optimistic, but still relatively stable."

And Ms. Ye (female, 37 years old, interview time: 2020.03.04), a high school teacher living in Dalian, was also mentioned.

> "……There are a lot of fake news on the Internet, and it is not easy to distinguish. It is better to watch TV directly to know about the relevant content."

This also suggests that risk communication is easily influenced by the form of presentation or discursive framework (69). When people lack a strong original viewpoint, they are easily dominated by the presentation of messages. For example, social media platforms more often presented fear appeals, and simplistic presentation of risk effects in the early stages of an epidemic with shocking music effects, which could easily cause an increase in acute stress disorders. It is also noteworthy that, because of the social and cultural factors, the risks of the situation were not always easily understood. The low threshold of content production and the lack of a rigorous and comprehensive censorship mechanism in self-published media can easily become a breeding ground for fake news and hinder effective risk communication. In contrast, official media accounts and traditional media, especially television, focus on the description of the effectiveness of risk management in the process of disseminating risk information, which helps to enhance people's trust in the state and government's ability to manage risks and helps to stabilize public sentiment without causing mass panic.

Relevance and Social Norms Influence the Risk-Protective Behavior of Regular Citizens

People are more likely to be aware of direct or personally relevant risk threats. Personal experience, observation or knowledge, spatial proximity, and duration of residence are all related to risk judgment and assessment (64). In this outbreak performance, people were more likely to raise their risk awareness and make behavioral changes, such as wearing masks, washing hands regularly, and disinfecting touched objects with alcohol, in the event of a local case of infection. For example, Ms. Wang (female, 39 years old, interview time: 2020.03.14), a media worker living in Harbin, said:

> "Although I felt that the pandemic might be serious at first, I thought there was also a chance that COVID-19 would not spread to a place as far as Harbin. Since everyone didn't wear masks at first, I didn't do anything deliberately or take it seriously. Later, there were cases of infection in Liaoning, Jilin, and Harbin, and the range of activities of the infected people was wide, so I just started to wear masks."

Mr. Li (male, 36 years old, interview time: 2020.03.09), an art worker living in Beijing, said:

> "At the beginning, I didn't wear a mask all the time, because I often forget it, and I think it's okay not to wear it occasionally. Later, there were more and more people reminding me to wear a mask, and indeed there was an outbreak in Beijing, so I began to pay attention to personal protection."

Another point that can be drawn from Mr. Li's answer is the influence of community and social norms. Further, an individual's behavior is easily influenced by the attitudes, language, and behavioral norms of those around him or her. As the number of people who engage in a certain norm of behavior increases, individuals will change their behavior to meet this personal and social need out of a desire to fit in and not be excluded.

For example, Mr. Ji (male, 22 years old, interview time: 2020.03.11), a college student living in Harbin, mentioned that:

> "...You are required to wear a mask everywhere. If you don't wear it, others will stare at you. Even if you don't say it, you will definitely be criticized in their mind..."

Mr. Wang (male, 21 years old, interview time: 2020.03.11) a student from Dalian also said:

> "...I sometimes forget to wear a mask when I go out. After all, I am not used to it, but when I go out and see everyone wearing a mask, I will go home to get it... "

Some interviewees also said (Ms. Ma, Dalian, female, 22 years old, interview time: 2020.03.06):

> "In places with less people, I will take off the mask to breathe, or take pictures. How to take pictures with the mask on? Sometimes I think taking it off is okay, but sometimes I feel embarrassed. However, as long as I'm not embarrassed, it's someone else who is embarrassed…"

To sum up, risk imaginability and recall, personal relevance, spatial proximity (distance), media framing, communication strategies, and social norms can all significantly influence people's risk perceptions and behaviors in the early stages of a risk outbreak. If the government and the media fail to inform, publicize, and educate in time at this stage, it may cause fear and a negative response. However, it should also be noted that the style of media reporting and the recurrence of risks may have a counterproductive effect on the public's psychology and emotions. As stated in the Extended Parallel Process Model, on the one hand, fear appeals can help stimulate the public's positive response awareness and behavior, while on the other hand, it may also cause people to lose their sense of perceived risks, being unable to cope with the obstacles or ignoring the impact of risk (70).

From the perspective of the guidance of social norms on behavior, social norms have a positive effect on individual behavior, but gender and personal values may also affect social norms on it to a certain extent. It is generally confirmed in the literature regarding numerous health and environmental risks that gender, age, income, education level, and values will significantly affect personal risk perception and behavior (50, 56–58). Focusing on the analysis samples of this study also showed the same results. Women around the age of 40 showed a higher risk perception in this pandemic, that is, they believed that Covid-19 was a high risk. Respondents with a higher education level (above university) were more likely to search for risk information, and understand and disseminate risk-related information more rationally.

DISCUSSION

The purpose of this study was to analyze the characteristics and effectiveness of official Chinese media communication about COVID-19 on two popular social media platforms, Sina Weibo and WeChat, between December 30, 2019, and June 30, 2020, to determine how this communication affected people's risk perceptions and protective behaviors. The results from the analysis of this study show that the dissemination of COVID-19 information fully demonstrated the characteristics of public health emergency communication, and how it is different from other forms of crisis communication or emergencies in terms of content and intensity. This risk communication combined important factors of medical research such as emergencies, natural disasters, emergency relief, highly infectious threats, and uncertainty, presenting a different unknown risk and unstable communication environment and mechanism (66).

While the Government and Official Media Were in a State of "Lack of Information and Lag" at the Beginning of the Outbreak, Self-Media Played a Key Role as a Risk Perceiver

The government and official media have always adhered to a technical model aimed at managing and disseminating risk information from top to bottom. This study found that at the beginning of the COVID-19 epidemic, the official media accounts experienced "information lag" deficiencies because the risks had not been confirmed by the scientific community and effective defensive measures had not been identified. The delayed reporting and negligent management of the epidemic by local risk management units led to the failure of the government and official media to perform their risk warning. The official media failed to perform the power and function of risk warning and timely control. In addition, the official media did not open effective channels of dialogue between the government and the public, and the control of public opinion and rumors on the Internet lagged behind.

In contrast, self-media, by virtue of its proximity, low professional access threshold, instant, decentralized, dynamic, and fast dissemination characteristics, successfully broke through the qualitative mode of traditional media production, dissemination, and control, making themselves the main channel for the public to obtain and disseminate epidemic information on COVID-19. The individual and niche Weibo and WeChat accounts (especially WeChat) became the main channel for risk warning, risk dissemination, and public opinion guidance, playing the key role of "risk perceiver."

However, in this process, it was difficult to guarantee and control the accuracy and authenticity of circulating information, because unverified information spread at an uncontrollable rate (72), and the public was influenced by a large amount of mixed

information, making it difficult for them to distinguish between scientific evidence and unreliable information (73). As concluded by Dubey et al. (74) and Pedrosa et al. (72), information overload and indistinguishable outbreak content exacerbate public anxiety. This study also found that self-published media often amplified information related to the epidemic through fearful music, images, and text during the epidemic, further exacerbating the public's panic and anxiety, resulting in a loss of efficacy and consequently a negative response to the risk.

In this regard, this study suggests that future risk communication and management needs to pay more attention to social opinion and public risk perceptions and emotions, disclose all information about outbreak risks in an adequate and timely manner, and ensure social warning, social mobilization, and effective cooperation between social agents and the government. At the same time, in addition to using fear appeals to raise public alertness to risks, official media should provide necessary and effective risk response measures to ensure a high sense of public efficacy, and appropriate control of self-media content to avoid the spread of false news in cyberspace and, consequently, into the greater public sphere.

During the Middle and Later Periods of COVID-19, the Government and the Official Media Began to Pay Attention to the Influence of Self-Media on Peoples' Emotions and Behavior, and Gradually Improved the Supervision of Online Information and the Operation of Official Media Accounts. This Was Intended to Achieve an Information Consistency and Linkage Mechanism Between Official Media and Self-Media, to Prevent and Correct Mistakes

In the middle and late stages of the epidemic, the official media gradually paid attention to timely and effective communication with the public and fully operated official media accounts, shaping a multi-channel collaborative release and risk management posture of official and self-published media. This study found that the official media were influenced by the content of self-published media and public opinion, and gradually set up a mechanism to check false information and control the content of self-published media, which led to a timely and accurate announcement of the epidemic by official media. At the same time, public panic and anxiety were alleviated, resulting in good social effects.

In addition, under the control of the official media, the information on official mainstream and social hotspots increased. Although there were still flaws in the excessive use of fear appeals to gain more traffic, in general, the content of the self-media gradually tended to be rational, and the public began to notice the unchecked characteristics of the self-media information, and thus gradually regained trust in the official media.

On the whole, COVID-19 revealed the weaknesses and deficiencies of the Chinese government in public health, government governance, and social systems. The government was not sufficiently alert to self-media rumors and sudden risk information and failed to grasp and manage the network opinion in time and establish an effective information checking mechanism. However, these shortcomings can also be effective entry points to promote social construction and reform. As Sun (75) suggests, SARS and COVID-19 were two major events that forced reforms in China's public health system, with SARS correcting the direction of public health reform and promoting the reconstruction of the public health system, while COVID-19 improved the Chinese government's disease prevention and control system and mechanism, as well as the social governance system for major public health emergencies.

From the perspective of information communication governance, public health emergencies are no longer just a health system issue, but a global issue concerning the modernization of national information governance and governance capacity. Information governance is different from the administrative governance of information. In the traditional emergency governance practice, the government is always regarded as the only source of emergency prevention and control and bears the entire responsibility of emergency governance (76). In the era of new media and mobile communication, administrative power alone can no longer cope with risk crises, and risk crisis management relies more on the participation, cooperation, and collaborative governance of multiple actors such as government, media, social organizations, enterprises, and citizens (77).

The communication governance of risk crises should ensure effective dialogue among multiple actors, and in effective communication, promote truth restoration and interest remediation, as well as rebuild trust (78). Furthermore, building multi-level crisis management and risk management paths such as information releases, crisis management, and public opinion guidance to realize multi-level dialogue, are needed to turn risk crises into opportunities for effective risk management and social governance (77).

When Faced With an Unexpected Health Risk, the Public's Recall of Past Risk Events, the Relevance of the Risk to the Individual, Spatial Proximity (Distance), Media Framing and Communication Strategies, and Social Norms Can All Significantly Influence Their Perception of the Risk and Related Behaviors

In-depth interviews with audiences revealed that social norms were the main factors influencing public self-health management behavior in this risk event.

First, the risk event reminded the public of SARS, which led to panic and a rush to buy medical supplies before the risk event was officially confirmed. Then, the fear appeal communication strategy favored by the self-media further aggravated the public's fear and pessimism, leading to a decrease in their self-efficacy.

In order to stabilize public sentiment, official media tried to avoid using fear appeals when managing risks and broadcasted the current situation of risks and protective measures more objectively to enhance the public's sense of efficacy in self-health management. The public's perceptions of the severity of the epidemic and self-inflicted diseases differed from region to region. Therefore, social norms held an important influence on public self-health management in the middle and late stages of an epidemic, with the behavior and evaluation of others significantly influencing public behavior. In this regard, this paper suggests that the differences in public perceptions of health risks should be taken into account and that social norms should be used to guide public behavior in risk communication and management so that risk communication and opinion guidance can be carried out in a more targeted and comprehensive manner.

Limitations

Although this study conducted in-depth interviews on the perceptions and behavioral influences of some online Chinese citizens, it did not interview government-related units or other official media to ascertain the reasons for the hindrances we found in effective governmental risk management. Also, this study only analyzed the online texts of 18 official media accounts and did not conduct more in-depth data mining. Future research may benefit from using big data to explore and more comprehensively analyze and organize the differences and similarities between official and private information dissemination in sudden risk events.

CONCLUSION

The Government Should Strengthen the Use of Social Media, Rumor Controls, and Fact-Checking Mechanisms, and Maintain Timely Communication With the Public

The use of self-media (WeChat, Weibo, et al.) may be an effective channel for the government and related agencies to communicate immediate and accurate information to the public in times of risk and crisis (79). On the one hand, relevant government departments should strengthen the operation and maintenance of online social platforms, provide transparent and timely updated risk information, and analyze the collation and analysis of public opinion, so as to actively anticipate and respond to the possible social impacts and fluctuations of identified risks.

It is important to ensure timely, and comprehensive communication and experts and decision-makers should fill in the information gaps among other organizations and individuals. This way, in addition to avoiding the confusion and influence of rumors or fake news, the public will be informed and equipped with the correct knowledge on how to protect themselves and those around them in the event of an unexpected risk event.

Misinformation or rumors can easily spread widely on social media and may increase people's perception of risk and fear of health-related topics (16, 80, 81). This makes it imperative for relevant governmental functions and community platforms to publish and regulate online information. The relevant government departments should also establish a sound online fact-checking platform and inform the public through diversified multi-channel to strengthen the public's attention and use of this platform so that the public can obtain it accurately. At the same time, strengthening the dialogue among functional departments, regional governments, academia, and civil society will ensure the implementation of effective risk management policies, help to clarify public concerns, and prevent obstacles to policy implementation.

The Media Should Pay Attention to the Timely and Accurate Reporting of Risk Events, as Well as the Presentation of Information on the Causes, Modes of Transmission, and Risk Impacts, and Be Cautious About Possible Social and Psychological Impacts of Risk Reporting, so as to Enhance Public Trust in the Government and the Media

In public health and health risk situations, the public is often in need of up-to-date and accurate risk information and advice on risk management to better protect themselves and their friends and family. The media serves as an important bridge for public risk perception (82), and the public's reliance on the media may be even stronger during unexpected risk events (83). The public expects the media to report risk assessments and give sound risk response advice through authoritative and trustworthy sources (79). Effective and accurate reporting of risk facts by the media can significantly increase the accuracy of public perception of risk (84), but with fragmented or scarce risk information and inconsistent and uncertain multiple discourses (government, experts, media, etc.), rumors spread through the Internet to various fields, resulting in increased negative emotions such as fear, worry, and anxiety among the public (85, 86). People are more likely to overestimate certain threat factors that are less risky or underestimate certain factors that are riskier, thus creating one-sided or false risk perceptions (87). People may even engage in disordered or overly aggressive risk responses and violent emotional outbursts, such as hearing rumors that spraying alcohol on a mask can increase the mask's viral defenses, or verbally abusing or beating a person suspected of being infected with the virus. Especially when the inherent uncertainty of risk factors is combined with the ambiguity of message communication, the public's psychological stress increases and negative emotions rise, thus accelerating the spread and proliferation of rumors. Therefore, the public should be better educated and advised to trust and rely on authorities such as the National Health Council, Centers for Disease Control and Prevention, or World Health Organization for the latest information on disease prevention and transmission and community-level threats.

It is also critical for the media to disseminate information to the public in order to promote appropriate health-protective behaviors and effective institutional responses. The media should not use sensational or distracting images when disseminating

information to avoid paranoid behavior by the public. In addition, communicating risk prevention knowledge and actions that can be taken to promote changes in behavior should be done in layman's terms and in a manner that is clearly understood and accessible to all.

The Public Should Enhance Risk Information Recognition and Dissemination Literacy to Avoid Further Spread of Rumors

Although global pandemics have occurred many times throughout history, the emergence and popularity of social media, has taken on an important role in educating the public on how to properly access, analyze, create, and effectively communicate risk information or other messages. However, through the process of dissemination and management of the epidemic, it is clear that misinformation about COVID-19 on online social media platforms adds to the confusion. Because the media access rights of online citizens were expanded with a low threshold, and convenient easily disseminated video and image production were available on social media platforms, fear and anxiety spread through cyberspace. This not only greatly reduces the public's trust in the government, but also hinders the effective management of risks. Therefore, media literacy should be considered a priority for prevention, mitigation of virus transmission as well as risk management, and necessary preparation for health management units to respond to risks in situations requiring rapid response (88).

All countries, governments, and relevant authorities should strengthen investment in and development of citizens' media literacy to help people learn early about disease management, infection prevention, effective dissemination of risk information, and social responsibility, as well as the potential social impact of their online behavior. At the same time, parents, schools, organizations, and even communities should actively conduct media literacy promotion activities to assess individual media literacy situations and issues, keep abreast of citizens' Internet use and problems and eventually establish rational information dissemination habits and atmosphere.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

LP: conceptualization, methodology, and validation. ZF: data curation, writing original draft preparation. ZQ: writing review and editing. All authors contributed to the article and approved the submitted version.

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How is "solidarity" understood in discussions about contact tracing apps? An overview

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Background: In the context of the COVID-19 pandemic, there is much discussion about contact tracing apps, their use to contain the spread of the virus as well as the ethical, legal, and social aspects of their development, implementation, acceptance, and use. In these discussions, authors frequently mention "solidarity" when making key points in arguments. At the same time, authors rarely specify how they understand "solidarity". This lack of specification about how they understand "solidarity" can lead to misunderstandings in discussions.

Objective: To prevent such misunderstandings, it is important to specify how one understands "solidarity" when mentioning it in the discussions on contact tracing apps. Therefore, the aim of this paper is to elaborate how "solidarity" is understood in the context of contact tracing apps, i.e., how different authors understand "solidarity" when using it in discussions about these apps.

Methods: In order to find out how different authors understand "solidarity" when discussing contact tracing apps, I conduct a literature review. I collect papers from several databases, inductively work out central differences and similarities between the different uses of "solidarity", and use them to code and analyze relevant passages.

Results: In the final sample, five different understandings of "solidarity" in the context of contact tracing apps can be identified. These understandings differ in how different authors (1) imagine the basic concept of solidarity, i.e., what "solidarity" refers to, (2) how they temporally relate solidarity to contact tracing apps, and (3) how they perceive the causal interactions between solidarity and contact tracing apps, i.e., the different ways in which solidarity and contact tracing apps influence each other.

Conclusions: The five understandings of "solidarity" in the context of contact tracing apps presented here can serve as guidance for how "solidarity" can be understood in discussions—thus contributing to a better mutual understanding and preventing communicative misunderstandings.

KEYWORDS

solidarity, contact tracing, digital tracing, COVID-19, SARS-CoV-2, review

Introduction

During the COVID-19 pandemic digital contact tracing was introduced as a vital part of public health surveillance strategies. Countries (1–3) as well as private sector companies (4) develop and deploy their own apps for contact tracing. Such contact tracing apps (CTA) are typically used to collect and combine two sets of data: first, the user's contacts; second, their COVID-19 infection status. Contact information is often captured by collecting user location data either automatically *via* WiFi, cellular or GPS location data or manually *via* QR codes and transmitting it to central servers. There, they are subsequently analyzed by health authorities who identify contacts (3, 5). Alternatively, contact data can be collected through Bluetooth data exchange between smart devices. Typically, contacts are identified when two smart devices with compatible CTA are within a certain distance to each other for a certain period of time (5). If users are tested positive for COVID-19 or manually report an infection, their detected contacts often receive an anonymized exposure message saying that they have recently had contact with a person infected with COVID-19. Based on this data, some CTA may also display their users their risk of infection—for example, the German *Corona-Warn-App* shows whether the user is at none, low, or high risk of infection (6)—as well as provide guidance for managing potential exposure and infection (e.g., get themselves tested for COVID-19 or enter voluntary self-quarantine). The goal is to use CTA to detect at-risk contacts more quickly than through manual contact tracing and to be able to take action sooner (7), thus breaking chains of infection more effectively and containing the COVID-19 pandemic in the long term.

The effectiveness of CTA in combating COVID-19 depends centrally on how many people use CTA and are informed about risk contacts (8). Particularly because initial data suggest that "contact-tracing apps help reduce COVID infections" (9, 10) and are effective complementary tools for containing the spread of the virus (11–14) it is important to further increase their number of users to make them even more effective. This requires knowing the factors that drive their public acceptance or rejection in order to be able to adapt them (15, 16). While concern for one's own health and the prospect of more activity opportunities increase their acceptance, it is mainly privacy concerns and fear if government control that prevent their acceptance (15, 17). The latter can be countered by building and maintaining strong public trust (18)—just as these concerns can be solidified or increased by a lack of trust (19, 20). To preserve the former, it is important not to create overly optimistic expectations, which in the long term could lead to disappointment with CTA and subsequent loss of acceptance (5).

Digital contact tracing and CTA have already been used in other epidemiological events prior to the COVID-19 pandemic, e.g., the outbreak of Ebola in Sierra Leone in 2014–2016 (21, 22). During the COVID-19 pandemic, CTA are used for the first time worldwide. This stimulates many discussions about CTA, with one central issue being privacy (23, 24). From a legal and moral perspective, there is discussion about how much the state, public health authorities, or private institutions may monitor the movements (in the case of a GPS-based CTA) and contacts of individuals (25); how much this surveillance and invasion of privacy limits the freedom and autonomy of individuals (26); and how digital contact tracing relates to existing moral principles (27, 28) and legal data protection laws (29), particularly the GDPR (30). From a technical perspective, there is discussion about how to protect privacy best by asking what form of anonymization and encryption of data would be most effective (31) and whether to store data centrally or decentrally (32). Other questions are how high how high the acceptance rate needs to be (7) to guarantee the effectiveness of CTA (33); how the uptake of CTA could be increased (34, 35); whether the use of CTA should be legally mandated; and whether there is a moral obligation to use them (36). In addition, there is moral discussion about the principles and guidelines that should be implemented in CTA (27, 28) as well as sociological discussion concerning the public acceptance of CTA (37), and the expected social consequences of introducing CTA (38). These discussions about CTA are persistently relevant, because COVID-19 continues to spread and needs to be contained, but also because there may be future pandemics. In fact, the risk of pandemic outbreaks is currently higher than ever before, making future pandemics "inevitable" (39). It is therefore all the more important to be prepared for them and to be able to counter them effectively as soon as they break out (40). This preparation includes developing the necessary (contact tracing) technologies now and without pandemic constraints and time pressure (41), discussing and finding solutions to the relevant social, moral and legal issues now as well as establishing public trust in governments, institutions, and technologies now (42, 43)—to have these resources present and not to have to build them in the last minute when they are urgently needed.

While scoping the literature on CTA, I made two observations. First, the discussions often refer to "solidarity" in central points of the discussion. Especially when some of the moral or legal issues mentioned above are addressed. Solidarity, thus, seems to play an important role in legal, moral, societal, and public health discussions about CTA and captures a "spotlight" (44) in discussions about the COVID-19 pandemic. Second, authors rarely define how they understand the notion in their discussions, instead assuming that everybody intuitively understands what they mean when using "solidarity". However, this assumption is deceptive and problematic. On the one hand, it is deceptive because no notion has a permanently fixed meaning and is understood the same way every time it is used. Instead, a notion acquires its meaning only when it is used and can only be understood by considering the context (45). As Bayertz (46) points out in his studies on solidarity, the same notion can even have

contradictory meanings: "The concept of solidarity thus shares the same fate as other central concepts within ethical and political terminology, namely that of not being defined in a binding manner, and consequently of being used in very different and sometimes very contradictory ways" (46). On the other hand, it is problematic to assume that solidarity has a fixed meaning and not to specify how one understands the term when using it as this can lead to serious misunderstandings in discussions. Where two (or more) people use the same notion but understand it differently, one polysemous notion (47) can be understood in *multiple* ways and can become lexically ambivalent (48). This lexical ambivalence might in turn result in these people talking past, misunderstanding, and disagreeing with each other (49)—while in the worst case not even realizing it.

Especially when discussing important concerns as the fight against the COVID-19 pandemic and when using the notion "solidarity" at crucial points in arguments, it is important to avoid these communicative pitfalls. This means specifying exactly how one understands "solidarity" whenever one uses it and making clear for what purpose one is using it in the particular context. To help specifying the notion "solidarity", I ask the research question: *what does solidarity mean in the context of the CTA*? Or, to be more precise: *how do different authors understand "solidarity" when using it in the context of CTA?*

Methodologically, I approach this research question by means of a literature review. After compiling a comprehensive sample, I analyze the passages that mention solidarity. By doing so, I identify central differences and similarities in their uses of "solidarity" and use these to elaborate different understandings of solidarity in the context of CTA. I then assign the papers to these understandings and thus work out which author understands solidarity in which way. Afterwards I discuss the *Results*, ask how these understandings of solidarity relate to each other, what limitations the study has, and finally give some practical recommendations.

Methods

In conducting my review, I am guided by methodological frameworks for conducting a systematic review (50–52). In large parts, I follow the methodological approach for conducting a systematic review by Tranfield et al. (51). I search databases using a search strategy, then select the literature according to both external and internal inclusion criteria. Next, I inductively extract criteria from the literature, which I then use to examine how solidarity is understood in the sample. Details on how I proceed in searching, selecting and collecting data will now be presented.

To identify literature for my review I formulate a search strategy that is based on the keyword of the review question: what does *solidarity* mean in the context of *CTA*? The final search strategy consists of combinations of the keywords "contact tracing" or "tracing apps" in combination with the keyword "solidarity" (see Table 1) that are used to search the databases: *GIFT*, *Scopus*, *PubMed*, *Web of Science*, and *Google Scholar*. I search the databases at regular intervals and add the papers that were new since the last search to the sample. The first search was on January 07, 2021, and the last search was on December 21, 2021. During 2021, the GIFT database was discontinued by WHO for public use, so this database could not be included in the most recent searches. The results of previous searches in this database are retained in the final sample and not subsequently removed. The final sample includes publications from January 1, 2020 [when the first academic papers on COVID-19 were published (53)] to December 21, 2021 (when the final search was completed).

The search strategy results in a corpus of 533 publications. Due to my language skills, I limit the review to articles written in English or German. Also, the review is limited to articles that are academic, already published, and reviewed to assure their quality (52). Based on these limitations pre-prints, gray literature, self-publications, student theses, and blog entries as well as publications in other languages are excluded (226)—leaving 307 journal articles, books, edited volumes, and articles in edited volumes that meet the formal requirements. After removing the duplicates (52) and the articles that I have no access to (11), I screen the remaining 244 full-text publications to examine whether they meet the content requirements to include them in my review or not (Appendix 1 in Supplementary Material 1). A paper is included in my final review if it mentions solidarity in connection with CTA. A paper is excluded if it does not make a connection between solidarity and CTA. The latter could be due to these papers using the notion "solidarity" as a proper name [e.g., *WHO's Solidarity Trial* in (54) or *France's Ministry of Solidarity and Health* in (55)] (22), mentioning tracing apps (56) or the notion "solidarity" (57) only in the references (58), or discussing both topics in different contexts without making a connection between them [e.g., when Brown et al. (59) discuss the challenges of immunity passports, they discuss the possibilities of a combining immunity certificates and CTA once and another time discuss the impact of immunity certificates on social solidarity—but both considerations are independent of each other] (60). After sorting out 197 papers, 47 papers are included in my final review (Appendix 1 in Supplementary Material 1). For a visual representation of procedure for selecting literature, see Figure 1.

The final 47 papers come from different disciplines (e.g., ethics, sociology, psychology, law, and tourism studies) and address different issues concerning CTA. I analyze them with a focus on the passages mentioning solidarity. The goal is to find out how different authors understand the "solidarity" when they use it in the context of CTA. Starting from a structuralist understanding of language (61), one must analyze the central

TABLE 1 Overview of the search, listing the names of the databases, the search strategies used, and the number of results.

Database	Search strategy	# of results
GIFT (until discontinued)	"Tracing apps" solidarity	17
	"Contact tracing" apps solidarity	41
Scopus	"Tracing apps" AND solidarity—TITLE-ABS-KEY	3
	"Contact tracing" AND apps AND solidarity—TITLE-ABS-KEY	1
Pubmed	"Tracing apps" [All Fields] AND solidarity [All Fields]	2
	"Contact tracing" [All Fields] AND apps [All Fields] AND solidarity [All Fields]	1
Web of Science	TOPIC: (tracing apps) *AND* ALL FIELDS: (solidarity)	1
	TOPIC: (contact tracing) *AND* ALL FIELDS: (apps) *AND* ALL FIELDS: (solidarity)	0
Google Scholar	"Tracing apps" solidarity	467

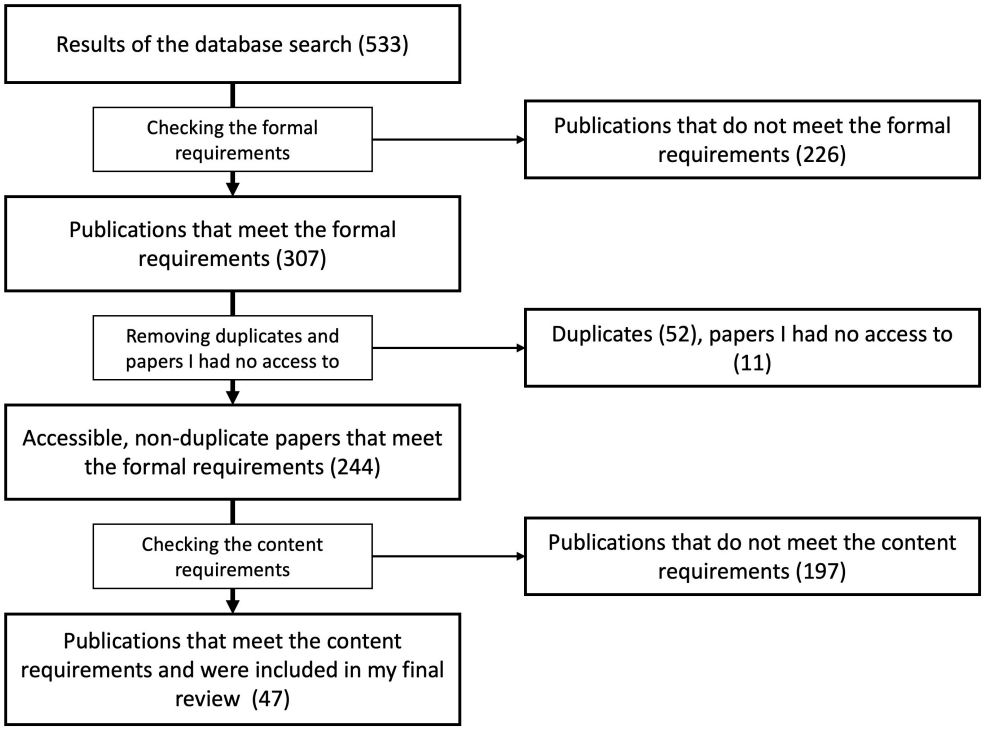

FIGURE 1
Procedure for selecting literature for my final review (created by the author).

differences (and similarities) between the various uses of the notion in the various papers and passages in order to work out how an author understands the notion "solidarity". In short: to find out how an author understands "solidarity" in the context of CTA, one must show how her or his understanding differs from or relates to other authors' understanding of the notion.

In order to work out these differences and similarities between the various understandings of solidarity, comparative criteria are needed. As comparative criteria I use binary distinctions, which I call "key distinctions". Each use of the term solidarity can be assigned to one side of the key distinctions. If two uses of the term solidarity are similar, they can be assigned to the same side of the key distinction; if they are different, they are assigned to different sides of the key distinction. Thus, differences and similarities between the different uses of the notion "solidarity" can be worked out. A binary distinction is a key distinction only if each use of the notion "solidarity" can be assigned to exactly one of its sides. There are several of these key distinctions. The more different key distinctions there are and the more often one use of the notion "solidarity" can be assigned to one of their sides, the more precisely one can work out its understanding of solidarity, i.e., the more precisely one

can identify its differences and similarities to other uses of the notion "solidarity".

The more key distinctions and the better they are, i.e., the more they help to make central differences visible, the more useful they are for elaborating the understanding of the uses of "solidarity". Therefore, the central question is how to get specific key distinctions. There are two ways to get key distinctions: either one takes them from existing conceptual discussions of solidarity and uses them deductively to distinguish the understandings in the passages analyzed; or one or one extracts the key distinctions inductively from the passages that are being analyzed. In order not to pre-determine, limit, or bias the results by making prior assumptions about the notion's key distinctions (58) and to ensure that the key distinctions are tailored to the sample—i.e., they contribute as best as possible to making central differences visible—I choose the inductive approach. During several iterations I extract distinctions from the analyzed passages and test their validity on the other passages. I keep a distinction as key distinction if all analyzed passages could be assigned to one of its sides and discard or modify it if this does not work—thus arriving at the final key distinctions.

With these key distinctions, I code the passages mentioning solidarity and assign their use of "solidarity" to the corresponding sides of the different key distinctions. This assignment is based on criteria called "operators". These operators act as rules for which side of the key difference a use of the notion "solidarity" should be assigned to. I extract these operators, like the key distinctions, inductively from the passages themselves in an iterative process. By coding the passages, I arrive at an understanding of how different authors understand solidarity in the context of CTA.

Based on the key distinctions, different understandings of the concept of solidarity in the context of CTA can be distinguished. The operators help to assign the different passages in which solidarity is mentioned to the different understandings and thus to answer the question: how do different authors understand "solidarity" when they use it in the context of CTA?

Results

The sample first shows that different authors use "solidarity" with different degrees of precision: some authors mention the term only once as an "ethical buzzword" (62) without further specifying how they understand it, some authors define the term precisely and use it throughout. Second, it can be shown that different authors understand the notion "solidarity" differently in the context of CTA. In the sample, two key distinctions play a central role and help to distinguish the different understandings of "solidarity" in the context of CTA.

- The first key distinction I call "basic concepts of solidarity": there are two different basic concepts of solidarity in the sample, which differ in how they understand solidarity and what they refer to.
- The second key distinction I call "temporal relations between solidarity and contact tracing apps": there are two different ways in which solidarity temporally relates to CTA in the sample.
- In addition to the two key distinctions, two different "causal interactions between solidarity and CTA" can be distinguished, i.e., different ways in which solidarity and CTA interact with and influence each other in the sample.

In the results, I present these key distinctions—first, the different basic concepts; second, the different relations of solidarity and CTA—as well as the third distinction of different causal interactions. In doing so, I subordinate the distinctions to each other, i.e., the second key distinction is a sub-key distinction of the first key distinction and the different causal interactions are a sub distinction to the second key distinction.

Basic concepts of solidarity

In the sample, one can first distinguish between two basic concepts of solidarity: Solidarity can either be understood as *a factual form of social cohesion*. As a factual form of social cohesion, solidarity describes the modes of how different individuals or groups of people live together (63) as well as the different bonds and organizational forms with which they structure their living together (46). Thus, as a form of social cohesion, solidarity always refers to existing collectives—and explores the interactions between CTA and the modes and organizational forms of their coexistence. Or solidarity can be understood as a *moral value*: something that people care about, that they consider good, and that grounds their judgment (64). As a moral value, solidarity comes into play in moral reasoning (65)—and can represent a principle used in considerations and discussions about CTA, a good used to guide them, or a criterion used to evaluate future or past considerations and discussions. Thus, as a moral value, solidarity always refers to considerations and discussions about CTA, and examines how this moral value affects them. Both basic concepts of solidarity are *not* mutually exclusive. Instead, the distinction helps to hermeneutically highlight different aspects of the notion "solidarity" that are in focus when it is used in a specific context—which I will elaborate further in Section Discussion.

If solidarity is understood as a factual form of social cohesion of a society, it can either refer to a specific, individual nation such as Singapore (66), Ireland (67), France (68), Germany (69, 70), South Korea (68), the UK (71, 72), and China (70) or even the European Union (73), or to an unspecified, individual nation (74–79). It can furthermore be an indeterminate collective of unknown size (36, 80–87), a particular marginalized group of persons within an indeterminate collective (38, 88–91), or

an indeterminate human-technology-society called "post-digital hybrid assemblage" (92).

If solidarity is understood as a moral value, this moral value can be used in different discussions concerning CTA. It can be used when discussing or evaluating the development of CTA (28, 75, 80, 93–95), their implementation, i.e., their introduction into a society (95–100), or the organizational (101) or ethical (99, 102–106) framework of CTA. It can be used when individuals question themselves about whether to use CTA (107) or when individuals reflect on whether and how others use CTA (108). Solidarity can also be used when several of these points are discussed at once, e.g., the development and implementation (109) or the development, implementation, and use of CTA (110).

Looking at the absolute numbers, solidarity is more often understood as a factual form of social cohesion (29 papers) than as a moral value (22 papers). At the same time some papers understand solidarity as social cohesion *and* as moral value. For example, Lanzing understands solidarity both as the social cohesion that exists in an indeterminate country and as a moral value that guides decisions about the development of CTA (75). Leslie understands solidarity both as the social cohesion that exists in an indeterminate society and as a moral value that is used to guide the development of CTA (80).

Temporal relations between solidarity and contact tracing apps

In the sample, one can then distinguish between two different ways in which solidarity temporally relates to CTA. It proves to be useful to maintain the above distinction of basic concepts when considering solidarity's relation to CTA. If solidarity is understood as a factual form of social cohesion, it can either precede or follow the acceptance and use of CTA in time. This distinction depends on whether the text examines the consequences of different factual forms of social cohesion for the development, introduction, acceptance, or use of CTA or, conversely, the consequences of the introduction, acceptance, or use of CTA for existing forms of social cohesion. As moral value, solidarity can be used to consider decisions about CTA from an ex-ante or ex-post perspective. This distinction depends on whether the decisions about CTA that the moral value refers to have already been made and are now being evaluated, or whether they are still pending and being discussed.

If solidarity is a form of social cohesion that precedes CTA in time, this form of social cohesion can be a condition for their public acceptance (67–71, 74, 76–78, 82, 85), a motivation for their individual use (36, 84, 85), or a necessary condition for their coordinated development (73).

If solidarity as a form of social cohesion follows CTA in time, this may have two different results. On the one hand, the public acceptance and individual use of CTA may strengthen the factual forms of social cohesion that exist in a collective (67) or strengthen factors that are elementary for them (72, 82), it may prevent negative consequences for forms of social cohesion that would have happened if CTA were not accepted and used (66), or open up possibilities for reimagining old and establishing new relationships (92). On the other hand, the acceptance and use of CTA may also have a negative impact on a society's forms of social cohesion: by threatening or undermining the forms of social cohesion that exist in a collective (83), by weakening factors that are elementary for them (75, 77, 80–82, 86), by reinforcing existing discriminations and worsening the situation for specific groups of people (38, 75, 90, 91), or by using resources for the development and implementation of CTA that would have had more positive effects on the community if used in an alternative way (88, 89).

As a moral value, solidarity can consider decisions about CTA—concerning their development, implementation into a society, or individual use—from an ex-ante perspective. Solidarity can guide or reflect the development of CTA morally (101, 106) and can prevent CTA from having negative impacts on their users (e.g., due to improper development) (75, 80, 93). Solidarity as a moral value can guide the introduction of CTA into a society morally (95, 98, 99, 104, 109), it can also motivate individuals to use CTA (72, 94, 107), and contribute to their public acceptance (110).

Similarly, solidarity as moral value can reflect on decisions about CTA that have already been made from an ex-post perspective, for example, by questioning past ethical discussions about CTA as to whether they have (sufficiently) taken into account the moral value of solidarity (28, 96, 102, 103, 105) or by evaluating how other people use CTA (108).

Looking at the absolute numbers, there are 16 papers in which solidarity as a factual form of social cohesion precedes CTA in time. There are 16 papers in which solidarity as a factual form of social cohesion follows CTA in time. There are 15 papers in which solidarity is used as a moral value to consider decisions about CTA from an ex-ante perspective. And there are eight papers in which solidarity is used as a moral value to reflect on decisions about CTA from an ex-post perspective. There are seven papers that relate solidarity and CTA in multiple ways at the same time. E.g., Gibney et al. (67) observe that the use of CTA at the same time "would benefit from and foster solidarity among the public in the national "figh" against the novel coronavirus" (9). Here, solidarity is understood as a form of social cohesion that precedes the use of CTA *and* results from their use.

Causal interactions between solidarity and contact tracing apps

By means of these two key distinctions—the two basic concepts of solidarity and the temporal relations between solidarity and CTA—several understandings of solidarity in

the context of CTA can be identified in the sample. Three understandings can be attributed one causal interaction between solidarity and CTA, i.e., one particular way in which solidarity influences the development, use, or acceptance of CTA or decisions regarding them. Two different ways of causal interaction between solidarity and CTA can be attributed to the understanding of solidarity as a form of social cohesion that follows CTA in time.

- If solidarity is understood as a form of social cohesion that precedes CTA in time, it can be a crucial condition for the implementation (67, 76) of CTA or encourage their public acceptance (67, 69–71, 76, 78, 79, 84, 85). See, for example, Milne and Costa (68) who describe solidarity as condition for the implementation and acceptance of CTA: "For example, CTA, such as those now implemented in France, Germany or South Korea, rely on adoption through a sense of solidarity". In addition, solidarity itself or appeals to a "we are all in this together" sense of social cohesion can motivate single individuals to use CTA, argue Parker et al. (36).
- If solidarity is understood as a form of social cohesion that follows CTA in time, the implementation and use of the latter can reinforce the former. As Gibney et al. argue, the use of CTA could give individuals a common sense of working together to fight the battle against COVID-19 (67), or, as Samuel and Sims put forward, it could provide them with shared visions or impose equal social obligations (72). Both, according to the authors, could constitute, maintain, and strengthen forms of social cohesion itself or factors that are elementary for it. Conversely, the use of CTA can also prevent negative consequences for social cohesion that might have occurred if hey were not implemented and used (66). Furthermore, CTA can open up possibilities of reimagining old and establishing new relationships and create new forms of social cohesions, e.g., by creating new, digital bonds between actors who previously had no contact with each other (92).
- If solidarity is understood as a form of social cohesion that follows CTA in time, the implementation and use of the latter can weaken or undermine the former (86, 90). E.g., as Pila (83) suggest, by providing "too much information about individuals' health risks" CTA "can undermine solidarity by depriving people of the very uncertainty about their own and others' fates on which a commitment to sharing those fates depends." This can result in existing vulnerabilities (75) or marginalizations being reinforced (38, 91). E.g., as Chang et al. point out, by warning CTA users not to have contact with homepless persons and drug users for health reasons—thereby adding another stigma to these groups of people (38). Alternatively, the resources used for the development and implementation of CTA could have had more positive effects on the community if used in an alternative way (88, 89).
- If solidarity is understood as a moral value that considers decisions on CTA from an ex-ante perspective, it can guide and orient decisions or actions concerning the development (75, 80, 102, 106, 109), implementation (75, 95, 98, 99, 104, 110), and use (94, 102) of CTA ethically. For example, Leslie advocates taking into account the UK Government's SUM values for safe and ethical AI, which include solidarity, when developing CTA (80), and Gasser et al. elaborate a diagram of six different values, one of which is solidarity, from which they then derive 17 moral challenges to be considered in the development of CTA (109). Also, educating individuals about the moral value of solidarity, as Roche notes, can help them become more aware of their role in fighting the virus (107).
- If solidarity is understood as a moral value that considers decisions on CTA from an ex-post perspective, it can serve as an ethical criterion for the evaluation of past discussions or decisions concerning the development (96, 102, 103) as well as the implementation (96, 97, 100, 102, 103, 105) of CTA. For example, Keating reflects on whether collaboration during the development and implementation of CTA would have worked better if solidarity had played a more central role (97), and Siffels wonders whether it would have been better to focus questions about CTA development and implementation not only on privacy and health, but also to consider other values, including solidarity (103). Furthermore, solidarity can be used as a criterion to evaluate other people's behavior toward CTA (108), when people consider other people's decision to use CTA as solidary or their decision not to use it as unsolidary (108).

The causal interactions assigned are not key distinctions, as they do not apply a binary distinction to all uses of the notion "solidarity" in the sample. Rather, these causal interactions specify the understandings of solidarity identified in the sample. This specification leads to adding a binary distinction to the second understanding, so that we can ultimately speak of five understandings of solidarity in the context of CTA.

Illustration of the five understandings of solidarity as a tree diagram

Given these two key differences and the different causal interactions between solidarity and CTA, there are five different understandings of solidarity in the context of CTA. These five understandings, as well as the distinctions that lead to them,

can be illustrated as a tree diagram (see Figure 2). Starting from the general notion of "solidarity in the context of CTA" one can apply the first key distinction and distinguish between the two basic concepts of solidarity, then one can apply the second key distinction and distinguish between the different temporal relations of solidarity and CTA, thirdly one can further specify by adding the different causal interactions between solidarity and CTA.

Assignment of the papers to the five understandings

Along this tree diagram, all 47 papers can be assigned to (at least) one of these understandings. To do so, one must first decide whether a paper understands solidarity as a form of social cohesion or as a moral value. There is a list of operators that indicates whether solidarity is understood as the former of the latter. Subsequently, one can use the next list of operators to assign each paper to (at least) one understanding of solidarity.

Operators indicating that solidarity is understood as a form of social cohesion are: Solidarity explicitly refers to a social system (e.g., societies and communities); solidarity denotes an organizational form of social systems (e.g., nations, countries, the public sphere, and community initiatives); solidarity refers to groups or individuals of social systems (e.g., poor people, citizens of a state, the public, and population); solidarity describes the cohesion of a social system or an essential factor for it (e.g., shared feelings); solidarity describes a group of persons close to each other (e.g., families); solidarity describes the cooperation of different actors; or solidarity describes a relationship between different actors (e.g., human and technology). Operators indicating that solidarity is understood as a moral value are: Solidarity is explicitly described as a moral value or ethical principle; solidarity is mentioned in a series with other moral values or ethical principles; solidarity is described as belonging to the good; Solidarity is mentioned in reference to concerns, considerations, decision, evaluations or failures; or solidarity is taught through moral education.

Subsequently, the second key distinction and the causal interactions—which I have summarized in the following list of operators for the sake of clarity—can be used to classify how solidarity relates to CTA in terms of time and causality.

- If solidarity is understood as a form of social cohesion, operators indicating that solidarity precedes CTA in time are (*understanding 1*): Solidarity is described as condition for the implementation and acceptance of CTA; solidarity promotes the acceptance and use of CTA; or solidarity is necessary for the development of CTA.
- If solidarity is understood as a form of social cohesion, operators indicating that solidarity follows from CTA and that CTA constitute or strengthen solidarity are (*understanding 2a*): The text explicitly states that CTA constitute or strengthen social cohesion; CTA strengthen factors that are elementary for social cohesion; CTA prevent

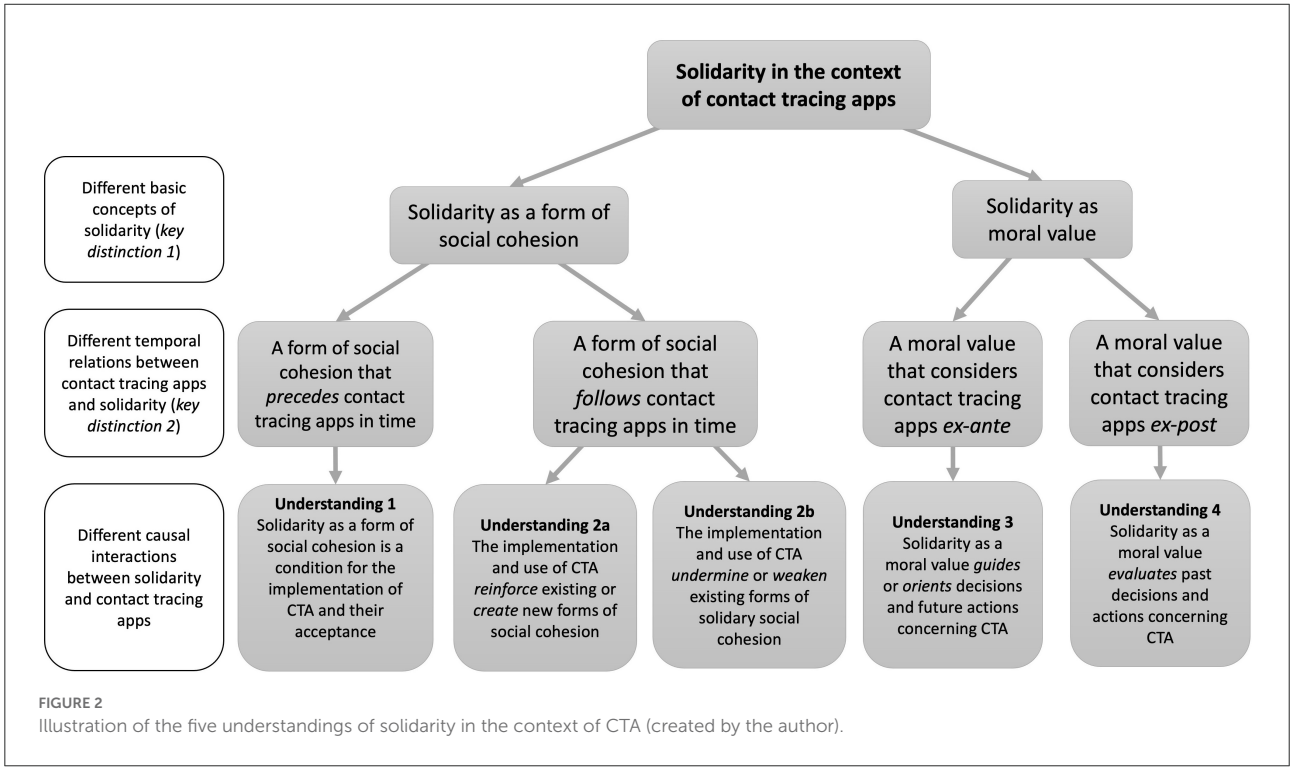

FIGURE 2
Illustration of the five understandings of solidarity in the context of CTA (created by the author).

negative consequences for the social cohesion; or CTA open up possibilities of reimagining old and establishing new relationships.

- If solidarity is understood as a form of social cohesion, operators indicating that solidarity follows from CTA and that CTA weaken or undermine solidarity are (*understanding 2b*): The text explicitly states that CTA threaten, weaken or undermine social cohesion; CTA weaken factors that are elementary for social cohesion or reinforce factors that damage social cohesion; the introduction of CTA worsens the situation of a group of people or increases existing vulnerabilities or marginalizations; or the resources used for the development and implementation of CTA would have had more positive effects on the community if used in an alternative way.
- If solidarity is understood as a moral value, operators indicating that solidarity considers CTA from an ex-ante perspective are (*understanding 3*): Solidarity is referred to as a central criterion for ethical or legal concerns, considerations or decision; solidarity is introduced to orient or guide a decisions or actions; solidarity imposes obligations to act; or solidarity helps individuals to become aware of their role.
- If solidarity is understood as a moral value, operators indicating that solidarity considers CTA from an ex-post perspective are (*understanding 4*): Solidarity refers to past discussions or decisions; solidarity serves as criterion for the evaluation of past discussions or decisions; solidarity is presented as a moral value with which past failures could have been avoided; or solidarity is a criterion to evaluate other people's behavior.

Since the list of operators in the text can be somewhat confusing, there is a table of the various understandings of solidarity and their corresponding operators in Appendix 2 (Supplementary Material 2, starting from page 1).

Using the operators to identify how "solidarity" is understood in the passages mentioning the notion, one can assign the papers to the understandings. A paper is assigned to an understanding if the operators indicate that solidarity is understood in this way in at least one passage of the paper. A paper can also be assigned to several understandings if the operators identify different understandings in several passages of a paper. A detailed overview of the passages analyzed and their assignment to an understanding of solidarity in the context of CTA using the above operators can be found in Appendix 3 (Supplementary Material 2, starting from page 3).

As Table 2 with the overview of the different understandings and the authors shows, the five understandings of solidarity in the context of CTA occur with different frequency in the sample: most frequently, the notion "solidarity" is understood as a form of social cohesion that precedes CTA, is a condition for their implementation, and encourages their public acceptance and individual use (*understanding 1*, 16 times), closely followed by the understanding of solidarity as a moral value that considers CTA from an ex-ante perspective that orients and guides decisions about future actions concerning CTA (*understanding 3*, 15 times). Third most common is the understanding of solidarity as a form of social cohesion that is undermined or weakened by the implementation and use of CTA (*understanding 2b*, 12 times). Less frequently, the notion "solidarity" is understood as a moral value that considers CTA from an ex-post perspective, reflects and evaluates past decisions concerning their development, implementation, and use (*understanding 4*, 8 times), or as a form of social cohesion that is reinforced or created by the implementation and use of CTA (*understanding 2a*, 5 times).

Discussion

The results show that there are five different understandings of solidarity in the context of CTA in the sample. These different understandings differ in how authors determine the basic concept of solidarity (solidarity as a form of social cohesion or as a moral value), the temporal relation between solidarity and CTA (solidarity either precedes or follows CTA) and the causal interactions between solidarity and CTA. The five different understandings vary in frequency in the sample. These results raise further questions: First, how do the different understandings of solidarity in the context of CTA relate to each other—are they mutually exclusive or complementary? Second, are the key distinctions on which these different understandings are based valid—i.e., are they really five *different* understandings of solidarity in the context of CTA? Third, what is the scope of these findings and what are their limitations? And fourth, how can these results help address the communication problems mentioned in the *Introduction*?

Relations between the five understandings of solidarity

These five different understandings of the notion "solidarity" in the context of CTA can relate to each other in different ways.

On the one hand, there are a total of seven papers out of 47 papers—and thus a significant portion—which can be assigned to more than one understanding of solidarity. Assuming that these papers are not incoherent in how they understand or use the notion "solidarity" and do not contain self-contradictions, these seven papers suggest that the five different understandings do not need to be contradictory. Instead, the different understandings can stand side by side, indicating that they are mutually complementary. For example, Nijsingh, van Bergen, and Wild describe the relationship

TABLE 2 Overview of the different understandings and the authors.

Understanding 1	Understanding 2a	Understanding 2b	Understanding 3	Understanding 4
Dowthwaite et al. (69)	Gibney et al. (67)	Alemanno and Bialasiewicz (90)	Batifoulier and Diaz-Bone (95)	Braun and Hummel (28)
Georgieva et al. (74)	Lee and Lee (66)	Barocas et al. (91)	Blauth and Gstrein (104)	Christofidou et al. (105)
Gibney et al. (67)	Nijsingh et al. (82)	Chang et al. (38)	El-Haddadeh et al. (106)	Hendl et al. (96)
Lu et al. (70)	Price (92)	French et al. (88)	Findlay and Remolina (93)	Hoffman et al. (102)
Matt (84)	Samuel and Sims (72)	Lanzing (75)	Gasser et al. (109)	Kaspar (108)
Milne and Costa (68)		Leslie (80)	Hoffman et al. (102)	Keating (97)
Montanari Vergallo et al. (85)		Mangan et al. (81)	Hummel and Braun (101)	Siffels (103)
Nanni et al. (76)		Milan (89)	Kahn (110)	Watson et al. (100)
Nijsingh et al. (82)		Nijsingh et al. (82)	Lanzing (75)	
Parker et al. (36)		Pila (83)	Leslie (80)	
Sagan et al. (78)		Sekalala et al. (77)	Mbunge et al. (98)	
Samuel et al. (71)		van Hees et al. (86)	Mbunge et al. (99)	
Saunes et al. (79)			Mello and Wang (94)	
Sekalala et al. (77)			Roche (107)	
Stefan (73)			Samuel and Sims (72)	
Wnuk et al. (87)				

The authors that are assigned to multiple understandings are highlighted gray.

between solidarity and CTA as feedback loops: "Attempts to responsibly introduce CT technology are thus confronted with *feedback loops*: *low effectiveness raises costs and decreases uptake*, attempts to counter this by raising effectiveness may decrease privacy, which then potentially decreases uptake, while raising uptake by implementing more or less mandatory approaches creates risks of backlash and crumbling public support, which then again lowers effectiveness. Of course, scenarios where positive reinforcing feedback loops take place are also possible. A fair and reliable system would lead to an *increase in trust and potentially a shared feeling of solidarity*, which will lead to a further increase in use and therefore effectiveness, etc." (82) (italics added). When they describe solidarity as a shared feeling, they understand it, as the wider context of the passage makes clear, as an essential factor for the cohesion of a social system. The effective use of CTA can contribute to increasing this form of solidarity (*understanding 2a*), just as, conversely, the non-effective use of CTA can lead to a decrease in it (*understanding 2b*). At the same time, a circular relationship between CTA and solidarity as a feedback loop implies that solidarity contributes to the acceptance of CTA (*understanding 1*). A second example is Samuel and Sims and their accounts of solidarity and CTA: "Our findings showed how, through the mixture of both promissory discourses and altruistic discourses of *solidarity, an imaginary* was created that was imbued with implicit understandings of what is good or desirable in the social world. The *future-oriented visions and promises attached to the app*, along with calls of *social obligation*, constructed the trial of the app as a venture which was *morally good*, which was valued because of its ability to bring health benefits, and which was desirable in *the social world of the Isle of Wight*" (72) (italics added). They present solidarity as a currently imagined, future form of social cohesion in a particular social environment. The use of CTA, according to these visions, has a positive effect on social cohesion itself or central factors for it (*understanding 2a*). At the same time, solidarity is presented as a moral value that belongs to the morally good and from which a social obligation to use CTA arises (*understanding 3*). The understanding of solidarity as a moral value thereby emerges from the understanding of solidarity as an imagined form of social cohesion. In both Nijsingh, van Bergen, and Wild and Samuel and Sims, different understandings of solidarity in the context of CTA simultaneously coexist and complement each other.

On the other hand, the different understandings of solidarity can also contradict each other and lead to opposing recommendations. This becomes evident, when contrasting how, e.g., Kahn (110) understands "solidarity" with how Chang et al. (38), or how Pila (83) understand the notion. Kahn (110) assumes that the implementation and use of CTA will have a positive effect on society by counteracting the spread of COVID-19. Accordingly, he favors CTA and uses the notion "solidarity" to promote their implementation and use (*understanding 1*). In contrast, Chang et al. (38) and Pila (83) demonstrate how the introduction of CTA has negative effects on society or individual groups within it. They use "solidarity" to show how CTA can undermine it and to warn against the use of CTA in the name of solidarity (*understanding 2b*). These authors' examples show how different understandings of solidarity in

the context of CTA can contradict each other and lead to different recommendations.

Contrasting both positions shows that the different understandings of solidarity in the context of CTA can both complement but also contradict each other—and even lead to opposing recommendations. This makes it even more important to define exactly what the notion means whenever it is used.

The hermeneutic nature of the key distinctions

One result of the review is that in the context of CTA two basic concepts of solidarity can be distinguished. Solidarity is understood either as a factual form of social cohesion *or* as a moral value—this key distinction is the basis of the five understandings of solidarity.

At first glance, this distinction seems to be contradictory to the concept of solidarity, as it is outlined in the discussions about solidarity. As, e.g., Bayertz (46) shows in his study Four *uses of "solidarity"*, this distinction cannot be strictly maintained. He refers to the history of the concept solidarity and shows that only the earliest academic uses of solidarity understand it *solely* as a factual form of social cohesion. Yet, already Émile Durkheim at the end of the nineteenth century presents a concept of solidarity, that includes both, factual *and* moral aspects. For him, solidarity primarily refers to the various ties that bind members of a society together and thus ensure its cohesion (111). But he continues to show that this social cohesion has considerable influence on morality and moral obligations of the community (112)—thus indicating that factual forms of social cohesion and moral values can never be separated from each other (113). Durkheim's contemporaries, as Bayertz (46) and ter Meulen (114) show, share this understanding of solidarity. Bourgeois (115), for instance, uses the notion "solidarity" to refer to the factual forms of social cohesion in a society *as well as* to describe the moral obligations that arise from it. This understanding of solidarity as both factual form of social cohesion *and* moral value, prevails, so that: "'Solidarity' is now comprehended as a mutual attachment between individuals, encompassing two levels: a *factual* level of actual common ground between the individuals and a *normative* level of mutual obligations to aid each other, as and when should be necessary." (46).

This understanding of solidarity as a moral value, which is based on factual forms of social cohesion and aims at maintaining the community through its members solidary supporting each other, is common sense today in almost all publications concerned with solidarity (60, 114, 116–120). While there are still different understandings of how a solidarity community is constituted, what forms of cohesion exist within it, and what moral values arise from it, the simultaneity and mutuality of moral values and factual forms of social cohesion is set.

When I speak of solidarity either as a factual form of social cohesion or of solidarity as a moral value, I do not intend to fall behind the state of research and do not wish to separate and isolate moral values and factual forms of social cohesion from each other. By distinguishing between these two basic concepts, I want to do justice to the observation that many authors in the sample, when they use "solidarity", put an emphasis—and they understand solidarity either *rather* as a factual form of social cohesion or *rather* as a moral value. The distinction between both basic concepts should help to identify these emphases *in a hermeneutic way*—without separating factual forms of social cohesion and moral values or ignoring their reciprocity.

If the underlying key distinction is already hermeneutic in nature and indicates different emphases without introducing a strict separation between two basic concepts, the resulting five understandings of solidarity are also hermeneutic in nature—and serve to capture the various aspects, nuances and emphases of "solidarity" in the context of CTA.

Limitations

The review shows how "solidarity" is understood by different authors in the context of CTA. It proceeds inductively and is oriented toward the passages that mention solidarity in the context of CTA. Still—or maybe due to this approach—the review has some limitations.

First, the results are based on a relatively small database of only 47 papers, which are included in the final review. The database could be expanded if non-reviewed, non-academic papers, and gray literature were included. But this would, in turn, reduce the average assessed quality of the papers (52). So, although the database is small, it is of high quality. Second, the question about the different understandings of solidarity in the context of CTA is very specific—it focuses on only one notion in one single context. However, the same applies here: precisely due to its narrow focus, the review is highly informative.

Both limitations raise the question of whether the results are valid beyond this one context. On the one hand, it must be noted that the five understandings of solidarity as elaborated here are only valid for the context of CTA. On the other hand—as shown not least by the above discussion on the distinction between the two basic concepts—some of the distinctions made here can be found elsewhere in the discussions on the concept of solidarity. Thus, while the five understandings of solidarity have no validity beyond the context of CTA, they offer representative distinctions within the concept of solidarity that also prove to be valid elsewhere.

Practical recommendations

In conclusion, some practical recommendations can be given regarding the different understandings of the notion

"solidarity" in the context of CTA. First, it is important to specify precisely how one understands "solidarity" when using the notion in academic (or political) discussions about CTA. This helps to avoid polysemy, lexical ambiguity, and talking past each other, and thus contributes to preventing the central communicative misunderstandings identified in Section Introduction—as well as the negative consequences that result from them. The five understandings of "solidarity" in the context of CTA, presented in Section Results, can serve as orientation and help specify the notion in discussions.

Second, communication problems and misunderstandings also limit the success of public health communication (121, 122). Therefore, when using the term "solidarity" in public health communication, it is important to be specific about how it is understood. Because failing to do so, and not being clear about how and why the notion "solidarity" is used to promote public health intervention, e.g., the use of CTA, may in the worst case lead, as Guttman and Lev show (123), to the public beginning to distrust the notion—as well as the goals or public health measures it promotes and the institutions that use it. To prevent this loss of public trust, it is important not to strain the notions in public health communication (124) and to use them as clearly as possible—which, in the case of solidarity and CTA, the five understandings in Section Results can help to do.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.859831/full#supplementary-material

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Crisis communication strategies for health officials

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Background: Mixed messaging among health officials are prevalent amid COVID-19. Crisis communication strategies have the potential to help health officials effectively address issues such as mixed messages and improve their crisis communication efficacy. However, there is a dearth of insights in the literature. Therefore, to bridge the research gap, this study aims to examine practical strategies health officials can utilize to improve their crisis communication efficacy.

Methods: A literature review on effective crisis communication strategies amid COVID-19 was conducted in PubMed, Scopus, and PsycINFO, with a focus on scholarly literature published in English.

Results: The findings of the study identified the following strategies that health officials can utilize to improve their crisis communication capabilities: (1) develop fact-based, transparent, and accountable messaging, (2) utilize people-centered and empathetic persuasive strategies, and (3) leverage international collaboration for consistent messaging and comprehensive crisis communication.

Conclusion: COVID-19 has challenged health officials with unprecedented crisis communication duties and responsibilities. In this study, we underscored the importance of effective crisis communication amid global health emergencies like COVID-19, and identified communication strategies health officials could adopt or adapt to improve their crisis communication efficacy. Future research could explore strategies health officials can use to better communicate with government officials and media professionals to further help health officials improve their crisis communication capabilities, their abilities to avoid preventable miscommunication or mixed messaging, and in turn, society's collective strengthen in curbing and controlling the pandemic.

KEYWORDS

crisis communication, health officials, COVID-19, public health, health communication

Background

Crises are ubiquitous in healthcare (1). Ranging from everyday medical disputes (e.g., medical violence), periodical epidemics (e.g., seasonal influenza outbreaks), to once-in-a-century global pandemics (e.g., coronavirus disease 2019 or COVID-19), health officials often have to cope with emergency events on a daily basis (2–5). Take the COVID-19 pandemic for instance. As of mid-April, 2022, global COVID-19 cases has surpassed 500 million, while total deaths reached over 6 million (6). Accumulated evidence suggests that not only the pandemic is unprecedented, it evolves fast, as seen in the escalation of the transmissions of the Delta, Omicron, and then the BA.2 subvariant across the globe (7). This, in turn, may have partially contributed to the poor crisis communication practices among health officials across the pandemic (8, 9). For instance, three of the arguably most influential health officials in the U.S., the director of CDC Dr. Robert Redfield, the U.S. Surgeon General Jerome Adams, and the director of the National Institute of Allergy and Infectious Diseases Dr. Anthony Fauci, all have wrongly dismissed face masks' critical role in preventing COVID-19, in public, on record, and often on multiple occasions (10).

Dr. Fauci, for instance, said on record in a television interview that was directed to the general public "there's no reason to be walking around with a mask," while addressing the role of masking amid COVID-19 (10). Many thanks to the ever-presence COVID-19 infodemics, the statement was paraphrased into "masks are not good", and subsequently referenced a sobering number of times by various public figures, social media influencers, media outlets, and perhaps most alarmingly, conspiracy theorists (10–12). It is important to note that these three public health figures are only representatives of the pool of health officials that have issued and popularized mixed messages that range from confusing to conflicting (13–19). Accumulating evidence shows that health officials, including those working at the World Health Organization (WHO), arguably the most authoritative organization in healthcare directives, often fall victim to poor crisis communication practices that have resulted in ineffective pandemic communication, ranging from mixed narratives, conflicting advice, to poor communication skills (e.g., self-contradictory and confusing guidelines for masking) (20–24).

Considering that the pandemic is still evolving, it might be difficult to pinpoint the exact human and economic consequences of these contradictory statements (25–27). What is clear, though, is that failing to communicate with the public effectively about COVID-19 imperatives can cause substantial confusion in the public and negatively impact people's compliance with safety measures (28, 29). In addition, inconsistent health directives could also deteriorate people's trust and confidence in health officials and the government at large (30, 31). Not to mention that contradictory statements can ignite criticism from the public and demand additional communication efforts to further elaborate the messages, which in turn, could increase health officials' workload and fuel the physical and mental burnout many of them face constantly (32).

One way to address this issue is *via* effective crisis communication. Crisis communication could be understood as health officials' abilities to effectively, efficiently, and empathetically communicate and collaborate with key stakeholders in times of crisis, with the ultimate goal of controlling and containing emergency events and in turn, protecting personal and public health. Crisis communication, when coupled with persuasive strategies, has the potential to help health officials address issues such as mixed messages and improve their communication efficacy (33–43). However, though urgent attention is needed to address health officials' communication efficacy amid COVID-19, there is a dearth of research available in the literature (44). Therefore, to bridge the research gap, this study aims to examine practical strategies health officials can utilize to improve their crisis communication efficacy.

Methods

A review of the literature published in the COVID-19 context was conducted in PubMed, Scopus, and PsycINFO on December 12, 2021. Search terms used were: ("crisis communication strateg*"[Title/Abstract] OR "crisis communication method*"[Title/Abstract] OR " crisis communication mechanism*"[Title/Abstract] OR " crisis communication practice*"[Title/Abstract] OR " crisis communication intervention*"[Title/Abstract]) AND ("covid 19"[Title/Abstract] OR "covid-19"[Title/Abstract] OR "SARS-CoV-2"[Title/Abstract] OR "2019-nCoV"[Title/Abstract] OR "novel coronavirus"[Title/Abstract] OR "new coronavirus"[Title/Abstract] OR "coronavirus"[Title/Abstract]). Key information on crisis communication strategies amid COVID-19 was obtained. Table 1 lists the selection criteria adopted in screening the articles. Overall, studies were excluded if they: (1) did not focus on COVID-19 [e.g., foods-related crises (45)], (2) did not offer insights on crisis communication from health officials' perspectives [e.g., articles focused on government officials (46)], (3) did not discuss or identify crisis communication strategies, and (4) were not written in English.

Results

The search yielded 107 records. After the reviewing process, 18 peer-reviewed papers met the eligibility criteria and were subsequently included in the final review (see Table 2). The results indicate that, in addition to (1) a lack

TABLE 1 Study inclusion criteria.

Category	Criteria
Study context	COVID-19
Communication context	Crisis communication (as opposed to risk communication)
Language	English
Research focus	Crisis communication strategies for health officials amid COVID-19
Study type	Empirical and non-empirical research
Study outcome	Effective crisis communication strategies

of data and evidence ("known unknowns," what scholars refer to as the deficient uncertainty), (2) measurement errors, such as unreported and underreported COVID-19 cases (technical uncertainty), and (3) a lack of consensus about COVID-19 and best approaches to control it (consensus uncertainty), the ever-evolving nature of COVID-19 (e.g., virus mutations), may further result in (4) scientific uncertainty about the pandemic (47), which could result in health officials' poor messaging amid COVID-19, and subsequently, contribute to their suboptimal crisis communication capabilities (Figure 1).

The findings of the study identified the following strategies that health officials can utilize to countermeasure the abovementioned compounding factors, and in turn, improve their crisis communication capabilities: (1) develop fact-based, transparent, and accountable messaging, (2) utilize people-centered and empathetic persuasive strategies, and (3) leverage international collaboration for consistent messaging and comprehensive communication (48–65). These strategies will be discussed in detail in the following sections.

Discussion

This study set out to examine practical strategies health officials can utilize to improve their crisis communication efficacy. This study is among the firsts that examined actionable strategies health officials can adopt or adapt to improve their COVID-19 communication efficacy. The results of the study suggest that developing fact-based, transparent, and accountable messaging, incorporating people-centered and empathetic persuasive strategies, and leveraging international collaboration for consistent messaging and comprehensive communication can help health officials better manage crisis communication amid COVID-19 more effectively. A schematic representation of these strategies could be found in Figure 2. Details of these strategies will be discussed in the following sections.

Effective crisis communication strategies

Fact-based, transparent, and accountable messaging

A key effective crisis communication strategy is to develop fact-based, transparent, and accountable messaging (66–71). It is of critical importance that health officials base their statements on scientific facts, and communicate the key messages clearly and consistently with the public, including important caveats if the evidence shared was preliminary and subject to imminent change. Instead of merely emphasizing the core health message, health experts also should underscore limitations to the current knowledge base upon which the message is developed—that the message is derived "based on latest evidence" or "according to what we know so far." This approach will not only make sure health officials are responsibly communicating the facts and directives they ask the public to believe and follow, but also build rapport between health officials and the public.

Research on 6,000 Americans shows that while downplaying the uncertainty of COVID-19 can elicit support from the audience in the short term, reversals in projections can substantially reduce the message sender's scientific merit (72). Findings on 2,011 people living in Germany also show that most of the respondents prefer open discussion about COVID-19 uncertainties (73). These insights, overall, suggest that ignoring or downplaying uncertainties could harm health experts' credibility among members of the public, and further underscores the importance of transparent and accountable communication. Take the Omicron variant for instance. While it is critical that health experts support their crisis communication with facts, it is equally important, if not more, for them to communicate transparently and accountably—making sure the public understands that the current "knowns" about Omicron are in flux, and that scientists worldwide are working nonstop to unravel the "unknowns" about the variant to keep the public informed. It is important to underscore that it should be up to the public to decide if the style or substance of the communication should be "dumbed down" (59), rather than public health officials.

To be honest about what is known and what is subject to change about the pandemic, health officials are effectively making their messages more relevant and relatable to the public. Overall, many approaches can help health officials to clearly and responsibly communicate COVID-19 messages with the public, such as using visuals to accompany the message (e.g., interactive videos), adopting different narrative frames (e.g., promotion-focused vs. prevention-focused), and incorporating varied language formats (34–39). For instance, rather than framing health messages as hard truth, health experts can use clear and relatable language to explain the intricacies of health communication amid COVID-19, such as "Health mandates and policies amid COVID-19 are like software—for our benefits,

TABLE 2 List of included articles.

Author	Year	Title
Drescher et al. (48)	2021	The spread of COVID-19 crisis communication on Twitter: The effect of structure, content and style of COVID-19 tweets of German public authorities and experts
Ece (49)	2022	Health Communication Strategies: Crisis Management and Infodemic During COVID-19
Jong (50)	2020	Evaluating crisis communication. A 30-item checklist for assessing performance during COVID-19 and other pandemics
Kwok et al. (51)	2021	Crisis communication on social media: what types of COVID-19 messages get the attention?
MacKay et al. (52)	2021	Examining social media crisis communication during early COVID-19 from public health and news media for quality, content, and corresponding public sentiment
Ngai et al. (53)	2020	Grappling with the COVID-19 health crisis: content analysis of communication strategies and their effects on public engagement on social media
Noar et al. (54)	2020	(Mis)communicating about COVID-19: Insights from health and crisis communication
Paek et al. (55)	2021	Information Communication Technologies (ICTs), crisis communication principles and the covid-19 response in South Korea
Pang (56)	2021	Leadership and crisis communication during COVID-19: The case of Brunei Darussalam
Radanović Felberg (57)	2021	"Norwegian-Somalis are best suited to inform Norwegian-Somalis": Crisis communication, linguistic diversity and social (in)equality during the initial stages of the Covid-19 pandemic as represented by the Norwegian Broadcasting Corporation (NRK)
Ratzan et al. (58)	2020	Enhancing global health communication during a crisis: lessons from the COVID-19 pandemic
Shulman et al. (59)	2020	Don't dumb it down: The effects of jargon in COVID-19 crisis communication
Shulman et al. (60)	2021	The interplay of jargon, motivation, and fatigue while processing COVID-19 crisis communication over time
Su et al. (61)	2021	Mental health consequences of COVID-19 media coverage: the need for effective crisis communication practices
Subert (62)	2021	A gender-sensitive approach to U.S. crisis communication for COVID-19 and beyond
Tetteh (63)	2020	A leader's guide to crisis communication: lessons from Ebola for COVID-19
Wagner et al. (64)	2021	"The part played by people" in times of COVID-19: interpersonal communication about media coverage in a pandemic crisis
Wu et al. (65)	2020	COVID-19: peer support and crisis communication strategies to promote institutional resilience

they have to be updated, as their abilities to address public health imperatives get better with each update." This "full disclosure" step is essential, as once the public understands what to expect and why they will have the opportunity to adjust their mindset and are less likely to distrust or lose confidence in health officials and governments in general.

People-centered and empathetic persuasive strategies

People-centered crisis communication requires health officials to prioritize people's interests over politics and profits, whereas empathetic crisis communication needs health officials to factor in key contextual factors, such as the emotional burden and physical burnout the public might have already been shouldering throughout the pandemic (61), while delivering the essential pandemic updates. As of December 20, 2021, COVID-19 has already caused 275 million infections and 5.35 million deaths worldwide (74), along with its sobering impacts on people's mental health (75). In light of the ever-growing toll on lives, livelihoods, and economies that COVID-19 has exerted on the public, people-centered communication requires health experts to not only communicate fact-based, transparent, and accountable messages, but also convey care and empathy to the public as well (76).

In other words, health experts should make COVID-19 communication personable and relatable (77), and when possible, address the public's cognitive (e.g., information about COVID-19 vaccines), affective (e.g., fear and stress associated with receiving or not receiving a COVID-19 vaccine), and behavioral needs (e.g., lack of motivation or capabilities to uptake a COVID-19 vaccine) (42, 62, 78, 79). It is important

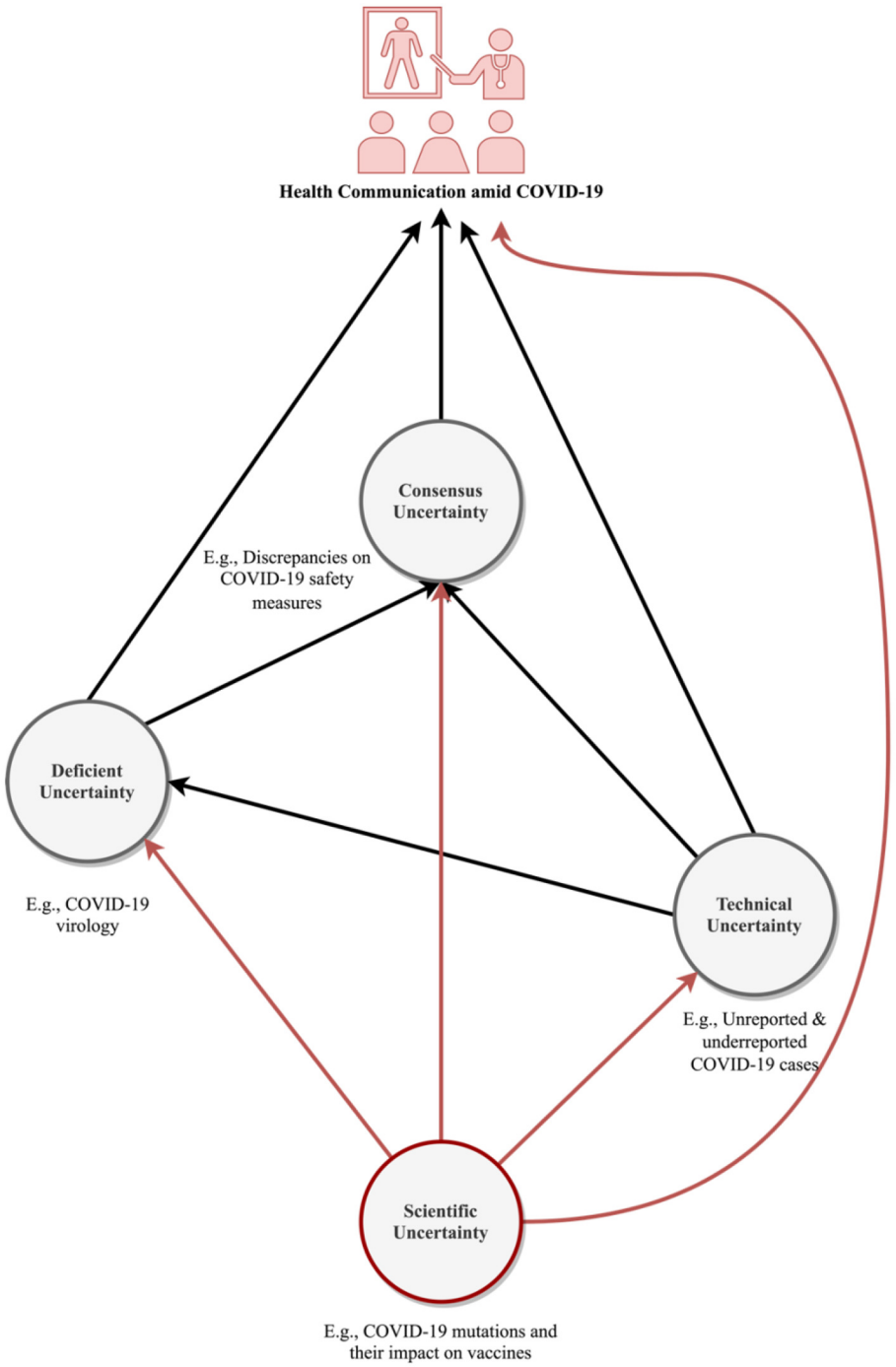

FIGURE 1
A schematic representation of the interplay between COVID-19 communication and uncertainties surrounding the pandemic.

to note that having a deep and comprehensive understanding of the target audience's characteristics is essential to effective communication (38, 42, 43), as it is not only essential to yielding desired health behavioral outcomes in the public, but also important to avoid potential unintended consequences that could harm individuals' mental health and wellbeing [e.g., anxiety (80); racism or stigmatization (81)].

For instance, one of the recurring reasons for African Americans' distrust in vaccines can be traced back to the Tuskegee Syphilis Study (82)— health and government officials

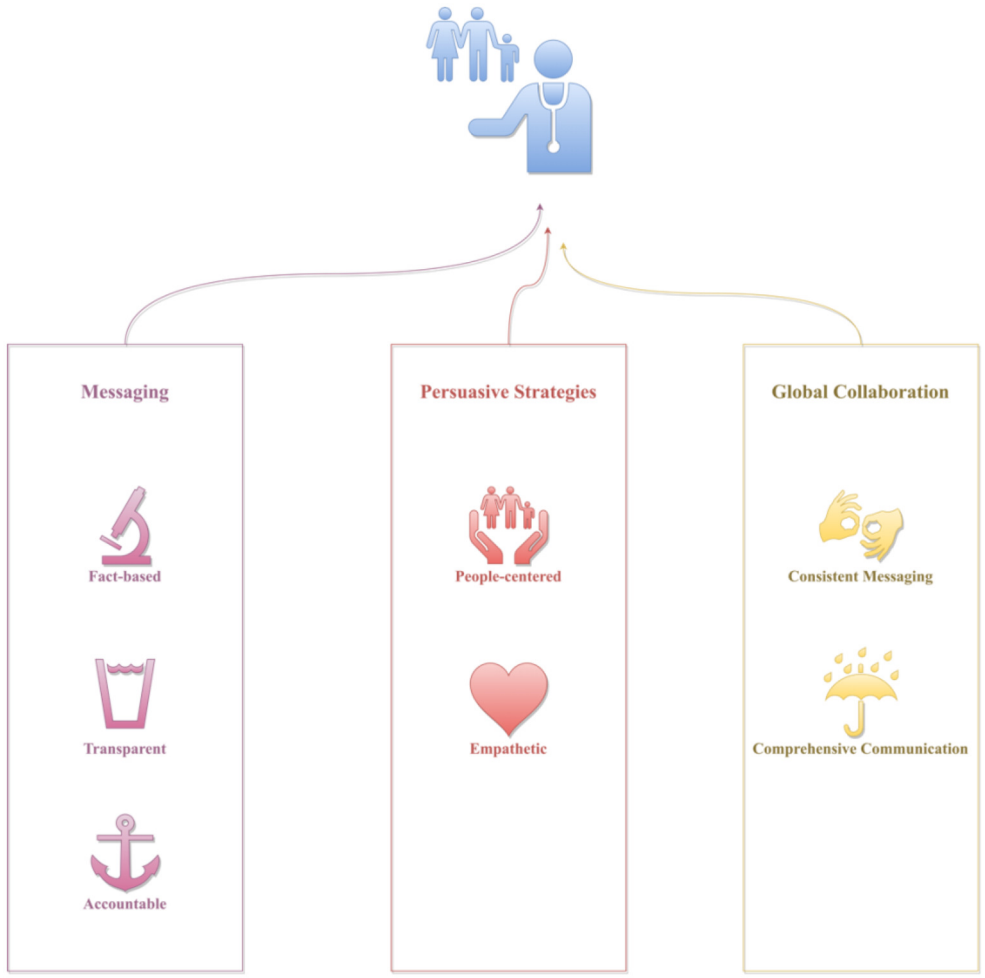

FIGURE 2
A schematic representation of the identified crisis communication strategies.

deliberately denied African American patients' medicine that can effectively treat syphilis, just to observe and collect data about the disease's progression (83). In light of these insights and according to ELM, to effectively communicate the importance of COVID-19 vaccines to personal and public health with African Americans, rather than emphasizing vaccine efficacy statistics that African Americans may distrust, health officials should consider collaborating with already trusted figures in the community, such as African American healthcare professionals and social media influencers, to stimulate conversations about adopting COVID-19 vaccines (84–87).

One good example is the selection of Sandra Lindsay, an African American nurse working at the Long Island Jewish Medical Center in New York City, as the first person who received a COVID-19 vaccine in the U.S. (88). Leveraging this high profile and heavily mediated event, the symbolic meaning of this communication endeavor is threefold: (1) to send a message to the public that COVID-19 vaccines are safe to take, (2) to encourage African Americans across the country to update COVID-19 vaccines, and possibly (3) to persuade the Jewish community in New York city to uptake the vaccine as well, a community which has been defiant in responding to government's COVID-19 safety measures (89). Overall, it is important to underscore that the cornerstone of crisis communication is the people—how to communicate effectively amid crises so that the public and the health officials can build back a new normal speedily and successfully. In other words, crisis communication should not merely focus on disseminating facts and figures; it should be centering on utilizing tailored people-centered and empathetic persuasive strategies to leverage factual messages to maximize their potential to inform, and engage, and empower the public to better cope with the crises.

International collaboration for consistent and comprehensive communication

As trusted public figures, health officials across the world have a fiduciary duty to the public to find the best possible solution in controlling COVID-19. One of the most cost-effective ways to accomplish this objective is via pooling scientific expertise and unifying COVID-19 communication strategies from international health officials, as international cooperation and collaboration can help: (1) bridge potential gaps in different governments' COVID-19 communication strategies, (2) broaden our collective understanding of effective ways to communicate about COVID-19, (4) improve the public's compliance with COVID-19 safety measures, (3) better equip global health systems for future pandemics (90). A key consideration is that individual nations could often fail to provide comprehensive or complete knowledge or know-how on COVID-19 single-handedly (52).

When the "there's no reason to be walking around with a mask" statement was made by Dr. Fauci on March 8th, 2020, almost two months after China shared the very first COVID-19's genetic sequence with the World Health Organization (WHO) (January 11th, 2020), evidence was available on the effectiveness of COVID-19 safety measures in many countries across the world (66–71). Take China for instance. On December 31st, 2012, 27 cases of pneumonia of unknown causes were reported in Wuhan. Less than a month later (January 23rd, 2020), the city of Wuhan initiated its lockdown—the single largest quarantine in recorded history (16). In February, 2020, China has opened its first Fangcang hospital that has the ability to hold 13,000 beds, with 13 more of these hospitals under construction. Yet by March 10th, 2020, these Fangcang hospitals were no longer needed.

In October, 2020, data showed that China's economy is the first to bounce back amid the pandemic—it is projected to be the only world's major economy to: (1) report a positive gain at year-end and (2) have an up to 9% GDP growth in 2021 (91). One key reason for China's successful management of COVID-19 centers on its effective crisis communication—against all odds, health officials have managed to persuade most of its 1.4 billion people to comply with COVID-19 safety measures such as masking, maintaining personal hygiene, and social distancing (92–95). Overall, effective communication practices can be found in many countries across the world, ranging from Finland, Ireland, New Zealand, Senegal, South Korea, to Vietnam (66–71, 96–99).

Take another nation, Senegal, for instance. Though it only has seven doctors for every 100,000 people, many thanks to its health and government officials' clear, consistent, and science-based communication about COVID-19 and what actions the government and its citizens need to be taken to control the pandemic (100), with a 16 million population, Senegal only have approximately 17,758 infections and 365 cases as of December, 2020 (101). These insights, overall, underscore the crucial imperative for international collaboration in thwarting COVID-19 (102). COVID-19 is a global health crisis—if the virus can cross borders and scientists across the globe can work together to develop COVID-19 vaccines, surely health officials worldwide can work collectively and collaboratively, above and beyond their political or ideological differences, to leverage international collaboration to develop more updated and collaborated crisis communication strategies and COVID-19 messages to better cope with the pandemic.

COVID-19 is also unprecedented, and to effectively control the pandemic, we need unprecedented levels of international cooperation and collaboration that bypass or transcend geopolitical concerns or "pandemic nationalism." While fighting infectious diseases can be accomplished by individual countries, cost-effectively controlling a pandemic of COVID-19's scale, both in terms of macro-level evidence-based decision-making and micro-level empathetic and effective interventions, requires health experts across the globe to work together and collaboratively (103–106). Overall, communication strategies—fact-based, transparent, and accountable communication, coupled with people-centered and empathetic persuasive strategies, developed based on international cooperation and collaboration, can help health officials across the globe manage COVID-19 more effectively, and get a head start in preparing for future health crises (107).

Limitations

While this study fills critical gaps in the literature, it is not without limitations. First, this study is not a systematic review, which means that the results of this study are limited in reproductivity and replicability. We excluded articles that focused on government officials or politicians' crisis communication practices. This means that studies that categorize health officials as government officials were not included in the review. Furthermore, only scholarly literature in English was reviewed and analyzed in the study, which suggests that it is possible that potential useful insights from COVID-19 articles in non-English language or non-academic in nature were not represented in the current study. To address these limitations, future research could adopt a systematic review approach that covers multiple languages to further shed light on COVID-19 crisis communication strategies for health officials.

Conclusion

COVID-19 has challenged health officials with unprecedented crisis communication duties and responsibilities. In this study, we underscored the importance of effective crisis communication amid global health emergencies like COVID-19, and identified communication strategies health officials could adopt or adapt to improve their crisis communication efficacy. Future research could explore strategies health officials can use to better communicate with government officials and media

professionals to further help health officials improve their crisis communication capabilities, their abilities to avoid preventable miscommunication or mixed messaging, and in turn, society's collective strengthen in curbing and controlling the pandemic.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

ZS conceived the work, reviewed the literature, drafted, and edited the manuscript. HZ, DM, JA, AC, and CY reviewed the literature and edited the manuscript. All authors approved the manuscript for submission.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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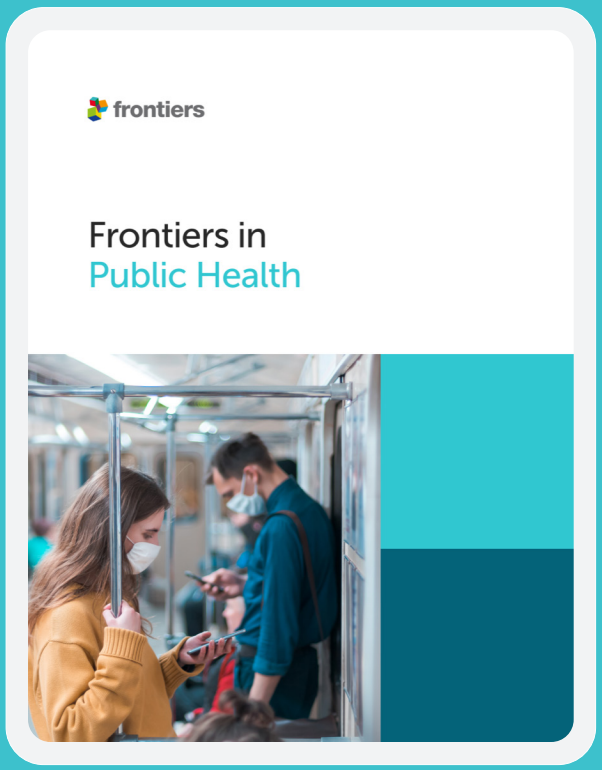

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