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A content analysis of government-issued social media posts during multi-jurisdictional enteric illness outbreaks in Canada

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Introduction: Most Canadians use at least one social media platform regularly, making social media a potentially effective tool for reaching broad audiences. The Public Health Agency of Canada (PHAC) uses social media as one tool for rapidly communicating with the public during multi-jurisdictional enteric illness outbreaks. However, the effectiveness of social media in enhancing public risk communication during these outbreaks remains unexplored. Addressing this gap may help optimise social media use for risk communication to inform the public and prevent additional illness. This study aims to analyse the engagement with and quality of PHAC's social media content regarding multi-jurisdictional enteric illness outbreaks.

Methods: Using a search of PHAC's social media platforms, 482 posts during enteric illness outbreaks (2014–2022) were identified, including 198 posts from Facebook and 284 posts from X (formerly Twitter) in English and French. A codebook was developed using engagement metrics for gauging public interest, the Centers for Disease Control and Prevention's (CDC) Modified Clear Communication Index (CCI) to assess clarity as a proxy for comprehension, the Health Belief Model (HBM) to evaluate the potential to motivate behaviour change, and measures of consistency. Descriptive statistics were used to analyse post content.

Results: The average engagement rates for PHAC social media accounts were < 1%, below standard average engagement rates (1–5%). While posts generally adhered to the CDC's CCI criteria, clear language (45.7% on Facebook, 26.5% on X) and clear communication of risk (7.6% on Facebook, 0.0% on X) were scarce. HBM constructs were present in all posts, but certain constructs, such as barriers were used sparingly (1% on Facebook, 0% on X). Despite this, posts consistently communicated outbreak investigation details and prevention information.

Discussion: The low average engagement rates suggest a lack of public awareness or interest in the posts. The partial adherence to the CCI indicates room for improvement in clarity, a key component for supporting public understanding. Although some HBM constructs were utilised, no posts incorporated all HBM constructs, which may hinder efforts to promote behaviour change. To enhance effective risk communication using social media during multi-jurisdictional

enteric illness outbreaks in Canada, tools like the CDC's CCI should be used to improve message clarity, use of all HBM constructs as applicable, and message consistency across products and channels are recommended to improve overall message quality and content.

KEYWORDS

health communication, social media, engagement, comprehension, behaviour change, risk communication, enteric illness, outbreak investigations

1 Introduction

In Canada, approximately one in eight Canadians are affected by enteric illnesses each year (Thomas et al., 2013). Enteric illnesses occur from the consumption of contaminated food or water, contact with animals, or person-to-person contact. These illnesses often result in self-limiting, gastrointestinal symptoms such as nausea, vomiting, and diarrhoea. While everyone is susceptible to enteric illnesses, young children, older adults, individuals with weakened immune systems, and people who are pregnant are at higher risk of severe illness, hospitalisation, and death (Barkley et al., 2016). Therefore, it is crucial that communication of enteric illness outbreaks is visible, understandable, and promotes preventive health behaviours to lessen the impact of the outbreak.

An enteric illness outbreak occurs when two or more persons become ill after exposure to a common source, such as a contaminated food item (Gould et al., 2013). In Canada, when an outbreak occurs in more than one province/territory, or between Canada and another country, the Public Health Agency of Canada (PHAC) manages the multi-jurisdictional outbreak response (Public Health Agency of Canada, 2017). PHAC communicates outbreak investigation details, pathogen information (if known), and health preventive strategies using several channels, including Public Health Notices (PHN) posted to the Government of Canada's website, and corresponding social media posts on Facebook, X (formerly Twitter), and LinkedIn (Patel et al., 2024). As new information becomes available, PHNs are updated, and new social media posts are made to reflect the latest details of the outbreak. Communication during these outbreak events is intended to enhance awareness and increase uptake of preventive behaviours at the individual level, such as hand-washing, proper cooking methods, or disposal of contaminated food items.

Given the accessibility and real-time nature of social media (Delisle et al., 2021), government public health officials have leveraged these platforms to increase dissemination, reach, and engagement with health information (Kass-Hout and Alhinnawi, 2013; Moorhead et al., 2013). Engagement with health information on social media can enhance comprehension (Bennett and Glasgow, 2009) and promote behaviour change (Webb et al., 2010). Features such as audiovisual elements and hashtags can foster engagement, prompting user actions such as liking, commenting, or sharing (Jiang et al., 2016). These actions not only symbolise social endorsement (Kim, 2018), but also influence other users' perceptions of the post and their subsequent behavioural intentions (Park and Jung, 2023), a phenomenon known as the bandwagon effect (Marsh, 1985). Additionally, social media has other advantages for risk communication, including the potential to increase public awareness using brief, tailored messaging (Hyland-Wood et al., 2021) and elicit emotional responses that can increase risk

perception and uptake of preventative behaviours (Al-Dmour et al., 2020; Li and Liu, 2020; Mahmood et al., 2021; Oh et al., 2020).

To improve use of social media for effective risk communication, standardised tools and frameworks have been developed to enhance message comprehension and effectiveness. One such tool is the Centers for Disease Control and Prevention's (CDC) Modified Clear Communication Index (CCI). The modified CCI, consisting of four introductory questions and 13 scored items, is a research-based tool that can be used to evaluate the characteristics of social media posts to enhance clarity and comprehension (Centers for Disease Control and Prevention, 2017). Previous studies have used the modified CCI to evaluate short-form and oral communication materials, such as social media posts, podcasts, and infographics (da Silva et al., 2021; Kelly et al., 2023; Nunes et al., 2023).

Effective health communication that influences behaviour change should be grounded in theory (Milgrom, 2015) as health communication materials grounded in theory are more effective than those without a theoretical framework (Glanz and Bishop, 2010). Studies have shown that health communication materials grounded in theory, such as the Health Belief Model (HBM), tend to be more effective at modifying behaviours than those not based on such frameworks (Brewer et al., 2007; Luquis and Kensinger, 2019; Vahedian-Shahroodi et al., 2019; Limbu and Gautam, 2023). The HBM has been widely adopted in health education and promotion programmes (Ngigi and Busolo, 2018). The HBM theorises that individual behaviour is dependent on beliefs about the threat to one's well-being and the perceived effectiveness of the recommended behaviour according to six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy (Becker, 1974; Rosenstock, 1974; Champion and Skinner, 2008). According to the HBM, optimal behaviour change occurs when all six constructs are present in health and risk messaging. Further, message consistency, as understood in this study, refers to the extent to which predetermined key message elements are consistently present across posts and is important in risk communication (Seeger, 2006). Consistent messages, in the context of behavioural recommendations, foster public understanding and improve behaviour adoption (Seeger, 2006).

While previous research has demonstrated the effectiveness of social media in risk communication, this approach remains understudied concerning food safety and food-related behaviours (Mou and Lin, 2014; Yang et al., 2015; Overbey et al., 2017). Despite growing concerns about enteric illness outbreaks among public health authorities (Hossain et al., 2015), the literature examining the role of social media in these outbreaks is scarce and limited in geographical scope (Overbey et al., 2017). Moreover, studies that investigate the use of social media in emerging infectious disease outbreaks, including foodborne illness outbreaks, often lack a theoretical framework (Tang

et al., 2018), which has demonstrated effectiveness in developing health communication strategies. These gaps present a challenge for developing effective communication strategies to mitigate the spread of enteric illnesses. Understanding how social media can be leveraged in the context of enteric illness outbreaks could fill this knowledge gap and enhance public health response strategies during these outbreaks.

While PHAC routinely uses social media platforms, particularly Facebook and X, to communicate outbreak information and prevention strategies, a formal evaluation of their content to promote public awareness and comprehension has not been conducted. This research aims to evaluate the content of PHAC social media posts on Facebook and X issued during multi-jurisdictional enteric illness outbreaks to identify communication strengths and opportunities for improvement. The specific objectives are to assess (1) the public's awareness of social media posts using engagement metrics, (2) the clarity of social media posts using the CCI, (3) the use of HBM constructs in social media posts using operationalized constructs, and (4) the consistency of social media posts through the inclusion and repetition of key information.

2 Materials and methods

2.1 Inclusion criteria

Social media posts published from May 27, 2014 (the date of the first PHN) to December 31, 2022 that explicitly mentioned multi-jurisdictional enteric illness outbreaks for which a PHN had been published were included. Posts were collected from official Canadian federal public health accounts on Facebook (Healthy Canadians, Canadiens en santé) and X (Health Canada and PHAC, Santé Canada et l'ASPC) in English and French.

2.2 Data collection

Social media posts were manually reviewed and collected by reviewing all account posts to identify those that met inclusion criteria. No specific keywords or search terms were used in the collection process. A unique identifier was created for each eligible social media post and the following metadata was recorded: link to the social media post, pathogen, publication date, and date of collection. Data was collected from May 10–18, 2023 by the first author and managed using Microsoft Excel (Microsoft Corporation, 2018).

2.3 Engagement analysis

An engagement rate was calculated for each social media post using published platform-specific formulas (Sehl and Mikolajczyk, 2023). Engagement metrics included number of reactions, comments, and shares on Facebook, and number of retweets and comments on X. For all calculations, the total number of followers at the time of data analysis was used (November 2023). The engagement rate per post (ER post) was calculated by adding the number of engagements divided by the number of followers. The overall average engagement rate per platform and language was subsequently calculated by dividing the total number of engagements by the number of social media posts. Descriptive time

trends in engagement rates over the study period (2015–2022) were assessed by examining differences in annual engagement rates.

2.4 Content analysis

A deductive, iterative content analysis of all social media posts was conducted following established methodology (Hsieh and Shannon, 2005). French social media posts that were direct translations of English social media posts were excluded to avoid redundancy in the content analysis. A codebook was developed by VP to guide the analysis, and included engagement metrics, CCI criteria, HBM constructs, other health communication best practices identified in the literature, and measures of consistency (Supplementary Table A1).

The modified CCI for short form communication materials includes a total of 13 items in four parts (Supplementary Table A2). Part A applies to all communication materials and includes the main message and call to action and language. Parts B, C, and D selectively apply and include behavioural recommendations, numerical information, and risk, respectively. For Facebook, 11 of the 13 CCI items were used, as written. Two criteria were excluded because no Facebook posts required mathematical equations or used numeric probability to describe risk. For X, 7 of 13 items were used, as written, while six items were excluded due to the lack of mathematical equations and the non-applicability of certain criteria in the context of short messages.

Similar to other studies, HBM constructs were operationalized to identify explicit features of the text that aligned with these constructs (Meadows et al., 2019; MacKay et al., 2022b; Bajouk and Ferré-Pavia, 2023) (Supplementary Table A3). For example, perceived susceptibility was coded as present if the post mentioned the number of cases.

Other health communication best practices were also included, specifically the use of hashtags (Lin et al., 2016), mentions (Zappavigna and Martin, 2018), visuals (Chou et al., 2021), tone (Maal and Wilson-North, 2019), intended audience information (Korda and Itani, 2013), interaction (Lin et al., 2016), and combatting misinformation (Lin et al., 2016) (Supplementary Table A1).

Consistency was measured at a high level through the inclusion and repetition of key information from the PHN (e.g., source, pathogen, and geographical distribution) and prevention information (e.g., link to additional information, behavioural recommendations) (Supplementary Table A1).

Two researchers (VP, HS) independently coded a ~ 10% simple random sample of 50 Facebook and X posts using the codebook. Interrater reliability was calculated in R using the 'irr' package (Gamer et al., 2010; Posit team, 2023) and met the *a priori* cut-off of 0.8. A kappa value (κ) of 0.92 was achieved indicating almost perfect agreement (McHugh, 2012). Minor disagreements were resolved through discussion, leading to no major codebook revisions. The codebook was applied to the remaining 432 posts by one researcher (VP). All coding was done using Microsoft Excel (Microsoft Corporation, 2018).

2.5 Statistical analysis

Descriptive statistics, including mean, standard deviation, and minimum and maximum values, were computed for continuous

variables. Frequencies and proportional frequencies were computed for categorical variables. Data were tabulated and visualised using RStudio version 2023. 6. 1. 524, using base packages (Posit team, 2023), dplyr (Wickham et al., 2023), ggplot2 (Wickham, 2016), and stringr (Wickham, 2023). Analyses were stratified by language, platform, and both language and platform.

2.6 Ethics

As per the University of Guelph's Research Ethics Board, ethics approval was not required as this study used publicly available data.

3 Results

In total, 482 social media posts were identified: 198 posts from Facebook (97 in English, 101 in French) and 284 posts from X (153 in English, 131 in French). The engagement analysis included both English and French social media posts ($n = 482$). Subsequent content analyses used English data only ($n = 250$).

3.1 Engagement

English social media posts ($n = 250$) had an average engagement rate of $0.36 \pm 1.32\%$ (0.01–12.45%) on Facebook and $0.01 \pm 0.02\%$ (0.00–0.21%) on X (Table 1). French social media posts ($n = 232$) had similar engagement with an average engagement rate of $0.37 \pm 0.89\%$ (0.00–7.02%) on Facebook and $0.01 \pm 0.01\%$ (0.00–0.05%) on X (Table 1).

Facebook and X average engagement rates varied across time and by language (Figure 1). On Facebook, engagement rates peaked in 2016 for French-language posts (ER post = 2.37%) and 2021 for English-language posts (ER post = 1.21%). On X, engagement rates were highest in 2016 and 2020 for English-language posts. Contrastingly, French-language posts demonstrated a consistent engagement rate of ~0.01% over the study period.

3.2 CDC's modified CCI

3.2.1 Main message and call to action and language

Facebook posts adhered to core communication principles, with 100% of posts featuring a call to action and 97.9% with a main message always displayed at the top of the post. Facebook posts less

frequently communicated the main message and call to action in an active voice (35.1%) using only words the public uses (2.1%). Most X posts also featured a call to action (99.3%) and main message statement (87.6%). Just over half of X posts employed an active voice when communicating the main message and call to action (51.6%); however, posts rarely communicated using plain language (1.3%) (Table 2).

3.2.2 Behavioural recommendations

Facebook and X posts consistently provided behavioural recommendations (99.0 and 96.7%, respectively). Further, Facebook posts frequently explained the importance of adopting the recommended behaviours (91.8%) (Table 2).

3.2.3 Numbers

If numbers were present in Facebook and X posts, they were always communicated clearly using whole numbers (100%) (Table 2).

3.2.4 Risk

Facebook and X posts less frequently explained the nature of the risk to the public (14.1 and 0.0%, respectively). Further, Facebook posts rarely addressed the risks and benefits of the recommended behaviours (1.0%) (Table 2).

3.3 HBM

Facebook posts frequently used cues to action (95.9%) and benefits constructs (91.8%). However, posts less often employed the severity (14.4%) and barrier constructs (1.0%). On average, Facebook posts most often incorporated three of the six HBM constructs (40.2%) per post. No Facebook posts employed all six constructs in a single post. Likewise, X posts also used cues to action (95.4%) and benefits constructs (87.6%) with infrequent use of severity (2.0%) and barriers constructs (0.0%). X posts typically included two HBM constructs (45.1%) per post, and like Facebook, no X posts contained all six constructs in one post (Table 3).

3.4 Other health communication best practices

Facebook posts frequently incorporated visuals in 94.8% of posts, primarily using still photographs (43.5%). Hashtags were rarely used on Facebook (10.3%), but when they were, posts adhered to the best practice of including a maximum of two or less hashtags per post (100%). Mentions of other organisations were infrequent (2.1%). Posts

TABLE 1 Descriptive statistics of engagement variables for Facebook (Healthy Canadians, Canadiens en santé) and X (Health Canada and PHAC, Santé Canada et l'ASPC) accounts in both official languages (English and French) for multi-jurisdictional enteric illness outbreak posts.

| Variable | Facebook | | X | |
|-------------------------------|----------|---------|---------|--------|
| | English | French | English | French |
| Followers as of November 2023 | 433,000 | 182,000 | 450,000 | 35,300 |
| Total engagements | 150,749 | 67,473 | 9,984 | 459 |
| Average post engagement rate | 0.36% | 0.37% | 0.01% | 0.01% |
| Total posts | 97 | 101 | 153 | 131 |

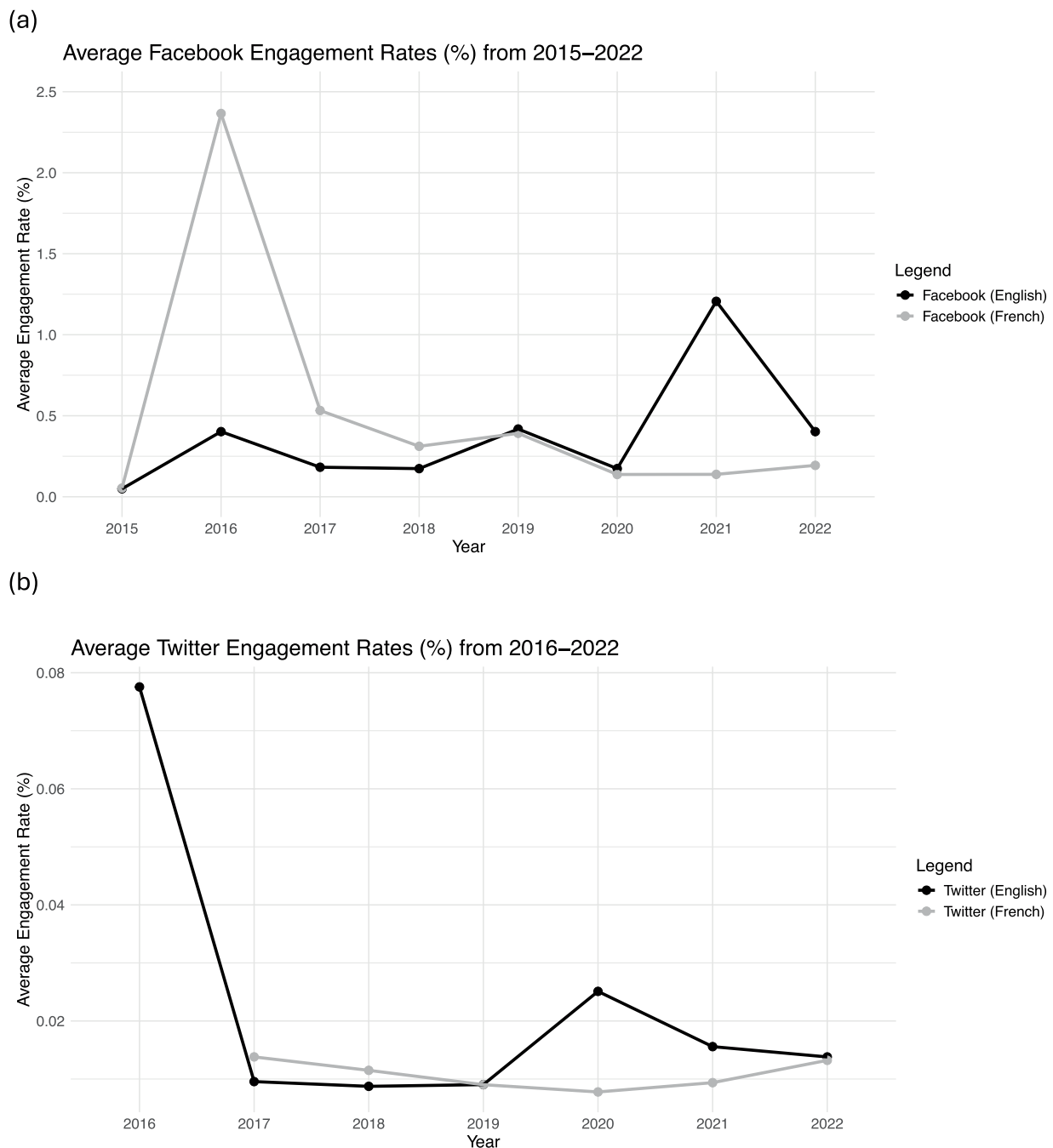


FIGURE 1 Time trends in average engagement rates on multi-jurisdictional enteric illness outbreak posts from 2015 to 2022 on Facebook accounts in both official languages (Healthy Canadians, Canadiens en santé) (A) and from 2016 to 2022 on X accounts in both official languages (Health Canada and PHAC, Santé Canada et l'ASPC) (B).

containing messaging to combat misinformation were never used (0.0%) (Table 4).

Likewise, X posts included visuals in 97.4% of posts, with still photographs most often used (53.0%). Hashtags were commonly used on X (70.6%), and like Facebook, a maximum of two or less hashtags per post was usually adhered to (94.4%). Mentions of other organisations were slightly more common on X (7.2%), aimed at increasing engagement with other governmental bodies like InspectionCan (54.5%), CFIA_Food (36.4%), and CDCgov (9.1%). X posts did not contain messaging to combat misinformation (0.0%) (Table 5).

3.5 Consistency

Posts on both platforms consistently provided details on outbreak investigations, including the source (99.0% on Facebook, 100% on X) and the pathogen (97.9% on Facebook, 100% on X). All Facebook posts and most X posts (98.7%) included a link to additional information for preventing illness. However, providing geographical distribution information was less consistent, with 52.6% of Facebook posts and 17.6% of X posts including this information (Table 6).

TABLE 2 Analysis of the binary (yes/no) presence of CCI criteria for multi-jurisdictional enteric illness outbreak Facebook posts (n = 97) and X posts (n = 153) on English accounts.

| Variable | Facebook | X |
|---|------------|-------------|
| | n (%) | n (%) |
| Core | | |
| Main message and call to action | | |
| One or more calls to action | 97 (100%) | 152 (99.3%) |
| One main message statement | 95 (97.9%) | 133 (87.6%) |
| Main message at the beginning | 97 (100%) | N/A |
| Language | | |
| Important information is summarised at the beginning | 97 (100%) | N/A |
| Main message and the call to action use the active voice | 34 (35.1%) | 79 (51.6%) |
| Only contains words the primary audience uses | 2 (2.1%) | 2 (1.3%) |
| Behavioural recommendations | | |
| One or more behavioural recommendations | 96 (99.0%) | 148 (96.7%) |
| Explains why the behavioural recommendation(s) is important | 89 (91.8%) | N/A |
| Numbers | | |
| Presents numbers the primary audience uses | 69 (100%) | 57 (100%) |
| Risk | | |
| Explains the nature of the risk | 12 (14.1%) | 1 (0.0%) |
| Addresses risks and benefits of the recommended behaviours | 1 (1.0%) | N/A |

TABLE 3 Analysis of the binary (yes/no) use of HBM constructs and integration of HBM for multi-jurisdictional enteric illness outbreak Facebook posts (n = 97) and X posts (n = 153) on English accounts.

| HBM Aspect | Facebook | X |
|--|------------|-------------|
| | n (%) | n (%) |
| HBM construct | | |
| Susceptibility | 69 (71.1%) | 56 (36.6%) |
| Severity | 14 (14.4%) | 3 (2.0%) |
| Benefits | 89 (91.8%) | 134 (87.6%) |
| Barriers | 1 (1.0%) | 0 (0.0%) |
| Cues to Action | 93 (95.9%) | 146 (95.4%) |
| Self-Efficacy | 34 (35.1%) | 30 (19.6%) |
| Total number of HBM constructs used | | |
| 0 | 1 (1.0%) | 3 (1.96%) |
| 1 | 3 (3.1%) | 12 (7.8%) |
| 2 | 22 (22.7%) | 69 (45.1%) |
| 3 | 39 (40.2%) | 58 (37.9%) |
| 4 | 24 (24.7%) | 10 (6.5%) |
| 5 | 8 (8.2%) | 1 (0.6%) |
| 6 | 0 (0.0%) | 0 (0.0%) |

4 Discussion

Designing and disseminating effective social media posts can improve public awareness and comprehension to prevent and promote health. This study assessed public awareness of and the potential to comprehend social media posts issued by PHAC during

multi-jurisdictional enteric illness outbreaks using a descriptive analysis of engagement metrics and a comprehensive content analysis. Although Facebook posts had higher overall engagement, neither Facebook nor X achieved the overall benchmark engagement rate across all industries (1–5%), indicating sub-optimal awareness. Social media posts met several CCI criteria, including clear communication of the call to action and main message, behavioural recommendations, and numerical information. However, using plain language and clarifying the nature of the risk may help to improve public comprehension. Similarly, social media posts used multiple HBM constructs. Integration of all six constructs could be improved to optimally promote healthy behaviours. Social media posts almost always demonstrated message consistency, supporting understanding and use of the provided information.

4.1 PHAC social media posts had below-average engagement

Engagement rates on social media platforms can be used to gauge public awareness of posts. Rates between 1 and 5% are indicative of good engagement (Sehl and Mikolajczyk, 2023). At the end of 2023, average engagement rates on Government of Canada accounts were 1.62% on Facebook and 1.36% on X (Mikolajczyk, 2023). However, our study revealed average engagement rates below 1% across all accounts and platforms for multi-jurisdictional enteric illness outbreaks with relatively higher engagement on Facebook. Facebook is more commonly adopted across all demographics (Krallman et al., 2016; Pew Research Center, 2021), as it traditionally serves as a platform for social interactions (Voorveld et al., 2018). In contrast, X is considered more news-oriented (Kwak et al., 2010) and tends to

TABLE 4 Analysis of other health communication best practices and intended audiences used for multi-jurisdictional enteric illness outbreak Facebook posts (*n* = 97) on English account.

| Variable | Variable level (if applicable) | Sub-variable (if applicable) | <i>n</i> (%) |
|---------------------------------|--|--|--------------|
| Hashtag | Hashtag use | | 10 (10.3%) |
| | Number of hashtags (1-2) (<i>n</i> = 10) | | 10 (100%) |
| | Title cased hashtags (<i>n</i> = 0) | | – |
| Mention | Mention | | 2 (2.1%) |
| | Mention name (<i>n</i> = 2) | Canadian food inspection agency (CFIA) | 2 (100%) |
| Visuals | Presence of visuals | | 92 (94.8%) |
| | Type of visual (<i>n</i> = 92) | Still photographs | 40 (43.5%) |
| | | Composite graphics | 28 (30.4%) |
| | | Symbols | 20 (21.7%) |
| | | Video | 3 (3.3%) |
| | | Moving photographs | 1 (1.1%) |
| | Visual of source of pathogen (<i>n</i> = 92) | | 72 (78.3%) |
| Text on visual (<i>n</i> = 92) | | 88 (95.7%) | |
| | Text on visual pertains to main message (<i>n</i> = 88) | | 88 (100%) |
| Tone | Conversational and professional | | 84 (86.6%) |
| | Compassionate and empathetic | | 0 (0.0%) |
| Intended audience information | | | 16 (16.5%) |
| Interaction | | | 1 (1.0%) |
| Misinformation | | | 0 (0.0%) |

TABLE 5 Analysis of other health communication best practices and intended audiences used for multi-jurisdictional enteric illness outbreak X posts (*n* = 153) on English account.

| Variable | Variable level (if applicable) | Sub-variable (if applicable) | <i>n</i> (%) |
|---|--|------------------------------|--------------|
| Hashtag | Hashtag use | | 108 (70.6%) |
| | Number of hashtags (1-2) (<i>n</i> = 108) | | 102 (94.4%) |
| | TitleCased hashtags (<i>n</i> = 12) | | 4 (33.3%) |
| Mention | Mention | | 11 (7.2%) |
| | Mention name (<i>n</i> = 11) | InspectionCan | 6 (54.5%) |
| | | CFIA_Food | 4 (36.4%) |
| CDCgov | | 1 (9.1%) | |
| Visuals | Presence of visuals | | 149 (97.4%) |
| | Type of visual (<i>n</i> = 149) | Still photographs | 79 (53.0%) |
| | | Composite graphics | 29 (19.5%) |
| | | Moving photographs | 27 (18.1%) |
| | | Symbols | 14 (9.4%) |
| | Visual of source of pathogen (<i>n</i> = 149) | | 135 (90.6%) |
| | Text on visual (<i>n</i> = 149) | | 147 (98.7%) |
| Text on visual pertains to main message (<i>n</i> = 147) | | 146 (99.3%) | |
| Tone | Conversational and professional | | 142 (92.8%) |
| | Compassionate and empathetic | | 0 (0.0%) |
| Interaction | | | 22 (17.6%) |
| Intended audience information | | | 2 (1.3%) |
| Misinformation | | | 0 (0.0%) |

TABLE 6 Analysis of the consistency of outbreak investigation and prevention information for multi-jurisdictional enteric illness outbreak Facebook posts ($n = 97$) and X posts ($n = 153$) on English accounts.

| Variable | Variable level | Facebook | X |
|------------------------|--------------------------------|------------|-------------|
| | | n (%) | n (%) |
| Outbreak investigation | Source | 96 (99.0%) | 153 (100%) |
| | Pathogen | 95 (97.9%) | 153 (100%) |
| | Geographical distribution | 51 (52.6%) | 27 (17.6%) |
| Prevent illness | Link to additional information | 97 (100%) | 151 (98.7%) |
| | Behavioural recommendations | 96 (99.0%) | 148 (96.7%) |

garner less engagement than Facebook (Reuter et al., 2021). This trend, where Facebook demonstrates higher engagement rates than X, aligns with our findings (Bhattacharya et al., 2017; Haro-de-Rosario et al., 2018; Reuter et al., 2021; DePaula et al., 2022).

Lack of engagement, as evidenced by rates below industry standards, may reflect an overall inattentive and unresponsive audience (Guidry et al., 2017), hindering the awareness and amplification of posts (Bajouk and Ferré-Pavia, 2023). Engagement metrics, such as share and like functions on social media posts, affect the perception of the post and other user's behavioural intentions (Kim, 2018). These functions can serve as a cue, triggering the bandwagon heuristic which leads people to accept others' beliefs, attitudes, or decisions, as their own (Sundar, 2008). Negative engagement can cue others to view the content in the same light. Therefore, the lower engagement rates observed on PHAC's social media posts may cause others to view PHAC content as uninteresting or irrelevant. Additionally, lower engagement rates may impact how platform algorithms rank and display these posts in followers' feeds (Meta, 2024; Twitter, 2023), potentially reducing visibility and further affecting engagement.

Social and mixed media features, almost always employed on both platforms, can increase engagement (Rus and Cameron, 2016; Moran et al., 2019; Li and Xie, 2020; Cao et al., 2021). The use of pictures in communication materials can enhance comprehension and adherence, especially among individuals with low literacy skills (Houts et al., 2006). Moreover, the use of a dialogue loop, initiated by hashtags and questions, can promote two-way communication (Men et al., 2018). These features can increase engagement by encouraging the public to voice their opinions through social media functions, such as sharing, liking, and commenting (Watkins, 2017). To complete the dialogue loop, organisations should take the opportunity to respond to questions, comments, and concerns (Kent and Taylor, 1998). Utilising dialogue loops enhances engagement and supports a public-centred approach, fostering trust between the public and the posting organisation (Kent and Taylor, 2002). In the future, social media posts should consider the use of social and mixed media features to improve engagement, comprehension, and adherence.

4.2 Social media posts could be improved by using plain language and clearly communicating the risks

An analysis of the posts, focusing on their adherence to the CCI, revealed that posts effectively communicated the main message, behavioural recommendations, and numerical

information. However, the use of plain language and the communication of risk could be improved. A similar study examining government health messaging in Canada found inconsistent application of the CCI, possibly impacting the clarity and comprehension of communication materials (Kelly et al., 2023).

Recognising the importance of clear health communication language, often termed plain language, the Government of Canada introduced the Directive on the Management of Communications. This directive emphasises the need for plain language in all public communications, defining it as writing that is easily understandable upon first reading (Government of Canada, 2021). Our analysis revealed that posts contained few familiar words that the public could easily comprehend. Unclear language can hinder public understanding and ability to adopt health behaviours (Zarcadoolas, 2010). Communicating about enteric illnesses, which often requires complex scientific terminology, is further complicated by the character limits imposed by social media platforms. These constraints make it challenging to streamline the content effectively, which can further impede understanding (Zarcadoolas, 2010). While plain language is crucial for improving health information comprehension (Greene et al., 2017), it is also important to recognise that some scientific terminology may be unavoidable, for example, pathogen names. Therefore, it is recommended to minimise the use of complex terms as much as possible while preserving accuracy, rather than solely relying on plain language. Further, social media is a common source of health information for older adults (Dooley et al., 2012; Tennant et al., 2015; Zhao et al., 2022). However, older adults, who have lower health literacy on average (Rootman and Gordon-El-Bihbety, 2008), are of particular concern as they are also at higher risk for enteric illnesses (Barkley et al., 2016). Therefore, ensuring information shared on social media is written in plain language is important to help older adults both understand and act on the content.

Effectively crafting posts during outbreak responses entails curating content that resonates with affected populations, including clear identification and explanation of public health risks (Tumpey et al., 2019). While social media posts often identified the cause of harm, crucial information enabling individuals to assess the risk's relevance, such as associated symptoms, was seldom provided. Without this information, affected populations may not understand the significance of the risk and how it relates to them, potentially hindering adherence to recommended health behaviours (Tumpey et al., 2019).

4.3 HBM constructs were used with variability, indicating an opportunity for enhanced integration to support behaviour change

According to the extended parallel processing model (EPPM), a communication theory, the susceptibility and severity constructs constitute a threat that needs to be elicited for individuals to respond to fear and engage in preventive behaviours (Witte, 1992). The posts inconsistently included the susceptibility construct and seldom the severity construct, hindering the ability of individuals to properly appraise the threat and take preventive actions. A prior meta-analysis of the HBM constructs' effectiveness indicated that benefit and barrier constructs are more predictive of behaviour change compared to severity and susceptibility constructs (Carpenter, 2010). While benefit constructs were almost always present, barrier constructs were rarely present in posts. This is important given that barrier constructs are influential in motivating behaviour change.

Nonetheless, the presence of all constructs is important: perceived susceptibility, perceived severity, perceived barriers, and perceived benefits to maximally influence health behaviours (Sulat et al., 2018). As such, social media posts should aim to incorporate all relevant HBM constructs to optimise the potential to influence behaviour change. For instance, posts could include the number of cases (susceptibility) and, if applicable, hospitalisations and deaths (severity) to influence risk perception and support accurate threat appraisal. Additionally, when providing behavioural recommendations, posts should offer stepwise and detailed instructions to enhance self-efficacy, helping individuals take preventive actions to avoid or reduce the threat. Briefly outlining the benefits (prevention of illness) and overcoming barriers (ease of task) can enhance an individual's confidence that completing the action will have a desirable effect and encourage individuals to adopt preventive actions to avoid or reduce the threat (Witte, 1992). Due to character limits imposed on social media, integrating the full HBM in a single post may not be feasible. Instead, multiple posts, such as a thread on X, can be used to convey information. Additionally, using visuals with text overlays or videos in combination with the captions can convey more information, while adhering to character limits.

4.4 Consistent posts can foster public trust, understanding, and use

During public health threats like enteric illness outbreaks, individuals intensify their reliance on trusted sources and perceived expertise for emotional release during information seeking (Ball-Rokeach, 1985). People seek information from the media and turn to organisations they trust (Holroyd et al., 2020). Public health organisations, such as PHAC, were historically viewed as trusted sources of health information (Lachlan et al., 2014). However, the COVID-19 pandemic has been associated with growing concerns about trust in the federal government (Herati et al., 2023). This growing scepticism may affect how people perceive and value information from PHAC, potentially impacting PHAC's communication effectiveness during enteric illness outbreaks.

For government communication, consistent posts are crucial to establishing trust (MacKay et al., 2022a,b; Seeger et al., 2018; Wray et al., 2008). The consistent messaging demonstrated by PHAC, exemplified by including outbreak investigation details and prevention information in each post, helps individuals sift through information, distinguishing between authentic and misleading content (Wajeaha et al., 2020), and builds trust in the information provided (Vereen et al., 2020). Conversely, inconsistent messaging creates confusion and hampers the public's ability to take preventive actions (Seeger, 2006). Trust in government organisations as key information providers is important for risk perception and subsequent adoption of preventive behaviours (Dohle et al., 2020; Lim et al., 2021; Jeong and Kim, 2023). Maintaining consistency in communication aids in building public trust and ensuring effective information dissemination during enteric illness outbreaks.

4.5 Limitations

Our study has several limitations. First, the study assumed that the follower count recorded in November 2023 was constant over the study period when calculating engagement rate metrics. This assumption may potentially impact the accuracy of engagement rate calculations. If followership increased over time, the engagement rate in earlier time periods would have been underestimated, potentially leading to an inaccurate assessment of engagement trends. Second, the application of CCI criteria was scored as absent or present but did not measure the effectiveness of each scored item. This means that recommendations coded as present might not be actionable, which could have overestimated how comprehensible the post was by the public. Third, the HBM was operationalized to identify explicit features that may motivate an individual to undergo a behaviour change; however, this study could not ascertain whether an individual would change their behaviours. Fourth, consistency was measured broadly to assess post patterns for key information surrounding outbreak and prevention information. However, this approach did not account for variation in the types of information present, which can mask inconsistencies.

4.6 Future research

Future research should explore the underlying causes of engagement rate variability over time, including assessing post characteristics to understand which features result in higher engagement to inform effective communication strategies. Further, the effectiveness to which the CCI was applied, beyond presence/absence, should be explored. While our study employed tools to assess the potential impact of posts on comprehension, other data collection methods, such as focus groups or surveys, are needed to directly assess comprehension. These insights can offer valuable perspectives on public comprehension of social media posts during multi-jurisdictional enteric illness outbreaks. Focus groups or surveys could also include open-ended questions to explore reasons for low engagement. Additionally, exploring consistency of content within and between posts, beyond merely assessing for the presence of key types of information, can help provide insights into content variations which may impact public trust. Furthermore, future studies could

benefit from international comparisons to understand how communication strategies vary across different public health contexts.

5 Conclusion

Government social media accounts are critical to inform the public about outbreak investigations and preventive measures during multi-jurisdictional enteric illness outbreaks. This study examined social media posts for their potential to engage and impact public awareness and comprehension during multi-jurisdictional enteric illness outbreaks. Our findings indicate that although engagement is below average industry standards, posts do incorporate some of the CCI and HBM constructs to support public comprehension. Social media posts demonstrated message consistency, fostering trust, understanding, and use. Social media is a useful communication tool during multi-jurisdictional enteric illness outbreaks and could be enhanced by improving engagement, alignment with CCI criteria, and full integration of the HBM. Enhanced risk communication during multi-jurisdictional enteric illness outbreak investigations can contribute to reducing enteric illnesses among Canadians.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the corresponding author upon request.

Author contributions

VP: Data curation, Formal analysis, Investigation, Methodology, Visualisation, Writing – original draft. LG: Conceptualisation, Methodology, Project administration, Supervision, Writing – review & editing. HS: Investigation, Writing – review & editing. MM: Methodology, Writing – review & editing. LC: Conceptualisation, Methodology, Writing – review & editing. MP: Conceptualisation, Funding acquisition, Methodology, Writing – review & editing. AP: Methodology, Supervision, Writing – review & editing. JM: Conceptualisation, Methodology, Supervision, Writing – review & editing.

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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/fcomm.2024.1512014/full#supplementary-material>

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