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Community series in the consequences of COVID-19 on the mental well-being of parents, children and adolescents, volume II

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Community series in the consequences of COVID-19 on the mental well-being of parents, children and adolescents, volume II

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Editorial: Community series in the consequences of COVID-19 on the mental well-being of parents, children and adolescents, volume II

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COVID-19, emotional distress, education, social distancing, isolation, family

Editorial on the Research Topic
Community series in the consequences of COVID-19 on the mental well-being of parents, children and adolescents, volume II

While the COVID-19 pandemic affected all people in some way, some were affected more than others. Society was forced to act quickly and adapt to new restrictions and rules in their everyday lives. Social distancing was adopted, people were forced into lockdowns and quarantines while schools and working places were closed and people made to work from home.

This second edition of the Research Topic aims to extend knowledge of the consequences of the COVID-19 pandemic and widen perspectives of the impact that it has had worldwide. The nine included papers come from different countries (Thailand, China, Malawi, Slovakia, Italy, and Germany) and cover various topics related to the pandemic. Four of the papers focus on data from adolescents and their mental health. Three papers use data from parents, how parents perceive changes in family dynamics, their own mental health as well as how they coped with the pandemic while the final two focus on instrument validation.

Adolescents are a vulnerable group that had to make great changes to their lives during the pandemic. Their lives changed significantly due to lockdown and not being able to meet friends. Guo et al. explored how adolescents aged 12–18 perceived lives during lockdown in 2022. A sample of 1,065 Chinese middle and high-school students filled in questionnaires to examine the association between social support, rumination, sleep quality and negative emotional states (e.g., depression, anxiety, and stress). The findings from this study showed that bad sleep quality and less social support is negatively associated with negative emotional states but positively correlated with rumination. These results highlight that social support for adolescents is important in decreasing negative emotions such as depression, anxiety and stress.

A longitudinal study from Germany by Güzelsoy et al. aimed to identify the risk and protective factors of depressive symptoms and anxiety in children and adolescents during the pandemic. In their study, the authors used data from about 800 adolescents and their parents from a baseline and at a 6-month follow up. The results showed that cross-sectionally, several family and school factors were associated with adolescent depression and anxiety. However, longitudinally only parental depressive symptoms were risk factors for depression and anxiety 6 month later.

Studies from different parts of the world are very important in understanding the impact of COVID-19 worldwide. A study carried out by Mmanga et al. in Malawi has shown results that are consistent with those from economically more advantaged countries. The authors used quantitative and qualitative methods to study depression and anxiety among adolescents and reported quite a high prevalence of depressive symptoms and anxiety. They also stress the need to improve the knowledge of Malawi adolescents in terms of the virus, vaccinations and mental health related topics.

Wang et al. provide a complex picture about depression and anxiety among children and adolescents pre- and post-COVID-19 in their meta-analysis. A selection process identified seven longitudinal studies (four from the USA, and one from each of the following countries: Canada, Greece, and Australia) that had studied depression and anxiety before and after the pandemic. The study showed a significant deterioration of child and adolescent mental health in the post COVID-19 period.

Parents have been affected by the pandemic in different ways and have even been seen as the most vulnerable group in some way (Vargová et al.). In Slovakia, the importance of parents' mental health was the focus of a study where a sample of 363 parents participated in four waves of data collection over one and a half years. The results showed a small change in depression and anxiety but higher changes in COVID-related stress and anxiety. There was also a stability that grew over time in that stress or anxiety did not increase but stayed the same or even decreased. This could be explained by parents adapting to the situation that the pandemic created. The authors highlight that the parents' wellbeing in a crisis like a pandemic is important since parents' wellbeing can have a spillover effect on their children's wellbeing.

Limsuwan et al. examined the effects of the pandemic on family wellbeing in Thailand. They used a cross-sectional study to learn more about the changes in family functioning and happiness. A questionnaire was distributed online and on Facebook with 485 participants answering questions about perceived family happiness pre-pandemic and post-pandemic. The majority (90.9%) were women. The score showed a slight decrease in the post-pandemic score. Moreover, general family functioning, strength and communication were significantly lower after 1 year of the pandemic. On the other hand, the results showed a lower level of verbal and physical violence. The strongest association to the change of family functioning was the change in family happiness which decreased during the pandemic.

Another study from China conducted by Ma et al. looked at how the pandemic affected children with intellectual disabilities during lockdown. Furthermore, it also explored the parent coping strategies. There were 457 parents recruited for the study who had at least one child between 12 and 18 with an intellectual disability. The analyses revealed that children with an intellectual disability had the most positive changes concerning sleep, diet and communication which were reported to function better during the pandemic. However, hyperactivity and inappropriate language did not improve. Parents used different coping strategies staying at home with their children, with the most popular ones being diversion (i.e., watching TV, eating, or playing with a mobile phone). However, it is not clear which coping strategy worked best and more research is needed to get a clear answer.

Valid instruments need to be implemented in research in order to be able to study the impact of the pandemic. Within this Research Topic, there are two validation papers included. The first paper by Yang et al. aims to study the factor structure and measurement invariance of the COVID-19 Phobia Scale in Chinese adolescents with depressive symptoms. This has been explored among nearly 2,000 adolescents. The instrument showed a stable four-factor structure (psycho-somatic factor, psychological, economic and social factors) and had good reliability and validity in the sample.

The second validation study carried out by De Stefano et al. aimed to explore the psychometric properties of the Children and Adolescents Psychological Distress Scale CAPDS-10. The new scale was developed to study distress during the COVID-19 pandemic with nearly 3,500 French children and adolescents filling in the questionnaire. The 10-item scale measures psychological distress over the most recent 2-weeks and has robust unidimensional structure and good psychometric properties. As the authors state, it could be used in crisis or prevention contexts in the general population or in clinical settings.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

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Affect, Behaviors of Children With Intellectual Disabilities and Parents' Coping Strategies During the COVID-19 Pandemic

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Background: In early 2020, the COVID-19 pandemic emerged. To prevent the spread of the virus, China implemented restrictions on going out and ensured that people stayed at home. This study aims to investigate the affect and behaviors of children with intellectual disabilities (ID) during the lockdown. The informal coping strategies adopted by parents and their effects were further evaluated.

Methods: In this study, a total of 457 parents of children (mean age: 14.82 years ± 1.96) with ID in 12 provincial administrative regions across China were surveyed online using the Positive and Negative Affect Scale and our own questionnaire on daily behaviors, problem behaviors and informal coping strategies.

Results: During the COVID-19 pandemic, the positive affect (PA) score was significantly higher than that of negative affect (NA) ($p < 0.001$). Some children experienced mostly positive changes in sleep (16.63%), communication (14.66%), and diet (5.69%). However, more than one-third (39.39%) exhibited problem behaviors such as hyperactivity. A significant correlation was found between affect and behavior. The informal coping measures adopted by parents were generally effective among affect and the relationship with problem behaviors.

Conclusions: The affect of the children with ID at home was mainly positive. The overall behaviors (diet, sleep, and communication) were good, but there were problem behaviors. Effective coping strategies are associated with higher PA, lower NA, and fewer problem behaviors. The greater the number of effective coping strategies, the lesser the problem behaviors.

Keywords: COVID-19, affect, children with intellectual disabilities, coping strategies, problem behaviors

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INTRODUCTION

In 2020, the COVID-19 pandemic broke out rapidly and spread all over the world. To effectively contain the pandemic, all Chinese provinces launched a Level I response to major public health emergencies and stopped all assembly and gathering activities. The Spring Festival holiday was extended from the January 28 to February 2, 2020 (1). People made efforts to fight against the pandemic by staying home both from work and social activities (2). According to clinical stress

theory, long-term home isolation limits the physical activities of individuals, which causes adverse effects on their physical state, their affect, and their behavior (3–5).

The COVID-19 pandemic resulted in a rapid shutdown of social life, creating a closed environment that may have impacted both the mental and emotional health of teenagers with intellectual disabilities (ID) (6), who are quite susceptible to emotional and problem behaviors (7–9). Affected by physical and psychological conditions, children with ID are quite different from those without ID in the expression of subjective effects, such as generally poor emotional management ability, slower development of emotional ability (9), and even some defects (8). In the field of emotional research, positive affect (PA) and negative affect (NA) are important embodiments of mental health and psychological efficacy. Excessive NA, such as anxiety and depression, predicts higher social and behavioral problems (10); further, it is associated with avoidance coping strategies, positively correlated with social anxiety (11), and closely related to eating disorder tendency (12). Emotional problems or mood disorders in children may induce other mental disorders, cause behavioral disorders, and even increase the risk of suicide (13). Therefore, for children with ID who have more emotional problems, it is important to detect the onset of NA and find ways to improve PA and reduce NA to maintain their good emotional state.

During the COVID-19 pandemic, more than half of people with ID reported more mental health problems in Chile, and that number was about 41% in the United States (14). A recent study confirmed the severely negative psychological impact on psychiatric patients due to the strict lockdown measures (15). In a telephone interview of vocational school students with developmental disabilities, the majority of whom had mild ID, more than one-third reported mild or more severe symptoms of anxiety and depression, with girls being more affected (16). At the same time, more problem behaviors were also reported by parents of children with ID (17, 18). A group of parents stated in fact that their child's problem behaviors had been their biggest challenge since the stay-at-home order went into effect (18).

As a result of the pandemic, more than 75% of families of children with ID lost at least one therapy or educational service (18, 19). In cases where professionals could not provide timely support, the possibly unhealthy conditions of children with ID presented a substantial challenge for guardians (20, 21). A survey conducted during the pandemic showed that relative to carers of children without ID, carers of both children and adults with ID had significantly greater levels of defeat/entrapment, anxiety, and depression. The differences were two to three times greater than reported in pre-pandemic studies (22).

Despite the enormous difficulties, parents have taken steps to cope with the challenges. Parents from California and Oregon have implemented behavioral strategies, routines, engaging in enjoyable activities, or finding fun activities to do (18). It should be noted that coping strategies such as seeking outside help and professional support (23) are not readily available during the COVID-19 pandemic. However, emergency situations (such as challenging behaviors) in families of exceptional children need to be dealt with in time to prevent more serious problems. A meta-analysis of emotional and problem behaviors of children with autism showed that, when faced with extreme situations (e.g., outbursts, meltdowns), parents will comfort them with positive and gentle words, physical acts such as hugs, or remove them from the situation (24). This is consistent with the previous conclusion that positive parenting strategies (such as praise and positive non-verbal responses) can effectively improve children's compliance and decrease inappropriate behaviors (25, 26). O'Nions et al. (24) further pointed out that, when faced with problem behaviors, the diversionary methods used by parents are effective and can even prevent outbursts in challenging situations, while negative parenting strategies such as yelling and conveying negative affect are often ineffective (27). However, it remains to be seen how effective these coping strategies are for children with ID, especially during this particular time. After all, there have been requests for support and services from parents to address such challenges during the pandemic (28). Before providing these services, we also need to figure out what parents themselves can do at home to make support strategies more targeted. To address this, it is necessary to study the specific affect and behaviors of children with ID (29), the coping strategies their parents have taken, and the effects of these strategies.

This study investigated the affect and behavior of children with ID at home during the novel coronavirus outbreak, as well as the coping strategies (including behavior, language and diversion) and effects adopted by their parents, to provide a reference for psychological intervention during this singular period, as well as subsequent school teaching, rehabilitation treatment, and family management.

MATERIALS AND METHODS

Participants and Settings

This study took place in March 2020 following approval by the Ethics Committee of Shaanxi Normal University. The participants were recruited through social networks in special education schools or rehabilitation institutions.

The participants were parents of exceptional children, selected based on the following criteria: (a) raised at least one child with ID, (b) children were between 12 and 18 years old, (c) children had IQ < 70, and (d) they voluntarily agreed to participate in this study.

Before the formal study, we conducted a pilot study with 16 parents and four teachers in two classes of children with ID. It helped to address any potential weaknesses of the survey items and included checking for clarity of wording, formatting, appropriateness of the number, labeling of response options, participants' acceptance of the questions, and so forth (30). This helped to improve the validity and reliability of the "Questionnaire on Daily Behaviors, Problem Behaviors of Children with ID and Parents' Informal Coping Strategies."

We used items in the questionnaire to screen out participants such as, "Do you have children with ID in your family?" and "What is your child's level of ID?" Only those parents who met the criteria were included in the follow-up survey.

In this study, we screened out 457 exceptional children, including 262 boys (57.3%) and 195 girls (42.7%), from 12

provincial administrative regions of China. The average age of the participant children was 14.82 years (SD = 1.96, range = 12–18 years). The parents of these children completed the online questionnaire.

Instruments

Positive and Negative Affect Scale

We used the Positive and Negative Affect Scale (PANAS) developed by Watson et al. (31) and revised by Huang et al. (32), with a 5-point Likert-type scale (1 = "almost none" to 5 = "extremely"). The scale is divided into two dimensions: positive affect (PA) and negative affect (NA). Each dimension consists of 10 questions. The results of confirmatory factor analysis showed that the model fit well ($\chi^2/df = 2.40$, $RMSEA = 0.06$, $TLI = 0.92$, $CFI = 0.93$), and the two-factor structure of the scale was confirmed. The average score of 10 items corresponding to each factor was taken. The Cronbach's alpha (α) coefficient was 0.87 for PA and 0.85 for NA.

Questionnaire on Daily Behaviors, Problem Behaviors of Children With ID and Parents' Informal Coping Strategies

We constructed a scale (Questionnaire on Daily Behaviors, Problem Behaviors of Children with ID and Parents' Informal Coping Strategies) to measure the behavior of children with ID and the effects of the informal coping strategies. The scale includes three aspects: daily behavior, problem behaviors, and informal coping strategy.

Daily behaviors and their changes were measured in three aspects: how were the children with ID eating at home during tough times; how were they sleeping during this time; how were they communicating with other family members. The first three questions examined the changes during the pandemic, and the participants rated each item on a 3-point scale (1 = better, 2 = no change, 3 = worse).

When we measured the specific problem behaviors, we used the five dimensions of the Aberrant Behavior Checklist (ABC) introduced by Ma et al. (33); additionally, the results of the pilot study with parents were used to identify more problem behaviors in the study. Finally, we indicated six main problems: hyperactivity, stereotyped behavior, inappropriate speech, violent behavior, sluggishness, and refusal to see people.

Informal coping strategies include behavioral comfort, language comfort, and diversion. *Behavioral comfort* comes from touch care, which refers to improving the emotional state and behavioral performance of teenagers with ID through touching, hugging, and other physical contacts (34, 35). *Language comfort* refers to positive comfort based on respect using a relaxed gentle tone (35). The specific ways to divert attention are based on the result of the pilot study with parents, which include watching TV, eating, playing on mobile phones, playing games, exercising, playing with toys, listening to music, writing homework, reading books, and other methods. The effects of the coping strategies are divided into two types, 1 = effective and 0 = ineffective, which were reported by the parents of children with ID.

TABLE 1 | ANOVA for the differences of affect among changes of daily behaviors ($N = 457$).

	Sleep	Communication	Diet
Positive affect	$F = 0.90$	$F = 2.37$	$F = 0.92$
Negative affect	$F = 4.12^*$	$F = 0.04$	$F = 12.43^{***}$

$^*p < 0.05$; $^{***}p < 0.001$.

Data Analyses

Data were coded and analyzed using the IBM SPSS Statistics 23. Descriptive statistics were computed for each variable. The correlation analysis, independent sample *t*-test, and one-way analysis of variance (ANOVA) were used to test the relation of affect, behaviors, and the effect of coping strategies. Mplus 7.4 was used for confirmatory factor analysis of PANAS.

RESULTS

Affect and Behaviors

During the pandemic, the PA scores of children with ID were significantly higher than those of NA ($t = 17.71$, $p < 0.001$). In addition, 16.63% of children with ID experienced changes in sleep, 14.66% experienced changes in communication, and 5.69% experienced changes in diet. These changes were mostly positive, such as communicating better and more frequently with families. Furthermore, 39.39% of the children with ID displayed problem behaviors at home. The top three problem behaviors were hyperactivity (19.91%), stereotyped behavior (12.04%), and inappropriate language (11.38%). "Hyperactivity and overactivity" has become one of the main problem behaviors at home of children with ID during the pandemic.

The results of ANOVA are shown in **Table 1**. Children with ID, whose sleep and diet worsened reported higher NA ($p < 0.05$). Better sleep and diet may reduce NA ($p < 0.05$). The problem behaviors were counted according to the number of occurrence categories (between 0 and 5). The number of problem behaviors was negatively correlated with PA ($r = -0.11$, $p < 0.05$) and positively correlated with NA ($r = 0.36$, $p < 0.001$). The more problem behaviors there were, the lower the PA, and the higher the NA.

Affect and Informal Coping Strategy

To mollify children with ID at home during the pandemic, parents have adopted informal coping strategies such as behavioral comfort ($N = 362$), language comfort ($N = 399$), and diversion ($N = 444$). In parents' opinion, the most effective strategy is diversion, followed by behavioral comfort and language comfort. Among the several attention-diverting strategies, watching TV ($N = 209$), eating ($N = 135$), and playing with mobile phones ($N = 140$) were the preferred ones. The most effective strategies to divert children's attention are listening to music and performing sports, though the above two were not the

TABLE 2 | Informal coping strategies adopted by the parents of children with intellectual disabilities.

Coping strategies	Behavioral comfort	Language comfort	Diversion (N = 444, Effective rate = 67.63%)								
			Watching TV	Playing with mobile phones	Eating	Performing sports	Listening to music	Playing games	Doing homework	Playing with toys	Reading
Samples	362	399	209	140	135	134	115	92	86	71	50
Effective rate	61.60%	57.14%	65.07%	70.71%	61.94%	75.37%	79.13%	69.57%	56.98%	66.20%	58.00%

most preferred strategies by parents. **Table 2** portrays the data of informal coping strategies.

The results of independent sample *t-test* are shown in **Table 3**. The PA and NA scores of different coping effects were significantly different. The PA of effective coping strategies was significantly higher than that of ineffective coping strategies, while the NA was significantly lower in ineffective coping strategies.

Problem Behavior and Informal Coping Strategy

Children with ID performed well at home during the pandemic and had few negative changes in sleep, diet, and communication. However, the incidence of problem behaviors was high. Therefore, we investigated the specific effects of three types of informal coping strategies. The results are shown in **Table 3**.

Our results indicate that the three types of coping strategies had inhibitory effects on problem behaviors. Children with ID whose coping strategies were effective reported fewer problem behaviors. When problem behaviors occurred, the coping effectiveness of language comfort, behavioral comfort, and diversion decreased sequentially ($|t|$: 5.40> 4.45 > 2.9).

Furthermore, the number of effective informal coping strategies adopted by each family was calculated (between 0 and 3). The correlation between the number of effective coping strategies and the number of problem behaviors was then calculated. A significant correlation was found between them, $r = -0.27$, $p < 0.001$. The greater the number of effective coping strategies used by children with ID, the fewer the problem behaviors reported.

DISCUSSION

Major public health emergencies can profoundly affect people's psychology negatively. Thus, it should come as no surprise that the pandemic has led to many psychological and neuropsychiatric problems for both ordinary people and patients (3, 36–39). However, the results of this study show that the emotional state of children with ID was not significantly worse off, and that children with ID generally exhibited good behavior, although this result may be due to the fact that the survey was conducted just after the Spring Festival. The Spring Festival is the grandest festival of the Chinese year, similar to the Christmas and New Year celebrations in Western countries. The festival offers opportunities to eat a lot of delicious food during the Reunion Dinner, while the custom of family reunion during the Spring Festival combined with home isolation during the pandemic might create more opportunities for family members to get along and communicate with each other. In the happy atmosphere of the Spring Festival, even though the children with ID were restricted from going out, they had significantly more PA than NA; sleep, communication, and diet also showed positive changes.

The overall good behavioral performance of children with ID was mutually correlated with better affect. Therefore, paying attention to the emotional changes of children with ID can predict possible problem behaviors and assist in carrying out suitable intervention (40). Similarly, for children with ID, maintaining a stable emotional and psychological state by developing regular living habits and reducing interference from negative information may help in both their education and social interaction (41). An effective coping strategy adopted by the parent can also affect emotions. In the process of long-term medical consultation and rehabilitation treatment, the parents have a certain understanding of the children's condition and have gradually found simple and effective informal coping strategies suitable for their children. Just as the parents noted, 'I was able to take care of my child very well, I knew what he/she wanted and how to deal with it, if he/she was too excited to show problem behaviors, I would hug him/her in my arms and sing a song at his/her ear, and he/she would calm down. These skills may contribute to their ability to take good care of children with ID when staying at home during the pandemic. Therefore, parents should also take time to pay attention and for informal coping strategies during non-epidemic periods, as such attention may help young people with ID establish and maintain a positive emotional state.

Some of the problem behaviors of children with ID during the pandemic may have been caused by the combined effects of physical and psychological barriers as well as the pandemic itself. One in five parents reported problem behaviors of hyperactivity, which perhaps are affected by restrictions on going out. Children are generally active outside, so now that outside activities are moved indoors (such as running and jumping), it might give parents the impression that the child is hyperactive and overactive. However, maybe the self-hindrance (such as behavior abnormality that may result from ID) is the major factor in problem behaviors. For example, children with ID and autism

TABLE 3 | *T*-test of the effect of informal coping strategies and affect in children with intellectual disabilities.

	Behavioral comfort ($N = 362$)	Language comfort ($N = 399$)	Diversion of attention ($N = 444$)
Positive affect	$t = 4.30^{***}$	$t = 4.65^{***}$	$t = 3.94^{***}$
Negative affect	$t = -4.03^{***}$	$t = -6.16^{***}$	$t = -2.08^{*}$
Problem behaviors	$t = -4.45^{***}$	$t = -5.40^{***}$	$t = -2.90^{**}$

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

are prone to problem behaviors such as aggression and self-mutilation (42). Staying at home during the pandemic may have an adverse impact on these problem behaviors but may not be the essential cause. There are also people with ID who take antipsychotic drugs daily to suppress problem behaviors (43, 44). Affected by the pandemic, many were not able to return to the clinic on time to maintain their drug routine, leading to problems such as insufficient drug reserves and irregular medicinal uptake schedules (20), which may aggravate old problem behaviors or induce new ones. Alternatively, if parents do not have the right coping strategies and external support, they may not be able to cope with the problem behaviors of children with ID. The lack of formal services and parent-mediated training may lead to problem behaviors for children with ID (18).

Most parents adopted at least one coping strategy. The self-reported data on affect and problem behaviors showed that coping strategies were effective. However, there remains debate about which strategy is more effective. Parents self-reported the order of effectiveness of coping strategies as diversion, behavioral comfort, and language comfort. However, when examining the relationship between the effectiveness of coping strategies and problem behaviors, it is exactly the opposite of the previous order. The problem behaviors corresponding to the effectiveness of diversion, behavioral comfort, and language comfort were gradually reduced. This may be because the children with ID who develop problem behaviors are more difficult to raise than those who do not. Informal coping strategies adopted by parents in the face of parenting dilemmas during lockdown are more likely to be effective when there are no problem behaviors. In addition, what parents self-reported as effective might not necessarily have been effective. In the absence of formal services and parental management during the lockdown, the effectiveness of informal coping strategies has not been verified by professionals. For children with ID, the effectiveness of a single coping strategy is uncertain (45). However, adopting several coping strategies at the same time can possibly lead to better intervention outcomes (46). When managing outbursts, the parents can try to comfort the child by telling them: "It's OK" (language comfort), hug them gently (behavioral comfort), and use the specific activities or "must-have" items to distract them (diversion) (24).

Limitations and Future Research

For children with ID, their parents play a more pivotal role in their growth at such an unusual time. However, this study only investigated some of the simplest informal coping strategies in the parenting process. In other words, future research should use experimental design rather than just observational data to verify the effectiveness of coping strategies as well as their long-term effects. For example, researchers can use panel research to track which informal coping strategy is more effective. They could also conduct a mixed study to make the conceptualization of informal coping strategies clearer and more accurate. IQ score is a key factor for children dealing with their affairs, so how to establish special family coping strategies for children with different intelligence levels may be another meaningful research direction. Simultaneously, the function of schools and social institutions (e.g., community and rehabilitation facilities) should also be considered. They should live up to their responsibilities and provide professional support to both parents and children to the best of their abilities. This will bring significant direct and indirect benefits to the children.

CONCLUSION

During the early pandemic, children with ID at home exhibited good affect and daily behaviors. However, 39.39% of the participants still had problem behaviors such as hyperactivity. We found that the greater the number of effective informal coping strategies, the lesser the problem behaviors exhibited. Future research should focus on effective coping strategies, and use this as a basis for parent management and training.

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 Shaanxi Normal University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MM: conception, design of the work, data acquisition, curation and analysis, writing—original draft, and writing—reviewing and editing. XW: translation and writing—reviewing and editing. PQ and TW: supervision and writing—reviewing and editing. All authors read and approved the final manuscript.

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Risks and Resources for Depressive Symptoms and Anxiety in Children and Adolescents During the COVID-19 Pandemic – Results of the Longitudinal COPSY Study

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Background: Mental health during the COVID-19 pandemic is of particularly high relevance. Especially for children and adolescents, the pandemic and its restrictions represent a significant burden. The present study aims to identify risks and resources for depressive symptoms and anxiety in children and adolescents during the pandemic in Germany.

Materials and Methods: Self-reported data from the first wave of the longitudinal COVID-19 and Psychological Health (COPSY) study were used to investigate risks and resources among n = 811 children and adolescents aged 11–17 years. Depressive symptoms and anxiety were measured at the first follow-up 6 months later. Multivariate linear regression analyses were performed to investigate the effects of risks and resources on depressive symptoms and anxiety.

Results: Parental depressive symptoms predicted depressive symptoms and anxiety in children and adolescents 6 months later. Female gender was identified as a risk factor for anxiety during the pandemic. None of the potential resources were associated with depressive symptoms or anxiety at the follow-up.

Conclusion: The findings provide evidence of risk factors for depressive symptoms and anxiety during the COVID-19 pandemic. Children and adolescents who face risk factors need to be identified early and monitored during the pandemic. Family-based intervention programs are needed to help vulnerable children and adolescents cope with the challenges of the pandemic.

Keywords: COVID-19, mental health, risk factors, resource factors, children and adolescents

INTRODUCTION

The challenges and restrictions resulting from the COVID-19 pandemic can have a negative impact on mental health (1, 2). Studies from throughout the world have shown the adverse effects of the COVID-19 pandemic on the mental health of children and adolescents (3–6). Findings from the population-based longitudinal COVID-19 and Psychological Health (COPSY) study show that a majority of children and adolescents in Germany have felt burdened by the pandemic (1). The lack of contact with friends and homeschooling due to school closures represents an additional burden (7, 8). Family life was negatively affected as conflicts within the family increased and escalated more often (8, 9). The COPSY study found that during the pandemic health-related quality of life decreased and the stress level, sleeping problems, loneliness, hyperactivity/inattention, conduct problems, and psychosomatic symptoms increased (8, 10, 11). Of particular note is the significant increase in symptoms of depression and anxiety in children, which seem associated with pandemic measures (12–16).

Mental health problems in children may persist into adolescence and pose risk factors for the emergence of mental disorders in adulthood (17–19). Therefore, information on risk and resource factors that influence the development of mental health problems such as depressive and anxiety symptoms during the COVID-19 pandemic is crucial.

Existing research identifies risks and resources that are associated with the occurrence of mental problems such as depression and anxiety in children and adolescents. In terms of social risk and resources, studies indicate that social isolation and loneliness as well as lack of peer relationships are linked to depression and anxiety during the COVID-19 pandemic (2, 14, 20). Moreover, excessive or insufficient demands at school and educational failure have been associated with an increased risk of depression (21). School and kindergarten ideally are a resource and can provide social support, foster emotional development and coping with trauma (22, 23). Traumas like domestic violence, abuse or neglect, which increased during the COVID-19 pandemic (2, 24), can lead to adverse long-term effects such as mental problems in adulthood (25, 26). Especially for traumatized children, social and emotional support can protect against depressive symptoms (27). Studies show that peers, school and good relationships between children and teachers have a promoting effect on mental resilience (28–30).

Regarding familial risks, parental stress and psychopathology play a key role in children's mental health (31, 32). Conflicts with parents and a negative family climate have an adverse impact on emotional health (33, 34). Children and adolescents whose mothers suffer from depression and those who have a negative mother-child relationship are at higher risk of developing internalizing problems such as depression (35–37). Conversely, a two-parent family structure, family cohesion and positive parenting are well-established resource factors for ameliorating mental problems (28, 36, 38).

Among personal factors, overall worse psychological health and preexisting psychiatric disorders present important risk factors for the deterioration of mental health (39). Quittkat et al. showed that the COVID-19 pandemic exacerbated the degree of symptom severity in children and adolescents with a history of mental problems (40). Self-esteem, a positive self-concept and an optimistic attitude (34, 38) as well as successful coping mechanisms (41, 42) can be considered resources for the mental health of youth.

Besides the psychosocial risks and resources, there are biological and sociodemographic factors associated with depressive symptoms and anxiety in youth. Female gender and puberty increase the risk of internalizing symptoms (43). Further, a low socioeconomic status as well as a migration background are strongly associated with psychological problems (8, 28, 44, 45). A study undertaken in Brazil during the COVID-19 pandemic demonstrated that anxiety rates are higher among children with parents who have essential jobs and who are separated from their parents (46). Quarantined youth living in high epidemic areas (47), who have a high-risk family member (48) or relatives infected with COVID-19 (49) also experienced higher rates of anxiety (6, 50, 51).

Overall, previous research has examined factors influencing the development of depressive symptoms and anxiety in youth before and at the beginning of the COVID-19 pandemic. However, there is a lack of knowledge regarding risks and resources for children and adolescents over the course of the pandemic based on longitudinal studies.

Therefore, the present population-based longitudinal study aims to determine which familial, personal as well as social risk and resources at the early stage of the pandemic predict depressive symptoms and anxiety over the course of the pandemic, i.e., 6 months later. Our hypotheses were that conflicts within the family, school stress and parental depressive symptoms (risk factors) predict depressive symptoms and anxiety in children and adolescents during the pandemic. Further, we assumed that a positive family climate, personal resources and social support (resource factors) are associated with fewer depressive symptoms and anxiety.

MATERIALS AND METHODS

Study

The population-based longitudinal COPSY study examines the mental health and quality of life of children and adolescents aged 7–17 years during the COVID-19 pandemic in Germany. The design and methodology of the COPSY study is conceptualized based on the population-based longitudinal BELLA study. The BELLA study presents the mental health module of the German National Health Interview and Examination Survey for Children and Adolescents (KiGGS) (52). The first wave of the COPSY study was conducted from May 26th to June 10th, 2020. At that time Germany was under a partial nationwide lockdown, with educational institutions, leisure and cultural facilities partly closed or restricted. In total, n = 1,586 parents of children aged 7–17 years as well as n = 1,040 children and adolescents aged 11–17 years took part in the online survey. The second wave of the COPSY study took place from December 17th, 2020 to January 25th, 2021, during the second wave of the pandemic.

At that time, there was a complete nationwide lockdown, with schools as well as leisure and cultural facilities closed. Families who had participated in the first wave of the COPSY study were re-contacted, informed about the second wave and asked for their consent. Overall, n = 1,288 families participated in the second wave (re-participation rate of 85.1%). A responder versus non-responder analysis revealed no significant differences in sociodemographic or health-related variables. The samples match the sociodemographic characteristics (age, gender, education, region) of the German population according to the Microcensus of 2018. The COPSY study was approved by the Local Psychological Ethics Committee and the Commissioner for Data Protection of the University of Hamburg. Detailed information on the design, methods and results of the first two waves of the COPSY study can be found elsewhere (1, 53).

Participants

In the present analysis, data from the baseline survey (wave 1) and the first follow-up (wave 2) of the COPSY study were used. Participants were included in the analysis if (i) they were 11–17 years old at baseline, provided self-reports, and (ii) their data of depressive and anxiety symptoms were available at follow-up. This resulted in a final sample of n = 811 children and adolescents.

Measures

Sociodemographic Variables

The self-report version of the online survey included questions on age and gender of the children and adolescents. In addition, the parent-reported version included further sociodemographic information on the educational and migration background of the parents. Socio-demographic data collected at baseline were defined as control variables in the regression analysis. Parental education was assessed in accordance with the Comparative Analyses of Social Mobility in Industrial Nations (CASMIN) classification. For this purpose, the highest academic and vocational qualifications of both parents were assessed by two items (54). A categorization into three status groups (low, medium and high parental education) was performed for sample description and further analysis. In addition, information on migration background was gathered by asking the parents two questions regarding their migration status.

Risk Factors

Conflicts within the family were assessed by one newly developed item ("To what degree did the frequency of arguments in your family change compared to before the pandemic?") with a five-point response scale (1 = *a lot more* to 5 = *much less).* The variable was dichotomized into 0 = family conflicts did not increase (summarizing the response options *much less*, *a little less* and *just as much*) and 1 = family conflicts increased (combining the response options *a lot more* and *a little more*). School burden was also measured by one newly developed item ("How do you perceive schooling and learning/work now compared to a regular school or workday?") presented with a five-point response scale (1 = *a lot more difficult* to 5 = *much less difficult*). The variable was dichotomized into 0 = school was not perceived as more stressful (combining the response options *much less difficult*, *a little less difficult* and *both equal*) and 1 = school was perceived as more stressful (summarizing the response options *a lot more difficult* and *a little more difficult*). Parental depressive symptoms were assessed by the eight-item Patient Health Questionnaire (PHQ-8), which is a valid diagnostic and severity measure for depressive disorders used in population-based studies (55). Each item (e.g., "Over the last week, how often have you been bothered by any of the following problems? Feeling down, depressed or hopeless") was offered with four response options ranging from 1 = *not at all* to 4 = *nearly every day*). A scale sum score was calculated with values ranging from 0 to 24. A higher score indicates more severe depressive symptoms of parents.

Resource Factors

Personal resources were measured using five self-reported items administered in the KiGGS study (56). The scale captures individual capabilities such as self-efficacy, optimism, and a positive self-concept. The items (e.g., "I look to the future with optimism/confidence") were provided with four-point response options (1 = *not true* to 4 = *exactly true*). The whole scale comprises total scores ranging from 5 to 20, with higher scores reflecting more pronounced personal resources. Four self-report items from the Family Climate Scale (FSC) were administered to assess family cohesion (57). The FSC collects data on sense of belonging and cohesiveness of individual family members. Each item (e.g., "In our family everybody cares about each other's worries") was provided with four-point response options (1 = *not true* to 4 = *exactly true*). The scale sum score ranges from 4 to 16. A higher sum score reflects a stronger family cohesion. Data on social support were collected using four self-report items from the German translation of the Social Support Scale (SSS) (58). The items (e.g., "How often has there been someone you can count on to listen to you when you need to talk") were answered by children and adolescents using a five-point response options (1 = *never* to 5 = *always*). The scale comprises total values from 4 to 20, with higher scores demonstrating more social support.

Depressive Symptoms

The German version of the Center for Epidemiological Studies Depression Scale (CES-DC) was administered to assess self-reported depressive symptoms in children and adolescents at baseline and at follow-up 6 months later (59). The scale consists of seven items (e.g., "I felt sad") offered with a four-point response scale (1 = *rarely or not at all* to 4 = *mostly, all the time*). A scale sum score was calculated with values ranging from 7 to 28. A higher score indicates more depressive symptoms.

Anxiety

To measure anxiety in children and adolescents at baseline and at follow-up 6 months later, the subscale for generalized anxiety from the Screen for Child Anxiety Related Disorders (SCARED) questionnaire was applied as self-report version (60). It includes nine items (e.g., "I worry about what is going to happen in the future") presented with three response options (0 = *not true or hardly ever true* to 2 = *very true or often true*). The sum scale score ranges from 0 to 18, with higher scores indicating more anxiety.

Data Analysis

Descriptive analyses were carried out covering the calculation of frequencies, means and standard deviations of all variables. Bivariate analyses (chi-square tests, Spearman and Pearson correlations) were performed to examine associations between the predictor variables. Furthermore, linear regression analyses were conducted to determine to what degree the predictors can be considered as risk or resource factors for anxiety and depressive symptoms in children and adolescents. First, the association between each of the predictors and anxiety and depressive symptoms was examined using univariate linear regression analyses. Second, two multivariate linear regression models were carried out (one for anxiety and one for depressive symptoms). All predictor and control variables such as age, gender, parental education, and migration background were entered simultaneously into the regression models. For all regression analyses, metric variables were centered around the mean. All statistical analyses were performed using the SPSS version 25.

RESULTS

Sample Characteristics

The analyzed sample including $n = 811$ children and adolescents aged 11–17 years (50.3% female) is described in **Table 1**. The majority of the children and adolescents were German (86.3%). The parents had a medium educational level (53.1%). The mean score for depressive symptoms at baseline was $M = 11.35$ and for anxiety $M = 5.74$. Among the risk factors, school stress was reported most often at 64.2%. Slightly more than a quarter of the children and adolescents reported an increase in family conflicts (26.4%). The mean scores of parental depressive symptoms was $M = 5.17$. Among the resource factors, the mean scores for personal resources were $M = 15.30$, for family climate $M = 12.92$ and for social support $M = 16.35$. Six months later, the mean score for depressive symptoms among the children and adolescents was $M = 11.85$ and $M = 6.08$ for anxiety.

TABLE 1 | Description of the analyzed sample of children and adolescents.

	Total ($n = 811$)	
	n (%)	*M (SD)*
Control variables		
Gender		
Female	408 (50.3%)	
Male	403 (49.7%)	
Age (in years)		14.27 (1.87)
Parental education		
Low	164 (20.2%)	
Medium	431 (53.1%)	
High	203 (25.0%)	
Migration background		
Yes	111 (13.7%)	
No	700 (86.3%)	
Depressive symptoms at baseline		11.35 (3.68)
Anxiety at baseline		5.74 (4.38)
Risk factors		
Family conflicts	214 (26.4%)	
School burden	521 (64.2%)	
Parental depressive symptoms	119 (14.7%)	5.17 (4.85)
Resource factors		
Personal resources		15.30 (2.73)
Family climate		12.92 (2.32)
Social support		16.35 (2.82)
Outcome variables (6 months later)		
Depressive symptoms		11.85 (4.05)
Anxiety		6.08 (4.42)

n, number of participants; M, mean; SD, standard deviation; Missing values were given for n = 13 for parental education.

Correlations Between Predictors

The correlations between the control and predictor variables are shown in **Table 2**. The sociodemographic variables showed only weak associations with one another and with the risk and resource factors, with correlation coefficients less than $r = 0.20$. Depressive symptoms at baseline were strongly correlated with anxiety at baseline ($r = 0.600$, $p < 0.001$). Both depressive symptoms at baseline ($r = -0.552$, $p < 0.001$) as well as anxiety at baseline ($r = -0.458$, $p < 0.001$) showed strong correlations with personal resources. Among the risk factors, the highest intercorrelation was found between family conflicts and family climate ($r = -0.291$, $p < 0.001$) and between parental depressive symptoms and children's depressive symptoms at baseline ($r = 0.399$, $p < 0.001$). In terms of resource factors, the strongest positive relationships were detected between family climate and personal resources ($r = 0.486$, $p < 0.001$) and between family climate and social support ($r = 0.567$, $p < 0.001$).

Univariate Linear Regression Analyses

The results of the univariate regression analyses are presented in **Supplementary Tables 1** and **2**. The findings indicate that among the sociodemographic variables, only female gender was significantly associated with depressive symptoms (ß = 0.11, $p = 0.002$) and anxiety (ß = 0.16, $p < 0.001$) 6 months later. Depressive symptoms at baseline (ß = 0.60, $p < 0.001$) and anxiety at baseline (ß = 0.45, $p < 0.001$) were positively associated with depressive symptoms at follow-up. In addition, depressive symptoms at baseline (ß = 0.48, $p < 0.001$) and anxiety at baseline (ß = 0.64, $p < 0.001$) also showed positive associations with anxiety at follow-up. An examination of the risk factors revealed that all the risk factors proved to be significant predictors of later depressive symptoms and anxiety. Parental depressive symptoms were most strongly associated with depressive symptoms (ß = 0.39, $p \leq 0.001$) and anxiety (ß = 0.27, $p \leq 0.001$) at follow-up. In terms of resource factors, all were associated with fewer depressive symptoms and anxiety 6 months later. Personal resources demonstrated the strongest negative association with depressive symptoms (ß = –0.41, $p \leq 0.001$) and anxiety (ß = –0.39, $p \leq 0.001$) at follow-up.

Multivariate Linear Regression Analyses

The results of the multivariate linear regression analyses are presented in **Tables 3** and **4**. Among the sociodemographic variables, female gender proved to be a significant risk factor

TABLE 2 | Zero-order correlations among predictor variables.

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Gender[a]	–											
2. Age[c]	0.00	–										
3. Parental education[b]	−0.72*	0.08*	–									
4. Migration background[a]	1.96	−0.04	0.11**	–								
5. Depressive symptoms at baseline[c]	0.09*	−0.02	0.08*	0.04	–							
6. Anxiety at baseline[c]	0.16***	−0.05	0.03	−0.05	0.60***	–						
7. Family conflicts[a]	1.49	−0.08*	0.06	0.40	0.23***	0.15***	–					
8. School burden[a]	0.10	−0.08*	0.52	0.13	0.24***	0.12***	25.75***	–				
9. Parental depressive symptoms[c]	0.01	−0.03	−0.09*	0.02	0.40***	0.26***	0.23***	0.18***	–			
10. Personal resources[c]	−0.10**	0.09**	0.02	−0.01	−0.55***	−0.46***	−0.21***	0.20***	−0.25***	–		
11. Family climate[c]	0.02	−0.02	−0.16***	−0.09**	−0.41***	−0.28***	−0.29***	−0.06	−0.19***	0.49***	–	
12. Social support[c]	−0.01	−0.08*	−0.14***	−0.07*	−0.41***	−0.25***	−0.20***	−0.06	−0.17***	0.35***	0.56***	–

Zero-order correlations are presented by pearson correlations for continuous variables, point-biserial correlations for one dichotomous and one continuous variable, spearman correlations for one ordinal and continuous variable and chi-square tests for dichotomous variables.
[a]Dichotomous variable; [b]Ordinal variable; [c]Continuous variable.
**p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001.*

for later anxiety (ß = 0.07, $p = 0.012$). Findings from both models indicated that parental depressive symptoms were significantly positively associated with depressive symptoms (ß = 0.18, $p < 0.001$) and anxiety (ß = 0.08, $p = 0.011$) among youth 6 months later, which is in line with results of the univariate analysis. In addition, depressive symptoms at baseline (ß = 0.38, $p < 0.001$) as well as anxiety as baseline (ß = 0.13, $p < 0.001$) significantly predicted later depressive symptoms. Anxiety at baseline (ß = 0.53, $p < 0.001$) was strongly associated with anxiety at follow-up. Among the resource factors, none were significantly associated with depressive symptoms or anxiety 6 months later.

DISCUSSION

The aim of this study was to identify risk and resource factors for depressive symptoms and anxiety in children and adolescents during the COVID-19 pandemic. Findings of the population-based longitudinal COPSY study revealed that parental depressive symptoms were associated with stronger depressive symptoms and anxiety in children and adolescents during the pandemic. Other than expected none of the potential resources were associated with depressive symptoms or anxiety during the pandemic in our multivariate model.

TABLE 3 | Results of the multivariate linear regression analyses; risk and resource factors in children and adolescents predicting depressive symptoms 6 months later.

	b	ß	*p*
Constant	11.834		<0.001
Control variables			
Gender (female)	0.392	0.048	0.082
Age	0.099	0.045	0.102
Parental education (reference: high)			
Low	−0.228	−0.023	0.497
Medium	−0.118	−0.015	0.655
Migration background	0.243	0.021	0.455
Depressive symptoms at baseline	0.414	0.376	<0.001
Anxiety at baseline	0.116	0.125	<0.001
Risk factors			
Family conflicts	0.270	0.029	0.318
School burden	−0.277	−0.033	0.252
Parental depressive symptoms	0.148	0.178	<0.001
Resource factors			
Personal resources	−0.092	−0.062	0.083
Family climate	−0.040	−0.023	0.524
Social support	−0.091	−0.064	0.062
Model fit	$F[13] = 43.06$		
	$p < 0.001$		
	adjusted $R^2 = 0.403$		

Outcome: depressive symptoms; n = 811.

TABLE 4 | Results of the multivariate linear regression analyses; risk and resource factors in children and adolescents predicting anxiety 6 months later.

	b	ß	*p*
Constant	5.915		<0.001
Control variables			
Gender (female)	0.602	0.068	0.012
Age	0.069	0.029	0.284
Parental education (reference: high)			
Low	−0.108	−0.010	0.762
Medium	−0.182	−0.021	0.516
Migration background	0.436	0.034	0.207
Depressive symptoms at baseline	0.088	0.073	0.061
Anxiety at baseline	0.540	0.534	<0.001
Risk factors			
Family conflicts	0.031	0.003	0.931
School burden	−0.135	−0.015	0.599
Parental depressive symptoms	0.068	0.075	0.011
Resource factors			
Personal resources	−0.089	−0.055	0.114
Family climate	−0.098	−0.051	0.146
Social support	−0.012	−0.007	0.823
Model fit	$F[13] = 49.38$		
	$p < 0.001$		
	adjusted $R^2 = 0.437$		

Outcome: anxiety; n = 811.

Findings of the univariate regression analyses showed that the examined risk factors such as family conflicts, school burden and parental depressive symptoms were positively associated with stronger depressive symptoms and anxiety in children and adolescents during the pandemic. However, most of the identified risk factors did not predict later depressive symptoms and anxiety in our multivariate analysis. This might be due to the fact that in the interaction of several risk factors, family conflicts and school burden lose their significance. Further, controlling for depression and anxiety scores at baseline means that we modelled the change in depression and anxiety scores from baseline to follow-up. Thus, it is likely that predictors that are important for the occurrence of depression or anxiety *per se* might not turn out to be significant regarding the change in these outcomes.

In the multivariate model, only parental depressive symptoms emerged as a risk factor for depressive symptoms and anxiety in children and adolescents 6 months later. This finding is in line with previous studies investigating the relationship between parental psychopathology and mental disorders in children and adolescents (32, 36, 37).

In the univariate regression analyses, the examined factors such as personal resources, family climate and social support were significantly associated with fewer depressive symptoms and anxiety 6 months later. However, we found no direct effects of those resource factors in our multivariate model. Nevertheless, the important role of family cohesion in the context of internalizing mental health problems has been well examined in previous studies (35, 61, 62). Our results of the univariate regression analyses thus underline the importance of family-based intervention programs during the COVID-19 pandemic to support a positive family climate and strengthen family cohesion to mitigate the adverse effects of potential risk factors. Furthermore, special mental health counseling and support services should be offered for parents with depressive symptoms or mental health issues as well as for children and adolescents with pre-existing psychological health problems to cope with the additional burden of the pandemic.

Regarding the examined control variables, we found that depressive symptoms and anxiety at baseline were associated with depressive symptoms at follow-up. Moreover, anxiety at baseline predicted anxiety at follow-up. This finding is in line with the fact that mental disorders are highly recurrent and persistent and often last into adulthood (63). In addition, female gender was significantly associated with stronger symptoms of anxiety at follow-up, which is consistent with previous studies on gender distribution in internalizing disorders indicating that females are about twice as likely to experience anxiety compared to males (64, 65).

The present study shows the following limitations. The variables included in our multivariate regression analyses explained 40.3% of the variance in depressive symptoms and 43.7% of the variance in anxiety. Although this is a sizeable proportion, these findings may suggest that the development of depressive symptoms and anxiety during the COVID-19 pandemic is related to other important factors that we did not take into account in our models. These factors can be genetic risks, environmental aspects such as living conditions or the experience of stressful life events, domestic violence, and abuse (66). These aspects should be investigated in future studies. Moreover, it should be noted that the population-based COPSY study cannot identify causal relationships, as it is an observational study that only detects associations between risk and resource factors. Furthermore, it cannot be ruled out that other events occurred between the baseline and follow-up that influenced the development of depressive symptoms and anxiety during the pandemic. With regard to the assessment of depressive symptoms and anxiety measured by established and validated screening questionnaires it should be noted that these instruments are mostly not suitable for clinical diagnoses of mental health problems. The results of the COPSY study are neither generalizable nor transferable to other countries due to possible differences in study design and methodology as well as existing differences in conditions during the pandemic such as infection rates, lockdown measures and access to health care services.

The present study has the following strengths. First of all, the COPSY study is one of the first population-based longitudinal studies on health-related quality of life and mental health in children and adolescents with two measurement points during the COVID-19 pandemic. The study provides important findings on psychosocial risks and resources for the development of depressive symptoms and anxiety in children and adolescents during the pandemic, that are highly relevant for prevention, clinical practice and policy. The strengths of the COPSY study include the wide age range of the participants and the longitudinal analysis over a pandemic time period of 6 months. We examined a large population-based sample of n = 811 children and adolescents including their parents. Established self- and proxy-report measures were used to assess a range of psychosocial risk and resource factors. The self-reported data allowed insight into the perspective of children and young people.

Overall, the findings of the present study revealed that parental depressive symptoms were associated with stronger depressive symptoms and anxiety in children and adolescents during the COVID-19 pandemic. Given the high number of adults affected by depression and anxiety during the pandemic, the overall poorer mental health of parents is of particular concern for the emotional health of children and young people. Compared to pre-pandemic data showing a prevalence of 10.1% for depression among adults in Germany (67), the prevalence in this study, also assessed with the PHQ-8, is slightly higher at 14.7% during the pandemic. Other studies have also shown that parents reported higher rates of depression and anxiety during the pandemic compared to pre-pandemic estimates (68, 69). Mothers seem to be particularly impacted, most likely due to a higher burden caused by household chores, homecare/schooling and home office during lockdown phases (70, 71). These results are in line with several studies from Germany (72–74) as well as international reviews (75–78) reporting high prevalence rates for depression and anxiety in the general population during the pandemic.

Further, girls seem to be at higher risk than boys for developing anxiety during the pandemic. Special focus should

also be placed on children and adolescents who have already shown depressive symptoms and anxiety at the start of the pandemic. These children and adolescents at higher risk for developing mental health problems during the COVID-19 pandemic need to be detected at an early stage to avoid mental health problems exacerbate into clinical mental disorders. Based on our findings, we recommend the implementation of low-threshold prevention and intervention measures such as resource-oriented and family-based as well as parent support programs in communities, kindergartens and schools to target this high risk youth. In addition, in the planning of lockdown measures such as school closures or social distancing, the mental health of children and adolescents should be carefully taken into account. Particularly politicians as well as education and healthcare professionals should be aware of the importance of preventive measures for child and adolescent mental health during the COVID-19 pandemic. The latter need to be empowered by financial resources to plan and implement such measures. Future research is needed to identify further risk and resource factors for the development of mental health problems in children and adolescents over the course of the pandemic, so that prevention and intervention measures can be adapted to the specific burden and needs of children and adolescents to help them cope with these challenging times.

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 COPSY study was approved by the Local Psychological Ethics Committee and the Commissioner for Data Protection of the University of Hamburg, Germany. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

NG performed the statistical analyses, interpreted the data, and wrote the first draft of the manuscript. UR-S and AK were principle investigators of the COPSY study, responsible for its design, funding, general decisions of measurement, supervised data cleaning and preparation, and revised the manuscript critically. JW, JD, ME, and HH revised the manuscript critically. All authors contributed to the article 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/fpsyt.2022.901783/full#supplementary-material

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Depression and anxiety among children and adolescents pre and post COVID-19: A comparative meta-analysis

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Background: Published studies in comparing pre and post the COVID-19 pandemic depression and anxiety levels among children and adolescents yielded incongruent results. Therefore, there is a necessity to perform a timely meta-analysis to synthesize existing evidence.

Methods: A total of 10 digital databases (PubMed, Web of Science, PsycINFO, the Cochrane Library, Embase, Scopus, ScienceDirect, CNKI, WanFang, CQVIP) were fully searched for eligible studies published before November 6, 2021. Based on quality assessment results, relevant data were extracted for eligible studies of higher quality. We combined standardized mean difference (SMD) or prevalence ratio (RR) for anxiety and depression pre and post the COVID-19 pandemic by using random-effects models. Sensitivity analysis was further performed to evaluate heterogeneity of included studies.

Results: 14,508 articles were preliminarily identified, and after stepwise screening process, 8 articles were included eventually. The results showed that the SMD for post COVID-19 anxiety score measured by GAD-7 was 0.12 (95% CI: 0.08, 0.17), an significant increase compared with pre COVID-19 period; the SMDs and 95% CIs for post COVID-18 depression scores measured by PHQ-9, PHQ-8, and MFQ were 0.17 (95% CI: 0.10, 0.24), 0.23 (95% CI: 0.08, 0.38), and 0.11 (95% CI: 0.06, 0.17), respectively, also significantly increased compared with pre COVID-19 period. The RR for depression was 2.54 (95% CI: 2.48, 2.60) in post COVID-19 period when compared with pre-pandemic.

Conclusions: Children and adolescents reported deteriorated anxiety and depression levels after the COVID-19 pandemic. More attention should be paid to this vulnerable group. Effective, expedient, and practical intervention measures which are compatible with COVID-19 prevention and control policies should be developed and implemented to maintain mental health wellbeing of the youths.

KEYWORDS

depression, anxiety, children and adolescent, COVID-19, meta-analysis

Introduction

Corona Virus Disease 2019 (COVID-19), caused by SARS-CoV-2, is a sudden, rapidly evolving pandemic (1). Since the outbreak of COVID-19 in Wuhan, China, it has swept the world, triggered unprecedented prevention and control measures like home isolation, school closure, and social distancing. The lockdowns and various security measures adopted in the pandemic have not only affected the economy, but also significantly changed the way people live (2). For instance, it has been reported that eating habits, sleep duration and quality, daily living, social, leisure, and educational activities were all prominently influenced by COVID-19 pandemic (3, 4).

COVID-19 pandemic also imposes great influence on mental health of the public (5). Kang et al. found that people were prone to mental health problems such as negative emotions, anxiety, depression, and post-traumatic stress syndrome (PTSD) after COVID-19 outbreak (6). Among all reported mental health problems during the COVID-19 pandemic, anxiety and depression are the most common (7, 8). Data released by Statistics Canada showed that between April and May 2020, nearly 24% of people reported average or poor mental health, a threefold increase from previous years, and 41% experienced moderate or severe anxiety symptoms (9). Statistics collected in June 2020 suggested that 18.4% of people in the United States experienced moderate to severe depression (10). During April to June 2020, a survey implemented in Canada and the United States showed that the impact of the COVID-19 pandemic on anxiety and depression in the general population was clear: 31% of people met the criteria for anxiety diagnosis and 29% people met the criteria for major depression diagnosis (11). An Ecuadorian cross-sectional study reported that social isolation has exacerbated anxiety and depression in the general population due to the outbreak of the COVID-19 pandemic (12).

Compared with other age groups, children and adolescent populations are observed increased risk of a variety of mood problems, typically depression and anxiety, and mood changes are associated with personality weaknesses that can flare up in the event of environmental triggers (13). During the COVID-19 pandemic, various environmental stressors, such as stay-at-home isolation, fear of contracting the virus, and dramatic changes in living environment, are the main causes of compromised psychological wellbeing for children and adolescents (14–16). A systematic review showed that COVID-19 pandemic caused psychological problems such as fear, concern, worry, attention deficits and hyperactivity, loneliness in children and adolescents, leading to a further deterioration of mental health in this vulnerable population (17). Another meta-analysis by Racine et al. found that the prevalence rates of anxiety and depression were 20.5 and 25.2% during COVID-19 based on commonly used symptom-based instruments (such as GDA-7, PHQ-9, MFQ), significantly higher than 12.9 and 11.6% reported by large cohort studies prior to COVID-19 (18).

To better elucidate the influence of COVID-19 on depression and anxiety of children and adolescents, some scholars measured and compared pre and post COVID-19 depression and anxiety prevalence rates, with incongruent findings. For instance, Li et al. found that both anxiety and depressive symptoms were less severe in post-pandemic period; another Canadian study of 146 adolescents aged 12-13 showed reduced anxiety symptoms and increased depressive symptoms after the COVID-19 pandemic (19, 20). Therefore, there is a necessity to combine existing evidence for yielding a more convincing conclusion. However, after careful literature review, no pertinent meta-analysis on this important topic has been published so far. In this meta-analysis, we aim to perform a timely synthesis for pre and post COVID-19 depression and anxiety among children and adolescents, so as to provide evidence for effective intervention.

Methods

This meta-analysis was implemented and organized according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (21). We focused on published quantitative studies reported changes in anxiety and depression among general children and adolescents before and after COVID-19.

Search strategy

We systematically searched seven English electronic databases (PubMed, Web of Science, PsycINFO, Cochrane Library, Embase, Scopus, ScienceDirect) and three Chinese databases (CNKI, CQVIP, WanFang). We searched studies published before November 6, 2021, the date that we performed literature searching. In the searching process, there is no need to put restrictions on the publication year, as nearly all articles related to COVID-19 were published from 2020 onward. According to the theme of our study, the keywords to be searched were "anxiety," "depression," "COVID-19," "children" and "adolescents." Every single keyword was searched separately. In reviews or other meta-analysis papers containing this keyword, we checked whether there are words with the same meaning but different expressions, and added these words into the search formula to expand the search scope. The following search term was used: ("mental health" OR "mental illness*" OR "mental disorder*" OR "psychological illness*" OR "Psychiatric Disorder*" OR anxiety OR angst OR nervousness OR hypervigilance OR social anxiety OR "anxiety disorder*" OR anxious OR "overanxious disorder*" OR depress* OR

"depressive disorder*" OR "Depressive Symptom*" OR "Emotional Depression" OR "affective disorder*" OR "mood disorder*") AND (adolescent* OR teenager* OR child* OR student* OR juvenile* OR school* OR teen* OR young OR youth* OR minors) AND (COVID-19 OR coronavirus OR SARS-CoV-2 OR cov-19 OR 2019-nCoV OR severe acute respiratory syndrome Coronavirus2). Two authors (SW and LC) independently searched all the 10 databases with the same search term to ensure relevant studies were not missed.

Two authors (YC and DF) screened the titles and abstracts of the database records, retrieved full-text for qualification assessment, and independently qualified full-text records. If there is a disagreement between the two researchers, a third party (senior researcher, YX) will participate in discussion and resolve the inconsistencies. Some articles reported results that from the same study, in this case, we selected the articles which reported outcome variables that best match the inclusion criteria of the current study. References of the included studies were also carefully screened for potentially eligible studies.

Inclusion and exclusion criteria

Studies were deemed eligible and included into the meta-analysis if they: (1) Quantitatively assessed and compared anxiety or depression in children and adolescents pre and post COVID-19; (2) Were of longitudinal design or two-wave (pre and post COVID-19) cross-sectional design; (3) Written in English or Chinese; (4) Reported depression or anxiety prevalence rates/reported means and standard deviations for depression or anxiety scores. Studies were further excluded if: (1) Were not original studies, like reviews, case reports, correspondences, comments; (2) Study subjects were not children or adolescents; (3) Analytical results provided were not suitable for synthesis; (4) Study subjects were clinical populations (patients with COVID-19 or another disease); (5) Contain small sample size subjects (<100).

Study quality assessment

The Newcastle-Ottawa Quality Assessment Scale (NOS) is specifically designed to evaluate the quality of longitudinal studies in systematic reviews. NOS is consisted of 8 entries in 3 sections: (i) Selection: a. Representativeness of the exposed cohort; b. Selection of the non-exposed cohort; c. Ascertainment of exposure; d. Demonstration that outcome of interest was not present at start of study. (ii) Comparability: e. Comparability of cohorts on the basis of the design or analysis. (iii) Outcome: f. Assessment of outcome; g. Was follow-up long enough for outcomes to occur; h. Adequacy of follow-up of cohorts (22). The NOS uses a rating system to evaluate the quality of the literature, with a full score of 9: a study can be awarded a score of 1 for each item within the selection and outcome sections, a maximum score of 2 can be given for comparability. Two researchers (HR and XL) independently evaluated quality of the articles based on the above criteria. If discrepancies exist between two researchers' evaluations, the original article will be re-examined by a third person (senior researcher, YX). Studies with rated scores $\geq$ 6 are deemed high-quality, a rated score between 4 and 5 indicates moderate quality, a rated score $\leq$ 3 reflects low quality (23). All the studies included into the present meta-analysis with rated NOS scores no <5. Details of the NOS scores for included studies can be seen in Supplementary Table S1.

Data extraction

Two authors (JP and HS) independently extracted data from the included studies. A standard information extraction table was designed in advance, which mainly includes the following information: author, publication year, origin of study, study period, study population, mean age of the participants, sample size, measuring scales used, reported prevalence or mean scores of anxiety or depression in pre and post COVID-19 periods. The information extracted by the two authors will be compared, if any disagreement exists, a senior researcher (YX) will perform data extraction again.

Statistical analysis

Results were analyzed separately according to different outcome variables. For continuous outcome, measured by means and standard deviations of depression or anxiety scores, standardized mean difference (SMD) together with its 95% confidence interval (CI) was used; whereas for categorical outcome, measured by prevalence of depression or anxiety before and after COVID-19, relative risk (RR) with its 95% CI was used. Considering the included studies may use different depression or anxiety instruments, only studies used the same scale and reported the same outcome variable were combined. Therefore, the results were organized in subgroups.

Heterogeneity was tested by using the I^2 statistic, with a $I^2 >$ 50% considered substantial heterogeneity (24). If significant heterogeneity emerged, random-effects model will be used as recommended (25). A sensitivity analysis was further performed to evaluate the influence of each included individual study. All analyses were performed in STATA statistical software (Version 14, Stata Corp., College Station, Texas, U.S.) and R software (Version 4.2.0). Two-sided statistical tests were used consistently, with a $p < 0.05$ considered statistically significant.

Results

The process of literature screening is shown in PRISMA flowchart (Figure 1). A total of 14,508 records were obtained initially from the 10 databases. The EndNote X9 software was used to remove duplicated articles, and 11,013 records remained. Two researchers (HR and YC) separately screened 11,013 articles for titles and abstracts and excluded 10,771 records. 242 articles were screened for full-text reading, and 8 articles were finally included in the study based on inclusion and exclusion criteria (26–33): 2 articles reported both anxiety and depression, 5 articles reported only depression, 1 article reported only anxiety. Therefore, 7 studies were included in meta-analysis of depression and 3 studies were included in meta-analysis of anxiety.

Characteristics of included studies

Characteristics of the included studies are displayed in Table 1. Included studies were conducted in different countries: 5 in North America (4 in the US and 1 in Canada), 2 in Europe (1 in Greece and 1 in Norway), and 1 in Oceania (Australia). Sample sizes ranged from 100 (Jolliff 2021, the US) to 47,684 (Mayne 2021, the US). All studies used commonly used scales to measure anxiety and depression. The scales used to measure

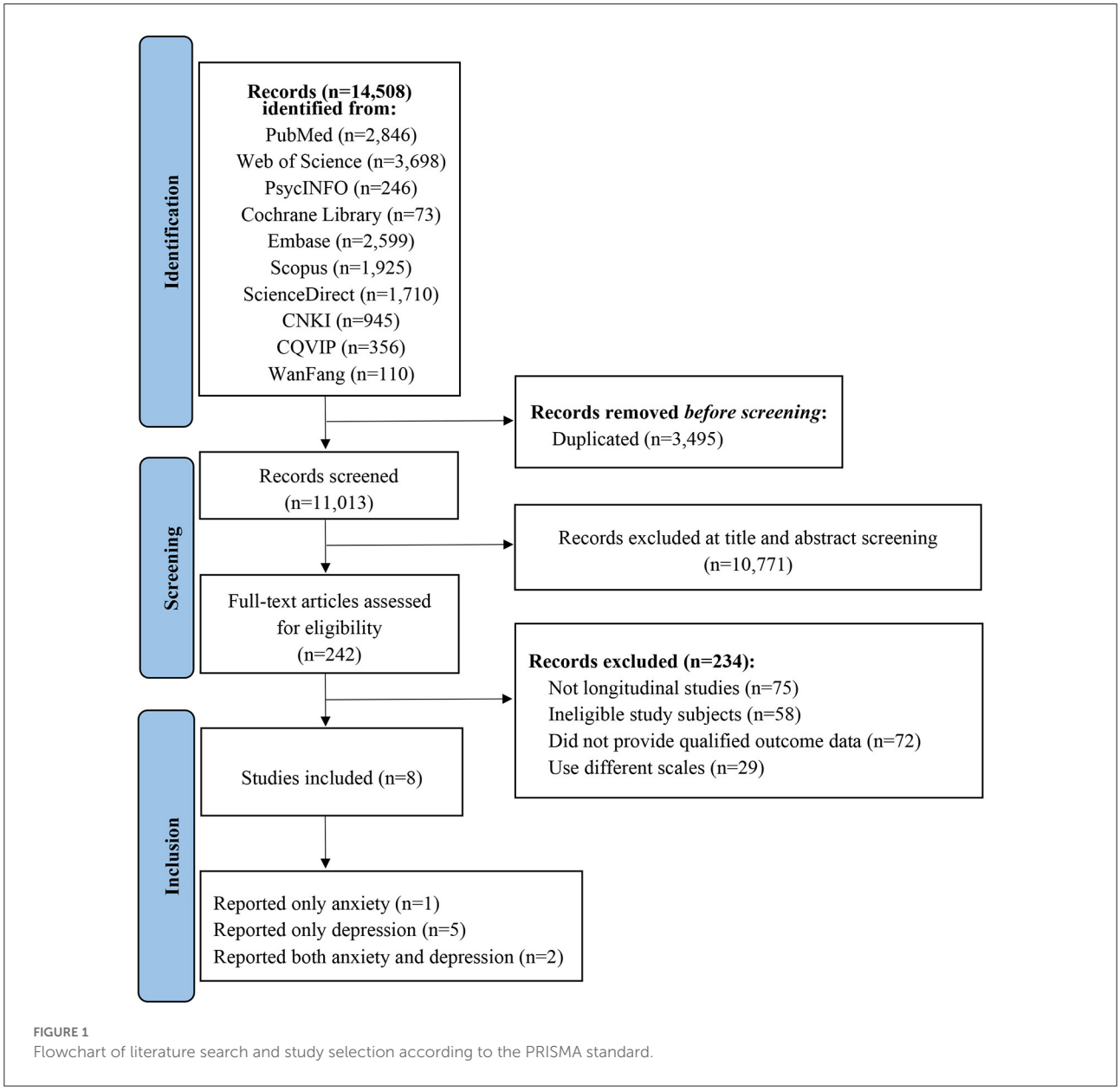

FIGURE 1
Flowchart of literature search and study selection according to the PRISMA standard.

depression included: PHQ-9, PHQ-8, and MFQ. The GAD-7 was used to measure anxiety. All the instruments used by included studies had been repeatedly validated in children and adolescent populations (34–41). Among the 8 included studies, 6 reported scores (means with standard deviations) of depression or anxiety, 1 reported prevalence rates of depression, 1 reported both prevalence rates and scores of depression before and after the COVID-19 pandemic.

Meta-analysis results of anxiety

Combined effect

A meta-analysis was performed on the 3 included articles that measured anxiety by using the GAD-7. The means together with their standard deviations for GAD-7 scores pre and post the COVID-19 pandemic were compared, as shown in Figure 2. Among the three studies, Giannopoulou et al. (27) reported a significantly increased anxiety level in post COVID-19 period, with an SMD of 0.51 (95% CI: 0.37, 0.64), another two studies revealed insignificant differences between pre and post COVID-19 anxiety in children and adolescents, with SMDs of 0.13 (95% CI: −0.12, 0.39) and 0.03 (95% CI: −0.02, 0.08). Heterogeneity was significant among the three studies (I^2= 95.5%, $p < 0.05$), therefore random-effects model was adopted. The combined SMD value was 0.12 (95% CI: 0.08, 0.17), suggesting a statistically higher anxiety level after COVID-19 pandemic.

Sensitivity analysis

As only 3 eligible studies were included for meta-analysis, regular statistical methods in detecting publication bias, such as Funnel plot and Begg's test, could not be applied. Therefore, we further performed a sensitivity analysis to evaluate the influence of individual studies. The results were presented in Supplementary Figure S1: among the three included studies, the exclusion of Giannopoulou et al. (27) or Bélanger et al. (29) prominently swayed the combined effect, whereas the study by Jolliff et al. (28) only showed negligible influence.

Meta-analysis results of depression

Combined effect

A total of 7 studies provided data on depression in children and adolescents before and after the COVID-19 pandemic: 5 studies reported depression scores based on different instruments, 1 study reported both score and prevalence of depression, 1 study only reported prevalence of depression. Considering heterogeneity in instruments and outcome measurement, meta-analysis was performed for different subgroups of studies separately. For the two studies

TABLE 1 Characteristics of the 8 studies included into the meta-analysis.

References	Country	Study design	Sample size		Instrument		Age (years)	Anxiety, Mean (SD)		Depression *n* (%)/Mean (SD)	
			Pre[a]	Post[b]	Anxiety	Depression		Pre[a]	Post[b]	Pre[a]	Post[b]
Giannopoulou et al. (27)	Greece	Cross-sectional	442	442	GAD-7	PHQ-9	SHSS[c]	7.93 ± 4.60	10.59 ± 5.79	212 (47.96)10.82 ± 6.24	278 (62.89) 13.59 ± 7.25
Andreas and Brunborg (30)	Norway	longitudinal	1,621	915		PHQ-9	Grades 8–10			8.17 ± 8.45	8.58 ± 7.41
Bélanger et al. (29)	Canada	longitudinal	7,160	1,863	GAD-7		Grades 9–12	6.06 ± 5.51	6.23 ± 5.44		
Black et al. (26)	United States	Cross-sectional	362	362		MFQ	8–17			10.28 ± 5.57	12.02 ± 5.13
Westrupp et al. (33)	Australia	Cross-sectional	2,365	2,365		MFQ	11–12			4.28 ± 4.58	5.04 ± 12.35
Mayne et al. (32)	United States	Cross-sectional	4,3504	4,7684		PHQ-9	15.3 (SD: 2.1)			8,937 (20.54)	10,929 (22.92)
Gladstone et al. (31)	United States	longitudinal	228	228		PHQ-8	12–18			3.44 ± 4.55	4.37 ± 4.88
Jolliff et al. (28)	United States	Cross-sectional	100	134	GAD-7	PHQ-8	13–17	4.67 ± 5.22	5.37 ± 5.18	5.27 ± 5.06	6.81 ± 5.67

[a] Pre COVID-19.
[b] Post COVID-19.
[c] SHSS: senior high school students.

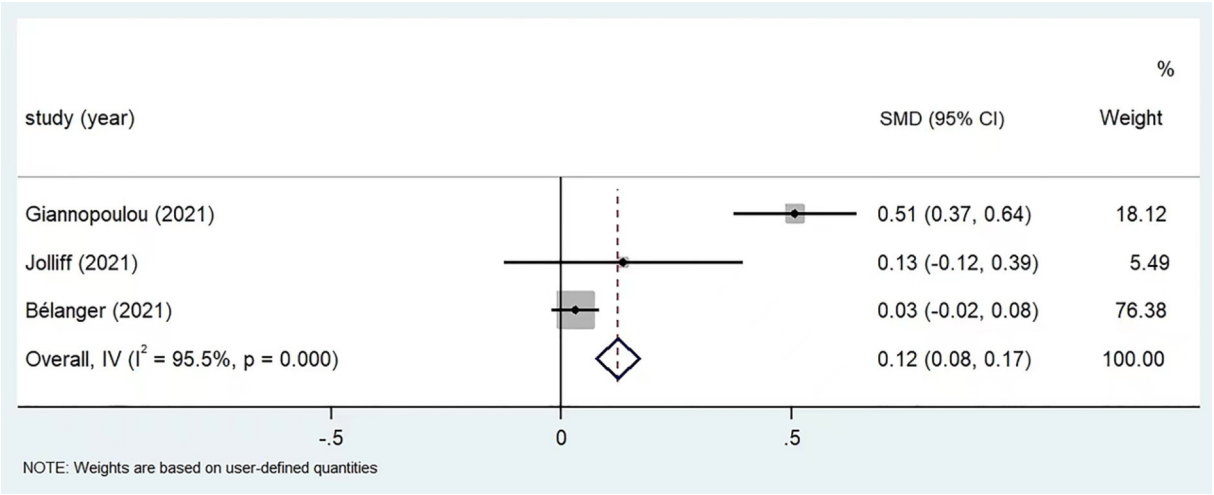

FIGURE 2
Meta-analysis of anxiety score before and post COVID-19 in children and adolescents ($n = 3$).

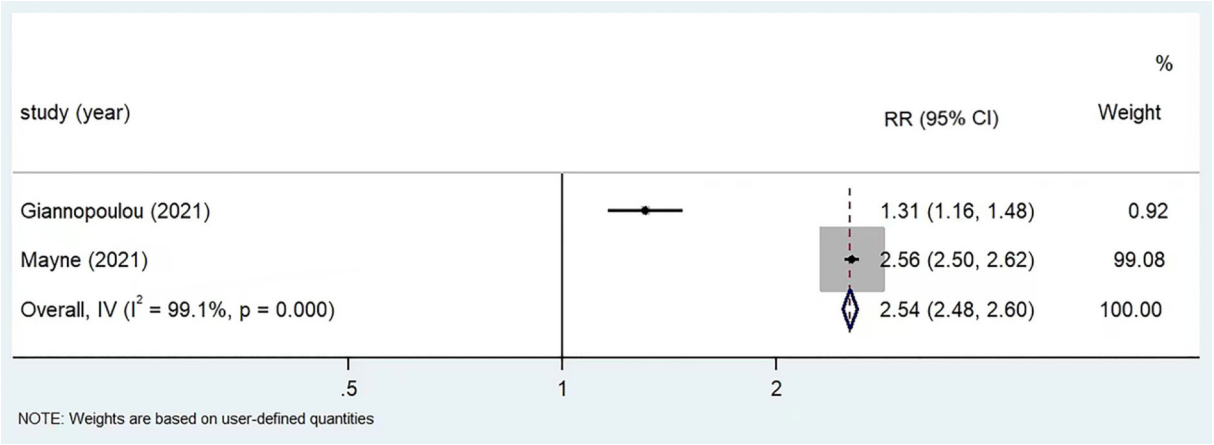

FIGURE 3
Meta-analysis of prevalence of depression before and post COVID-19 in children and adolescents by using PHQ-9 ($n = 3$).

reported prevalence rates of depression, a statistically higher depression rate had been revealed, with RR values of 1.31 (95% CI: 1.16, 1.48) for Giannopoulou et al. (27), 2.56 (95% CI: 2.50, 2.62) for Mayne et al. (32). The combined RR was 2.54 (95% CI: 2.48, 2.60) based on random-effect model ($I^2 = 99.1\%$, $p < 0.05$) (Figure 3).

Mean and standard deviation for depression scores were reported in 6 articles using PHQ-9, PHQ-8, and MFQ, respectively. The results for subgroup analysis by different measuring scales were collectively shown in Figure 4. For the two studies used PHQ-9, Giannopoulou et al. (27) reported statistically increased depression score in post COVID-19 period, with an SMD of 0.41 (95% CI: 0.28, 0.54), whereas for Andreas and Brunborg (30), the increase was insignificant (SMD: 0.05, 95% CI: −0.03, 0.13). The two studies used PHQ-8 all found higher depression score after COVID-19 pandemic, with SMDs of 0.28 (95% CI: 0.02, 0.54) for Jolliff et al. (28) and 0.20 (95% CI: 0.01, 0.38) for Gladstone et al. (31). The two studies used MFQ also yielded positive findings, with SMDs of 0.32 (95% CI: 0.18, 0.47) for Black et al. (26) and 0.08 (95% CI: 0.02, 0.14) for Westrupp et al. (33). Meta-analysis results based on random-effect model revealed statistically increased depression score in post COVID-19 period for all three subgroups: the combined SMDs were 0.17 (95% CI: 0.10, 0.24), 0.23 (95% CI: 0.08, 0.38), and 0.11 (95% CI: 0.06, 0.17) for PHQ-9, PHQ-8, and MFQ, respectively.

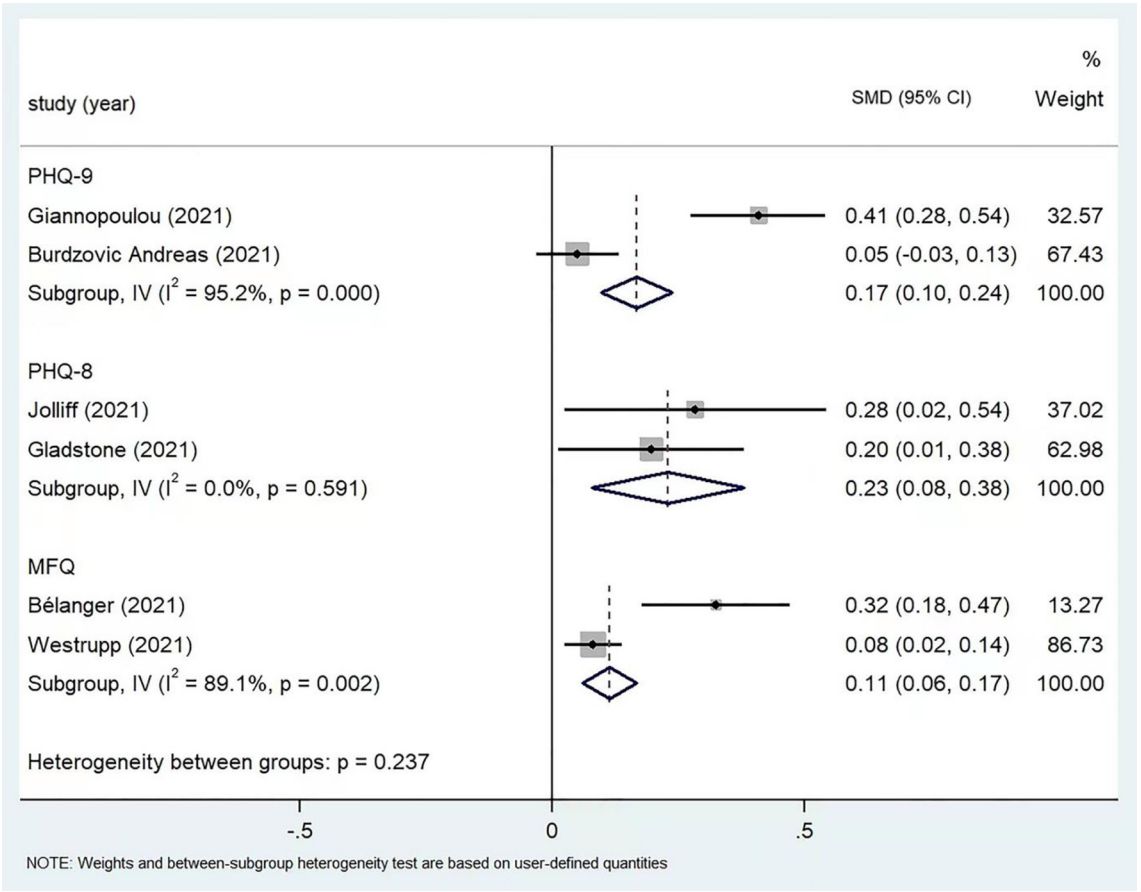

FIGURE 4
Subgroup meta-analysis of depression scores by using different scales ($n = 6$).

Sensitivity analysis

As for each depression instrument, only two eligible studies were included, sensitivity analysis for depression would be unnecessary.

Discussion

Although a plenty of studies had been published in the past several years on the negative psychological impact of the COVID-19 in children and adolescents, only a few of them compared the difference in depression or anxiety levels pre and post the pandemic within the same or comparable populations, and with incongruent conclusions. The need to synthesize existing evidence on this topic is urgent, in the purpose of generating stronger evidence for intervention. In this meta-analysis, we systematically searched, screened, evaluated, and combined published studies of higher quality, and found that for children and adolescents, their post COVID-19 anxiety and depression levels were significantly higher than pre-pandemic period. This major finding suggests the necessity of targeted intervention measures for this psychologically vulnerable population in post-pandemic era.

The COVID-19 pandemic has brought huge changes in lifestyle of children and adolescents, and these changes may act as environmental stressors for mood fluctuation. For instance, considering that novel coronavirus transmission is mainly through respiratory droplets and close contact, young people may actively avoid social activities in the fear of contracting the virus. Besides, due to the COVID-19 lockdown, children and adolescents in many areas were confined to their homes for a long time. It has been wide recognized that social isolation is associated with higher risk of depression and anxiety in children and adolescents (42, 43). In addition, children and adolescents spend less time in physical activity than they did before the COVID-19 pandemic, and some studies have shown that children and adolescents who lack of physical exercise were at significantly increased risk of anxiety and depression (44). As children and young people facing the continuing coronavirus

pandemic, the fear that they or their friends or family members will be infected by the virus had been shown associated with an increase in anxiety and depressive symptoms during COVID-19 pandemic (45). It has also been found that the global economic recession caused by COVID-19 pandemic had an impact on depression and anxiety in children and adolescents, especially for individuals from families with low socioeconomic status (46–48). Moreover, many studies have shown that COVID-19 also has a negative impact on parents' mental health (49, 50), and it has been reported that anxiety and depression of parents can be transmitted to children (51). Finally, as children and adolescents are isolated at home for longer periods of time and parents' pressure is increased due to isolation, the risk of child abuse in isolation period may also increase (52). It has been proved that maltreatment is associated with elevated risk of anxiety and depression in children and adolescents (53, 54).

Some important mechanisms might be involved in explaining deteriorated anxiety and depression status for children and adolescents in post COVID-19 period. At first, numerous environmental stressors generated by the pandemic can trigger neuroinflammation, a process intimately associated with dysfunctional hypothalamic-pituitary-adrenal (HPA) axis, that can lead to increased risk of mood disorders such as depression and anxiety (55, 56). Besides, longitudinal evidence suggests that adolescents under significant traumatic stress exhibited developmental increases in amygdala reactivity (57), and amygdala hyperactivity in adolescence had been associated with affect dysregulation (58). Moreover, COVID-19 may also cause brain structure and function changes that can contribute to aggravated psychiatric conditions. For instance, in a recently published multimodal magnetic resonance imaging study, the authors observed that widespread lower diffusivity among the main axis of white matter (WM), and abnormal functional connectivity (FC) among resting state networks were prominently associated with worse self-rated depression in 42 COVID-19 survivors (59).

The mental health conditions triggered by the COVID-19 pandemic, if left untreated, can compromise mental or even physical health of children and adolescents, and the adverse effect can extend into adulthood (60, 61). Therefore, effective and feasible intervention measures should be taken to prevent increased risk of anxiety and depression in children and adolescents. In COVID-19 pandemic background, expedient methods that compatible with infection containment policy should be devised and given priority. Some scholars have demonstrated that internet-based integrated interventions were effective for moderate anxiety and depression (62). An Italian study pointed out that in response to the psycho-social impact of the COVID-19 pandemic on adolescents, schools should organize online courses and social platforms not just for educational purpose, but also for adolescents to function socially (63). A newly published study revealed that a traditional Chinese physical exercise (Qigong) based intervention in combination with psychological support form of peer education can significantly reduce anxiety and depression in adolescents, which can help develop a mental health maintenance plan for adolescents living and studying at home during the COVID-19 pandemic (64).

This is the first comparative meta-analysis on depression and anxiety of children and adolescents pre and post COVID-19. Major findings of this study can provide important evidence for depression and anxiety intervention in children and adolescents during the COVID-19 pandemic. However, the current study has some limitations. First, as only a small number of eligible studies had been found and synthesized, our major findings should be further corroborated by future longitudinal studies of large samples and different origins. Second, for some of the included studies, pre COVID-19 depression and anxiety were measured by recall, therefore the possibility of information bias exists. Third, considering that for nearly all included studies, the time interval between pre and post COVID-19 measurements surpassed 6 months, it is possible that the change in symptoms of depression or anxiety was not a consequence of the pandemic. Finally, conspicuous heterogeneity existed between included studies, as suggested by sensitivity analysis, therefore, cautions should be taken when interpreting the combined results.

Conclusion

In this meta-analysis, by synthesizing timely evidence, we found that for children and adolescents, their anxiety and depression status significantly deteriorated in post COVID-19 period. This major finding suggests unneglectable psychological impact of the COVID-19 on youths. More attention should be paid to this vulnerable population during the pandemic. Effective, expedient and practical intervention measures which are compatible with COVID-19 prevention and control policies should be designed, evaluated, and implemented to maintain mental health wellbeing of children and adolescents in post COVID-19 era.

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.

Author contributions

YX conceived and designed this study. HR and YC were responsible for literature search and study selection. DF and XL were responsible for quality assessment. JP and HS were responsible for data extraction. SW and

LC performed analyses and wrote the original manuscript. YX critically reviewed and revised the manuscript. All authors contributed to the final version of the manuscript. All authors contributed to the article and approved the submitted version.

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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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Supplementary material

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Children and Adolescents Psychological Distress Scale During COVID-19 Pandemic: Validation of a Psychometric Instrument (CONFEADO Study)

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Aim and Object Purpose of the Study: In March 2020, the WHO declared a pandemic (COVID-19) due to the SARS-CoV-2 virus. In France, school closures and lockdowns were implemented. In this unprecedented context for French adolescents and children, the CONFEADO study surveyed children aged 9 to 18 years to assess their mental health, psychological distress, and resilience during and after the lockdown in relation to their living and housing conditions. To assess psychological distress, a psychometric tool (Children and Adolescent Psychological Distress Scale-CAPDS-10) was specifically designed for the research. This article presents the psychometric validity of the CAPDS-10.

Methods: This cross-sectional study collected data from June 9 to September 14, 2020, from children and adolescents (9 to 18 years of age) via an online questionnaire after sending it to a large network of partners. Psychological distress, resilience, and trait anxiety were assessed using the CAPDS-10, the Child and Youth Resilience Measure (CYRM), and the State-Trait Anxiety Inventory for Children (STAIC). The CAPDS-10 measured perceived psychological distress in the most recent 2 weeks (primary endpoint). The predictive power of the CAPDS-10 was determined by statistical analysis. We proceeded to a confirmatory factor analysis to validate the scale at a clinical level. We carried out a psychometric validation with a step to verify the uni-dimensionality of the scale (PCA analysis) and the calculation of convergent and divergent validity, correlation coefficient between items and subscales, Cronbach's alpha for reliability, determination of a cut-off score for the AUROC index.

Results: Three thousand and forty eight children and adolescents completed the CAPDS-10. Analysis confirmed a three-factor model (anxiety, depression, and aggressive behavior) (RMSEA = 0.072 [0.067; 0.077], CFI = 0.954), with a correlation coefficient between items >0.4. PCA analysis concluded that the scale is unidimensional. Reliability was satisfactory with Cronbach's alpha coefficients >0.7 (0.86). In addition, prediction was good with an AUROC index equal to 0.73 and a threshold score for severe distress greater than or equal to 19.

Conclusion: The CAPDS-10 measures psychological distress over the most recent 2-week period with good psychometric qualities. It could be used in crisis or prevention contexts in the general population or in clinical settings.

Keywords: children, adolescents, mental health, COVID-19, distress, validation, psychometric, scale

INTRODUCTION

Since early 2020, the whole world has been faced with a health crisis, resulting from the spread of the SARS-CoV-2 virus and COVID-19 (1). To contain the pandemic, the lockdown strategy was implemented by most countries around the world (2, 3), albeit without controlling all the consequences, in particular the psychological, psychiatric and social repercussions (4).

Early studies on the psychological impact of the lockdown showed a high prevalence of distress symptoms and psychological disorders (5–8). In groups of children and adolescents, initial findings highlighted an upswing in depressive and anxiety symtomatology (9–13), sleep and appetite disorders (14), anguish and worry related to disease (15), and behavioral disorders (16).

Most studies took the presence of symptoms of anxiety and depression as criteria for psychological distress. Other studies focused on the quality of life and sleep, on substance use (alcohol and tobacco) and on difficulties regulating emotions, with an impact on the children's and adolescents' relationships, emotions and behavior (17–19). All of this research indicates a wide range in the expression of psychological distress, but without being able characterize its severity.

We hypothesize that the COVID 19 pandemic, in connection with an emerging disease associated with the confinement of the population, is likely to cause psychological distress in children and adolescents in certain living conditions and context. The disease itself and the epidemic generate many uncertainties and anxieties (ex. variety of symptomatic expression with a deleterious evolutions, increasing number of deaths and hospitalizations in intensive care, scary media communication, overwhelmed health care system, risk of transmitting the disease to the most fragile relative). Moreover, the rupture of educational continuity and social life can lead to a loss of life habits of children and adolescents. In this double health and social constraint, anxious and depressive symptoms can appear, particularly in those who are deprived of their relationships (school, peer group). In addition, anxiety and depressive affects may be expressed in children and adolescents through somatic complaints (fatigue, physical pain, sleep). Moreover, the emotional context lead to dysfunctional manifestations in the relationships (opposition, irritability, more aggressiveness). These manifestations being exacerbated when there is no longer a third space such as school and social life to alleviate the weight of the reality of daily life within the families.

No self-report psychological distress screening tools evaluating children and adolescents aged 9–18 were currently available in French. K6 (French version available) and K10 (English version only) scales are used for screening distress but only in adolescents and adultes (20–22). In addition, although the KINDL scale (quality of life assessment) is available in French and at CONFEADO target ages, it does not meet our hypothesis (23). In fact, we were already exploring individual and relational resilience via the CYRM. We were aiming for a short, easy-to-complete scale that could be used in a variety of contexts (general or clinical population).

In France, school closures started on March 13, 2020, the general lockdown of the population began on March 17, 2020 and ended on May 10, 2020. The CONFEADO study focused on the emotional state and mental health of children and adolescents during and after the first lockdown. Within this framework, we produced a psychometric scale dealing with psychological distress, which is, from our viewpoint, clinically adapted to the experience of the crisis situation. The different registers as the anxiety, the depression, the somatic symptoms, the aggressiveness in relationships were integrated into our psychometric tool.

This article presents the psychometric validity of the tool as per psychological distress and the rules for interpreting the scale scores.

METHODS

Development of the Scale

We followed several steps to develop the CAPDS-10. First, a review of the literature was conducted to find a scale translated into French that measures psychological distress in children and adolescents aged 9 years and older.

Relevant and possible items were pooled by the first two authors of the study (CDS and DL). After categorizing into

internalizing and externalizing disorders, we selected sub-dimensions (depression, anxiety, aggressive behavior, relational difficulties, somatic pain/complaints). For each dimension we constructed items (20 items in total). After eliminating redundant items, another evaluation was carried out by the other authors of the article (SV, NO, TB) and by another child psychiatrist. Ten items were retained after having obtained a consensus in the group and a pilot phase started, in April 2020, with a group of children and adolescents who volunteered to assess the correct understanding of the items. A visual analog scale, ranging from 0 (not at all understandable) to 5 (completely understandable) was proposed. Eleven children participated in this pilot phase. The results show that the comprehension of our questions was rather good (mean age = 11.4; standard deviation = 2.6; mean global score = 4.5). After filling in the questionnaire, a mini interview was carried out by the first two authors in order to find out the children's suggestions for improving the tool.

Participants and Procedure

The study population includes parents and their children, aged 9 to 18. The age range chosen allowed us to focus on childhood, preadolescence and adolescence periods. The inclusion criteria were as follows: children and adolescents aged from 9 to 18 years old, capable of giving their informed consent. Exclusion criteria were as follows: children under 9 or over 18 years old. The study took place from June 9, 2020 to September 14, 2020. At the start of the study, the lockdown had already begun, gradually and heterogeneously implemented throughout France. In fact, some children had already returned to school while others were still staying at home. This survey was authorized by a French research ethics committee, the *Comité de Protection des Personnes Ile de France VIII*, before its initiation (N°2020-A01342.37). Information was provided to all participants before their enrollment. The survey was anonymous. No compensation was offered. The link to the questionnaire was sent to families by various institutions or associations, such as the FCPE (Parent Association) and the UNAF (National Union of Family Associations), through partners of the University Sorbonne Paris-Nord, Santé Publique France (Public Health France - SPF), the National Observatory of Child Protection (ONPE) and the Paris Hospitals Public Assistance communication network (AP-HP). The wide scope of associations and institutions involved made it possible to reach a diverse group of children and adolescents in France. In addition, the link was transmitted via social media (e.g., Twitter, Facebook). For children in the care of child welfare services (ASE), the questionnaire was available on paper through childcare workers willing to recruit participants for the study.

Measures

Demographic Informations

The questionnaire was made anonymous, standardized, and developed from a multidisciplinary perspective (public health, psychology, psychiatry and sociology). It had a section for parents or adult caregivers, followed by a section for youth (children/adolescents). A system using vocal synthesis capable of reading the questions and answers was provided in case of illiteracy. The questionnaire completed by parents collected socio-demographic data (gender, age, municipality of residence, employment status, occupation, diploma, nationality, perception of the financial status of the household).

The questionnaire completed by children collected:

- socio-demographic data (e.g. gender, age, family bilingualism…)
- data regarding the child's/adolescent's general physical condition and emotional state (e.g. sleep, appetite, emotions upon waking-up and at bedtime) for discriminant validity.

State-Trait Anxiety Inventory for Children (STAIC)

Screening trait anxiety in children aged 9 to 18 in the event that the child experienced stressful events unrelated to Covid-19. For that screening, we used the *State-Trait Anxiety Inventory for Children (STAIC)* (24). It is a self-report tool completed by the children themselves and includes 10 items rated from 1 to 3 points, leading to a total score between 20 and 60 points. A high score indicates a child with trait-anxiety characteristics. The STAIC was used for the concurrent validity of the CAPDS-10.

Child and Youth Resilience Measure

However, to evaluate resilience, we used the score from the Child and Youth Resilience Measure (CYRM-R) (25). It is a self-report tool completed by the children themselves, which includes 17 items each rated from 1 to 5 points, leading to a total score from 17 to 85 points. A high score indicates a child with characteristics of resilience. The CYRM-R was used for the concurrent validity of our instrument.

Statistical Analysis

Analyses for the CAPDS-10 validity were done using STATA 12.1 and R 4.3.0, with the valid scale module. The initial tool construct was divided into four dimensions: Depression (Items 1–3), Anxiety (Items 4–6), Somatic Complaints (Item 7), and Aggressive Behavior (Items 8–10).

CAPDS-10 Validity

Confirmatory Analysis

The confirmatory analysis was carried out to ensure the clinical validity of the tool in terms of the items chosen to assess depressive, anxiety and aggressiveness-related symptoms.

In order to confirm the correlations between the batches of hypothesized items and the latent variables associated with the initial dimensions, a Confirmatory Factor Analysis (CFA) was used. The parameters estimated were intercepts, factor loading, error variance, and the parameters of the latent variables. Maximum likelihood was the estimation procedure. Model adequacy was evaluated by a chi-squared test, but that test is more likely to be significant when the number of individuals is high (in this case, $N = 3{,}148$); it was therefore not the main indicator to be taken into account. The construct was actually confirmed through several indices: the root mean square error of approximation (RMSEA), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI). An RMSEA <0.08 is considered to represent a good fit, and the CFI reflects a good fit if it is >0.9. Factor loadings should be at least >0.4, and values >0.7

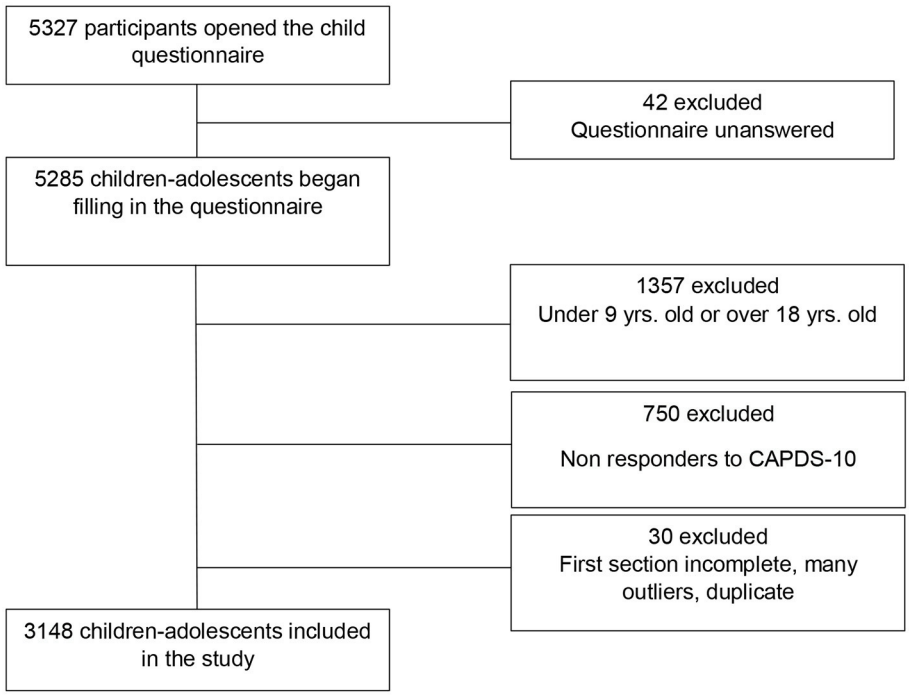

FIGURE 1 | Flow chart CONFEADO study, France, 2020.

demonstrate very good correlations between the items and the latent variables of the subscales [26, 27].

Uni-Dimensionality Check

Since the CAPDS-10 scale is built-up from different items, the underlying assumption is that the construct is dominantly uni-dimensional. In order to check that assumption, we conducted a principal component analysis (PCA). PCA is a statistical technique that allows to summarize the information content in some variables by means of a smaller set of summary indices called factors or dimensions. Analyzing the fraction of total variance captured by a single factor, we will be able to determinate if the scale can be considered uni-dimensional.

Convergent Validity

Convergent validity was evaluated by studying the matrix of correlations between the items and the scale. The correlation coefficient between each item and the scale should be >0.4 to have convergent validity.

Reliability

The reliability of the scale was evaluated using Cronbach's alpha. The measure is considered precise enough if the said coefficient is >0.7.

Discriminant Validity

The hypothesis that the score increases with distress was confirmed by an analysis of its association with other variables present in the CONFEADO study questionnaire. For that analysis, one-way ANOVA tests as well as pairwise-tests (with Bonferroni correction) were conducted. The variables included were: "I feel sad in the morning," "I feel worried in the morning," "I feel happy in the morning," and their three equivalents for the evening. Those variables are related to the child's emotions all had the following response modes: "No," "Yes, a little," "Yes, very."

Concurrent Validity

External validity was done using CYRM-R and STAIC scales. The correlation coefficients between those scales and the CAPDS-10 scale were calculated.

Determining a Distress Threshold

This distress screening tool requires determining a threshold score, called the "cut-off" score, starting at which a child can be declared to have a high likelihood of being in severe distress. An initial indication of this threshold can be given by the 95% quantile of the distress score. However, the threshold was truly determined by maximizing accuracy with the creation of a "real distress" variable.

That "real distress" variable was created using six other variables included in the rest of the CONFEADO survey questionnaire, which were: "I feel sad in the morning," "I feel happy in the morning," "I am afraid in the morning" and their equivalents for the child's feelings in the evening. The response modes were "No," "Yes, a little" or "Yes, very." Those variables were combined to limit their number to three binary variables: "I feel sad overall," "I feel happy overall," and "I'm afraid overall." Children were considered to be sad overall if they had indicated that they felt "a little" or "very" sad in the morning and in the

evening, and likewise for being afraid. Children were considered not to be happy overall if they had indicated that they didn't feel happy at all or just "a little" in the morning and in the evening.

The combination of these three binary variables resulted in a "real" distress mini-score between 0 and 3, which itself led to the creation of a "real" distress binary variable. That variable was the basis for determining the distress score threshold. Accuracy was calculated for all threshold values between 0 and 30:

$$Accuracy\,(threshold) = \frac{TP + TN}{TP + TN + FP + FN} = 1 - error\ rate(threshold)$$

Where TP is the True Positives rate, TN the True Negatives rate, FP the le False Positives rate, and FN the False Negatives rate.

The goodness of fit of prediction was established by calculating the AUROC (Area Under the Receiver Operating Characteristic) curve. An AUROC >0.7 is a sign of goodness of fit.

A severe distress threshold on this tool was therefore detected by maximizing the accuracy while minimizing the threshold to keep from missing any cases of distress.

RESULTS

Sample Characteristics and Population Selection

A total of 5,327 participants gave their consent and opened the questionnaire (**Figure 1**). Three thousand and forty eight children and adolescents were included in the study (**Table 1**).

TABLE 1 | Sample characteristics ($N = 3,148$).

Variables	9-11 years old ($N = 426$) N(%)	12-14 years old ($N = 496$) N(%)	15-18 years old ($N = 2,226$) N(%)
Sex (N)	**426**	**496**	**2,226**
Girl	208 (48.8)	267 (53.8)	1,731 (77.8)
Boy	218 (51.2)	229 (46.2)	495 (22.2)
Joint custody (N)	**426**	**496**	**2,226**
No	402 (94.4)	458 (92.3)	2,045 (91.9)
Yes	24 (5.6)	38 (7.7)	181 (8.1)
Child protection care (N)	**426**	**496**	**2,226**
No	414 (97.2)	484 (97.6)	2,205 (99.1)
Yes	12 (2.8)	12 (2.4)	21 (0.9)
History of mental disorders (N)	**424**	**493**	**2,221**
No	345 (81.4)	413 (83.8)	1,649 (74.2)
Yes	79 (18.6)	80 (16.2)	572 (25.8)
Psychological distress (CAPDS-10) (N)	**426**	**496**	**2,226**
No or mild distress	323 (75.8)	366 (73.8)	1,240 (55.7)
Moderate distress	90 (21.1)	101 (20.4)	788 (35.4)
Severe distress	13 (3.1)	29 (5.8)	198 (8.9)
Nationality (N)	**424**	**493**	**2,221**
Two French parents	362 (85.4)	432 (87.6)	1,702 (76.6)
A foreign parent	46 (10.8)	46 (9.3)	322 (14.5)
Two foreign parents	16 (3.8)	15 (3.0)	197 (8.9)
Parental social support (N)	**424**	**493**	**2,221**
Yes	370 (87.3)	420 (85.2)	1,923 (86.6)
No	54 (12.7)	73 (14.8)	298 (13.4)
Family structure (N)	**409**	**483**	**2,108**
Two parent or blended families	352 (86.1)	372 (77.0)	1,563 (74.1)
Single parent	57 (13.9)	111 (23.0)	545 (25.9)
Parents' occupational category (N)	**397**	**466**	**1,887**
Farmers	2 (0.5)	2 (0.4)	23 (1.2)
Artisans	8 (2.0)	8 (1.7)	90 (4.8)
Executives	128 (32.2)	148 (31.8)	249 (13.2)
Intermediate occupations	144 (36.3)	164 (35.2)	443 (23.5)
Employees	86 (21.7)	112 (24.1)	674 (35.7)
Laborers	8 (2.0)	10 (2.1)	167 (8.8)
Retired or inactive	21 (5.3)	22 (4.7)	241 (12.8)
Educational level (N)	**424**	**493**	**2,221**
No diploma	21 (5.0)	37 (7.5)	377 (17.0)
High school diploma	87 (20.5)	102 (20.7)	917 (41.3)
Bachelor's degree	133 (31.4)	157 (31.9)	505 (22.7)
Master's degree	141 (33.2)	153 (31.0)	369 (16.6)
PH.D	42 (9.9)	44 (8.9)	53 (2.4)

CONFEADO study, France, 2020. The meaning of the bold values is N.

CAPDS-10 Validity

The initial 4-dimension construct was questioned by the convergent and discriminant validity, and the impossibility to calculate Cronbach's alpha for the dimension "Somatic Complaints" which included only Item 7 ("I have felt physical pain, I have felt tired or I have had trouble sleeping"). Studying the matrix of the correlations between the items and subscales, as well as doing a principal component analysis (PCA) on the items, made it possible to assign that item to the "Depression" dimension. As such, the entire validity presented below was done on the tool divided into three subscales: Anxiety (three items), Depression (four items) and Aggressive Behavior (four items).

Confirmatory Analysis

The confirmatory analysis results showed that the three-factor model correctly fit the data observed. The factor loadings were all indeed very high, except for the items "have been restless or had trouble sitting still" and "not felt like doing things," for which the values remained correct (>0.4). Moreover, the goodness of fit was very good (RMSEA = 0.072 [0.067; 0.077], CFI = 0.954). The chi-squared test confirming the model adequacy was also significant.

Uni-Dimensionality Check

The PCA analysis produced the following graph (**Figure 2**). As one can see, the first-dimension concentrates about 45% of the information contained in the items while both the first and second dimensions concentrate 57%. We consider that this additional gain from the second dimension is negligible and keep only one dimension since 45% of variance is correct. We therefore conclude that the scale is uni-dimensional.

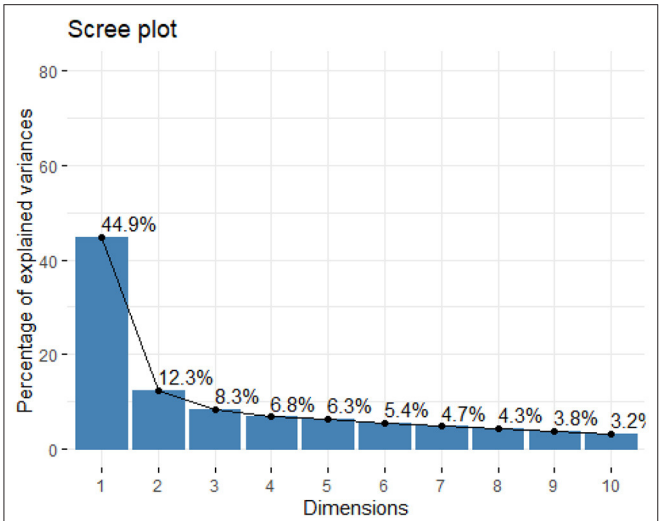

FIGURE 2 | Graphic of uni-dimensionality test. CONFEADO study, France, 2020.

TABLE 2 | Matrix of correlations between items and the scale.

Items	Correlations
1. I have felt angry, stressed out or worried	0.76
2. I haven't managed to overcome my stress or to deal with it	0.70
3. I have been restless or had trouble sitting still	0.59
4. I haven't felt like doing things or enjoyed doing things	0.60
5. I have felt discouraged or sad or unhappy	0.78
6. I have felt sluggish or I have felt a lack of energy	0.67
7. I have felt physical pain, I have felt tired or I have had trouble sleeping	0.70
8. I have disobeyed or I have opposed my parents	0.56
9. I have felt irritable or unpleasant or I have lost my temper	0.73
10. I have argued, I have had a fight, I have provoked other people	0.56

Convergent Validity

All 10 items had a correlation coefficient >0.4 with the scale (**Table 2**).

Reliability

The Cronbach's alpha value is 0.86 (>0.7) reflecting a good level of internal consistency of the scale.

Discriminant Validity

Table 3 presents the means and standard deviations of the CAPDS-10 score for all modes of the six emotion variables and the results of anova tests. For all those variables, the mean value of the score is higher when the child is very or little sad, worried or unhappy rather than happy or not worried at all. The anova tests revealed that for each of those emotion variables, the mean value of the score for at least one group is significantly different from the mean value of the score for the other groups ($p < 2.2e-16$).

TABLE 3 | Means of scale's scores for each mode of emotion variables.

	N(%)	Mean	Std deviation	*P*-value
Feeling sad in the morning				<2.2e-16 ***
No	2,015 (64.3%)	6.3	4.6	
little	920 (29.3%)	12	5.6	
Yes, very	199 (6.4%)	18	6.2	
Feeling worried in the morning				<2.2e-16 ***
No	1,796 (57.3%)	6.4	4.9	
little	1,026 (32.8%)	10	5.3	
Yes, very	311 (9.9%)	16	6.3	
Feeling happy in the morning				<2.2e-16 ***
No	1,057 (33.8%)	11	6.8	
little	1,520 (48.6%)	8.3	5.5	
Yes, very	549 (17.6%)	5.7	4.3	
Feeling sad in the evening				<2.2e-16 ***
No	2,088 (66.9%)	6.5	4.8	
little	702 (22.5%)	12	5.6	
Yes, very	332 (10.6%)	16	6	
Feeling worried in the evening				<2.2e-16 ***
No	1,833 (58.8%)	6.3	4.9	
little	970 (31.1%)	11	5.4	
Yes, very	314 (10.1%)	16	6	
Feeling happy in the evening				<2.2e-16 ***
No	1,485 (47.7%)	10	6.5	
little	1,240 (39.8%)	7.8	5.3	
Yes, very	391 (12.5%)	5.6	4.6	

*** *p-value <0.05.*

TABLE 4 | Correlation coefficients between the CAPDS-10 tool and the resilience and trait-anxiety scores.

	CYRM-R Resilience	STAIC State-Trait Anxiety
CAPDS total Score	−0.354	0.715

In addition, we performed a pairwise *t*-test using Bonferroni's correction that confirmed significant difference between all pairs of groups of every single emotion variables.

Concurrent Validity

The correlation coefficients between the resilience and trait-anxiety scores, and the CAPDS-10 score are shown in **Table 4**. As one can see, psychological distress measured by the CAPDS scale is negatively and weakly related to the resilience while positively and strongly related to the anxiety.

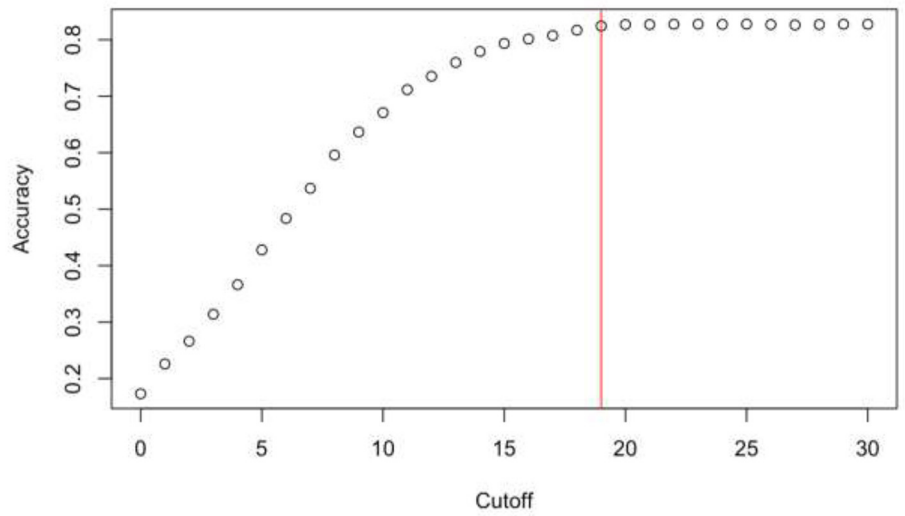

FIGURE 3 | Accuracy as a function of threshold values.

Determining a Cutoff Score

The "real" distress variable created through six emotion variables present in the rest of the questionnaire established that 545 (17%) children were in a state of distress, based on the emotions of sadness, fear and happiness.

Figure 3 shows the values of prediction accuracy as a function of each threshold on the distress variable from the CAPDS-10 tool, with the constructed variable of real distress as the base.

With the goal being to maximize accuracy while minimizing the threshold, it was established that a child is in a state of severe distress if s/he has a score $\geq$19. The AUROC index is equal to 0.73, therefore prediction is accurate. In addition, a score from 0 to 9 indicates no or mild distress, while a score from 10 to 18 indicates moderate distress.

DISCUSSION

This study presented the development of a new scale, Children and Adolescent Psychological Distress Scale - 10 items (CAPDS-10). Results showed that the CAPDS-10 has a stable unidimensional structure and robust psychometric properties. In addition, the overall score of the summed items can indicate the severity of psychological distress in children and adolescents. The internal consistency of the CAPDS-10 items was satisfactory with a Cronbach's alpha = 0.86. Based on the clinical distinction between depression, anxiety, aggressiveness and somatic complaints, a four-factor model was examined. Confirmatory analysis showed a three-factor model, aggregating somatic complaints to the depression factor.

In addition, some of the items proposed for the CAPDS-10 may be common to an anxiety and depression clinic such as irritability, or somatic symptoms. This is particularly true in children who express their suffering through aggressive behavior in relationships (externalized symptoms) due to a less mature emotional regulation capacity. Thus, treating psychological distress as a transnosographic dimension seems relevant. Given the original purpose of the CAPDS-10 to measure psychological distress and given the unidimensionality of the scale, we retained the simpler procedure of a global score for the measurement of psychological distress.

Concerning the construct validity of our tool, our results show a high and positive correlation of the CAPDS-10 with the STAIC scale and with the self-reported emotional experience of children and adolescents collected in the CONFEADO study questionnaire. Moreover, the CAPDS-10 is weakly and negatively correlated with the CYRM (−0.35), which means that the higher the resilience score, the lower the distress score. From a clinical point of view, resilience does not correspond to an absence of psychological distress but rather to a protective factor in interaction with other individual and environmental aspects of the child.

The clinical aim of the CAPDS-10 was to screen primarily children and adolescents with high levels of psychological distress. Clinically, we assumed a threshold of 20, which corresponds to symptomatic expression more than half the time for each item. This constitutes a demanding threshold. The calculation of the threshold for severe distress was statistically calculated. The statistical threshold (cut off score equal to and >19) is very close to the clinical score, which means that the child is in a state of severe distress. The threshold maximizes the AUC that leads to reduce the false positive rate by conserving a good detection rate. Regarding to this threshold, the CAPSD-10 has its optimal usage range above 19 score.

Several limitations must be taken into account in our study. We performed a single measure during the first confinement, which does not allow for comparison of scores with a pre-Covid measure. Furthermore, we could not verify the temporal stability of our tool in a test-retest setting. In addition, no depression

scale was used to complete the concurrent validity. The scale was validated on 3,148 participants, with the loss of 750 participants who did not complete.

In conclusion, the CAPDS-10 is the first French scale, validated in general population, to detect psychological distress in children and adolescents aged 9 to 18 years, in self-report. This scale has good psychometric properties and is very quick to complete. It can be easily used by health professionals in individual and collective crisis situations.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Comité de Protection des Personnes Ile de France VIII (N°2020-A01342.37). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

Critical revision of the manuscript for important intellectual content: CDS, DR, IL, V-CK-F, ME, SV, NO, PH, FD'H, TB, BF, and IK. Study supervision: BF, TB, and FD'H. Wrote the manuscript: CDS, DR, IL, and V-CK-F. Contributed reagents, materials, and analysis tools: PH, FD'H, BF, TB, and IK. Analyzed the data: IL, V-CK-F, ME, CDS, DR, SV, and NO. Conceived and designed the experiments: CDS, DR, NO, SV, and BF. All authors contributed to the article and approved the submitted version.

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Association of social support with negative emotions among Chinese adolescents during Omicron-related lockdown of Shenzhen City: The roles of rumination and sleep quality

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Objective: Adolescents are likely to suffer from negative emotions such as depression and anxiety due to the rapid development of biological, cognitive and social changes. Previous studies have indicated possible risk (rumination) and protective (good social support and high sleep quality) factors for depression and anxiety among this age group. The present study is the first to investigate the association between social support and negative emotions during the Outbreak of Omicron variant, on this basis, to further determine the mediating role of rumination and sleep quality on this link.

Method: A total of 1,065 Chinese middle- and high-school students (51.5% female, $M_{age} = 13.80$, $SD = 1.20$) completed a psychosocial battery, including the Social Support Rating Scale (SSRS), the Pittsburgh Sleep Quality Index (PSQI), the Ruminative Responses Scale (RRS), the Depression Anxiety Stress Scale (DASS). Serial multiple mediation analysis was conducted using PROCESS macro based on SPSS.

Results: Social support, rumination, and sleep quality were significantly negatively correlated with negative emotional states (Ps < 0.05). Further, rumination and sleep quality were found to partially mediate the relationship between social support and negative emotional states.

Conclusions: For early detection and prevention of depression and anxiety, providing sufficient social support is necessary for adolescents, because rumination and sleep problems are reported during stressful periods, such as the COVID-19 pandemic.

KEYWORDS

depression, anxiety, rumination, sleep quality, social support

Introduction

Negative emotions such as depression and anxiety are common when facing a life-threatening event like the COVID-19 pandemic (1, 2). These negative emotions can be more severe among individuals who have been forced to quarantine at home or other places such as a hotel during city lockdown. Shenzhen is one of the most economically developed, densely populated cities in China recently faced its 3rd city-wide lockdown. All residents were required to stay at home for more than a week, including students for whom online classes were developed. The youth experienced unprecedented isolation from their peers and teachers, which has substantial impacts on emotions (COVID-related increases in psychological distress) among high school students (3, 4). Thus, there is an urgent need to identify factors that buffer against the negative effects of social isolation on emotions among the adolescent population during the outbreak of the Omicron variant, using high school students in Shenzhen as an exemplary sample.

Research has revealed key predictors of negative emotional states such as social support, sleep quality, rumination and allostatic load (5–8). Social support refers to the perception of being cared for, esteemed and valued by others (9). This has been identified as one of the strongest protective factors against negative emotional states (10). Studies have consistently shown that social support acts as a buffer against psychological distress such as depression and anxiety caused by stressful life events (7, 11, 12). Specifically, social support comes into play in dealing with depression and anxiety during times of stress, especially in adolescents (13, 14). There are many sources of social support for Chinese adolescents, primarily family (e.g., parents) and school (e.g., teachers and classmates). The buffering effect model, a major social support theory, suggests that social support is related to the subjective assessment of people under stress (15).

Rumination is a type of unpleasant experience that individuals present repetitive and passive thinking about the same event or thing (16). Several studies suggested that rumination appears to be a transdiagnostic factor in depression and anxiety, a mechanism responsible for the high degree of comorbidity among certain mental disorders, as it amplifies and prolongs negative emotional states (5, 17–19). Other empirical studies showed that empirical studies showed that rumination is significantly associated with low social support (20, 21). Social support is known to protect individuals under stress from negative emotional states and maladaptive response (e.g., rumination). Thus, the mediating role of rumination on relationship between low social support and negative emotions during the outbreak of Omicron variant should be investigated.

Among the many pathways, sleep appears to have a particularly important role (22). A relatively large, and growing, body of literature has shown that sleep quality is a key predictor of both physical and mental health (23–26). Specifically, poor sleep quality has been linked to higher risk of depression and anxiety (27, 28). There is robust evidence for inflammation as a biological pathway linking sleep quality and depression (29, 30). In addition, regarding the positive impact of social support on sleep, evolutionary psychology explains that close associates protect individuals from danger during the sleep phase (31). Some studies have supported this hypothesis that higher levels of social support are associated with better sleep quality (22, 32). Therefore, it is crucial to explore the specific role of sleep quality between social support and negative emotional states to provide more effective methods for the intervention of adolescents trapped in psychological distress. Furthermore, the COVID-19 outbreak as a serious stressful life event was associated with higher levels of rumination, leading to poor sleep quality (33). Taken together, sleep quality and rumination may act as serial mediators of the relationship between social support and negative emotional states. However, the empirical evidence in this field is not sufficient and needs to be explored urgently.

To our knowledge, no previous studies have explored the associations among of social support, sleep quality, rumination, and negative emotional states. Therefore, the aim of the present study was to propose a serial multiple mediation model to examine the mediating effects of sleep quality and rumination between social support and negative emotional states. Accordingly, we hypothesized that: (1) negative emotional states would be negatively correlated with social support and sleep quality, and positively correlated with rumination; (2) rumination and sleep quality play mediating roles in the relationship between social support and negative emotional states.

Methods

Study participants

Four high schools (HS) from Shenzhen, China, were selected from March to April 2022 using convenience sampling. Students aged 12–18 years old from the selected schools were recruited. Permission for this in-school survey was obtained before the investigation from schools, legal guardians, and students. Participants were asked to complete an electronic questionnaire through a platform (Wenjuanxing-called Questionnaire Star), with the background, aim, and anonymity of the study being presented at the top of the questionnaire. A total of 1,179 HS and junior high school (JHS) students volunteered to take part in this study. After all the participants had completed the study, the data with and unacceptably short duration for response (<3 min to complete the e-questionnaire), or failing the lie detector quiz ($n = 114$) were removed, and valid answers were obtained from 1,065 participants (548 females, 517 males, $M_{age} = 13.8$, $SD = 1.2$). This study protocol (PN-2020-041) was approved by the ethical committee of Shenzhen University before data collection.

Measures

Negative emotional states were measured using the Chinese version of Depression Anxiety Stress Scale [DASS; (34, 35)], which is a self-report questionnaire in the present study. This questionnaire includes 21 items, with each rated on a 4-point scale: Zero (Did not apply to me at all) to three (Applied to me most of the time). Cronbach's alpha of this questionnaire in the present study was 0.88.

The Chinese version of the Pittsburgh Sleep Quality Index (PSQI) was used to measure sleep quality in the sample (36, 37). This scale includes 19 items assessing seven dimensions of sleep quality: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Specifically, a greater total score indicates worse subjective sleep quality. Cronbach's alpha of this questionnaire in the present study was 0.85.

The Ruminative Responses Scale (RRS) is a widely used self-administered measure of rumination (38, 39). It consists of 22 items and three domains of rumination (symptom rumination, brooding, and reflective pondering), with each rated on a 4-point scale (1–4). The total score ranges from 22 to 88, with higher score indicating more severe rumination. Cronbach's alpha of this questionnaire in the present study was 0.88.

Social support was assessed using the Social Support Rating Scale [SSRS; (40)]. The SSRS is a 10-item self-report instrument that measures 3 domains of social support (subjective social support, objective social support, and the utilization of social support). The global score for this scale can be obtained by adding up the scores of each item (range 12–66); higher scores indicate greater level of social support. Cronbach's alpha of this questionnaire in the present study was 0.95.

Sedentary time was also measured using a part of the International Physical Activity Questionnaire-short form [IPAQ-SF; (41, 42)]. A single-item question was used to collect the duration of sedentary behaviors of participants. Specifically, participants were asked to fill out the information of "— hours per day" and then "— minutes per day" following "During the last seven days, how much time did you spend sitting on a week day." Daily duration in hours was converted into minutes. Given that sedentary behavior was negatively correlated with social support ($r = -0.12$, $p < 0.001$) and sleep quality ($r = -0.16$, $p < 0.001$) but it is positively linked to negative emotion ($r = 0.16$, $p < 0.001$), it was considered as a covariate in this study.

Statistical analysis

Data were analyzed with SPSS 22.0 and PROCESS which is a widely used a macro program for SPSS to analyze mediation and moderation models (43). Descriptive analyses were first conducted of socio-demographic characteristics and the calculation of means and standard deviation (*SD*). Pearson's correlation was used to examine the association between each two continuous variables, after controlling for several co-variables including gender, age and BMI (Body mass index). To understand the mechanism of social support, sleep quality, rumination and negative emotional states, hypothesized mediation analyses were examined using the PROCESS macro. Multiple mediation analyses were based on bootstrapping (5,000 bootstrap samples) with 95% confidence intervals (CI). An effect was considered as significant at the 0.05 level if the 95% bias-corrected bootstrap CI of the mediation effect does not contain zero. Gender, age and BMI were considered as covariates in the model. *P*-values <0.05 were considered statistically significant when a two-tailed test was used.

Results

Descriptive analyses

Results for gender difference on socio-demographic and anthropometric variables are presented in Table 1. A significant gender difference was observed on age, BMI, PSQI, and DASS. Of note, compared with male counterparts, female participants demonstrated significantly lower sleep quality and higher negative emotional states.

Correlation analyses

Correlations for the key study variables under the control of gender, age and BMI are presented in Table 2. Social support and sleep quality were both negatively correlated with rumination and negative emotional states. In addition, rumination was significantly and positively correlated with negative emotional states.

Multiple mediation model

Multiple mediation analysis was conducted in PROCESS to explore the mediators of social support and negative emotional states among teenagers, with gender, age, BMI, and sedentary time as covariates. The total, direct, and indirect effects are listed in Table 3; Figure 1, the bias-corrected 95% CI for all six paths did not include zero. The analysis revealed that the total and direct effect of social support on negative emotional states were statistically significant, indicating that high level of social support was associated with less negative emotional states.

TABLE 1 Gender difference on sociodemographic and anthropometric variables.

Variables	Total (1,065) $M \pm SD$	Male (517) $M \pm SD$	Female (548) $M \pm SD$	t	p
Age (years)	13.77 ± 1.23	13.89 ± 1.27	13.66 ± 1.19	2.94**	0.003
BMI (kg/m^2)	19.99 ± 3.32	20.73 ± 3.65	19.39 ± 2.80	7.15***	<0.001
Sedentary time (minutes)	446.65 ± 169.443	431.82 ± 166.36	460.63 ± 171.28	−2.784**	0.005
SSRS	34.61 ± 7.03	34.62 ± 7.15	3,460 ± 6.93	0.06	0.952
PSQI	5.15 ± 3.17	4.89 ± 3.15	5.39 ± 3.17	−2.55*	0.011
RRS	22.28 ± 6.27	22.07 ± 6.30	22.49 ± 6.25	−1.087	0.277
DASS	12.26 ± 9.40	11.41 ± 9.20	13.07 ± 9.53	−2.879**	0.004

SSRS, Social Support Rating Scale; RRS, Ruminative Responses Scale; PSQI, Pittsburgh Sleep Quality Index; DASS, Depression Anxiety Stress Scale.
*p < 0.05, **p < 0.01, ***p < 0.001.

TABLE 2 Correlations of all tested variables.

Variables	SSRS	PSQI	RRS	DASS (total score)
SSRS				
PSQI	−0.175***			
RRS	−0.125***	0.117***		
DASS (total score)	−0.321***	0.248***	0.320***	

***p < 0.001.
SSRS, Social Support Rating Scale; RRS, Ruminative Responses Scale; PSQI, Pittsburgh Sleep Quality Index; DASS, Depression Anxiety Stress Scale.

TABLE 3 Mediation modeling results.

Path	Standardized effect	SE	LLCI	ULCI
Total effect	−0.3072	0.0386	−0.4863	−0.3349
Direct effect	−0.2478	0.0370	−0.4039	−0.2587
Total indirect effects	−0.0593	0.0166	−0.1139	−0.0491
Indirect 1	−0.0336	0.0124	−0.0709	−0.0222
Indirect 2	−0.0237	0.0099	−0.0537	−0.0149
Indirect 3	−0.0020	0.0012	−0.0054	−0.0008

SE, standard error; LLCI and ULCI, lower level and upper level of the bias-corrected 95% bootstrap confidence interval.

Social support was found to indirectly affect negative emotional states through three negative significant mediation pathways: (i) rumination (Standardized Effect = −0.0336, 95%CI [−0.0709, −0.0222]); (ii) sleep quality (Standardized Effect = −0.0237, 95%CI [−0.0537, −0.0149]); (iii) rumination and sleep quality (Standardized Effect = −0.0020, 95%CI [−0.0054, −0.0008]). Specifically, results showed that the negative association between high level of social support and less negative emotional states was mediated by less rumination and higher level of sleep quality.

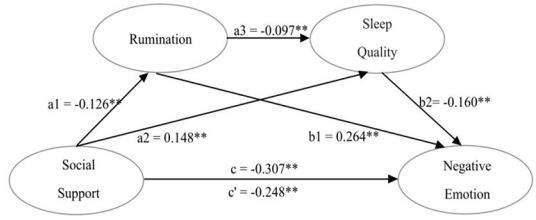

FIGURE 1
The mediation model. **$p < 0.01$.

Discussion

The aim of the present study was to examine the possible links between social support, rumination, sleep quality and negative emotional states (e.g., depression, anxiety, and stress). Consistent with previous studies (44–47), our results showed negative emotional states to be significantly negatively correlated with social support and sleep quality, and positively correlated with rumination which also concur with our theoretical hypothesis. Furthermore, the results of this study increase the understanding of the underlying psychological mechanism regarding the link between social support and negative emotional states. Based on the serial multiple mediation model, the present study explained how social support contributes to the reduction of negative emotional states.

The allostatic load model suggests that when repetitive allostatic responses are activated, the body undergoes a cumulative "wear and tear" which may become an important trigger for negative emotional states such as depression and anxiety (48). Specifically, prolonged activation of the HPA (hypothalamic–pituitary–adrenal) axis can indeed trigger pathological changes. However, anxiety and/or depression can develop in response to stress before such physical changes. The stress/allostatic load—poor mental health—poor physical

health relationship is more cyclical than linear and can be triggered at different points. For this population of healthy adolescents, the risk of entry into the cycle is stress leading to mental health problems. The key point is that the current results demonstrate the direct and indirect paths by which social support can be a protective factor against the risk of anxiety and/or depression being triggered by the stressful situation. Thus, good social support helps to prevent the cycle of prolonged stress—poor mental health—poor physical health. Previous studies have shown that social support is one of the most important protective factors for allostatic load leading to negative emotional states (49, 50). Rumination has been shown to be a precursor to mental disorders such as depression (51), and there are empirical studies suggesting that post-stress rumination may be a predictor of HPA axis non-habituation, an important physiological mechanism leading to depression (52). In line with our study, social support predicted negative emotional states indirectly through rumination. In the face of stressful events in life, perceived social support helps individuals to relieve themselves from repetitive, negative, unnecessary rumination, thereby reducing the production of negative emotional states (possibly due to habituation of the HPA axis).

The results of the multiple mediation model further showed that the sleep quality related to rumination was another significant mediator of the association between social support and negative emotional states, extending previous findings about this relationship among older adults (53). Specifically, adolescents with higher perceived social support also show a higher level of sleep quality, which, in turn, led to less negative emotional states during COVID-19 outbreak. Consistent with the results of the present study, a review found sleep as a potential mechanism linking social support and mental health (54). Physiological changes are critical in the development of depression and anxiety, and the allostatic load model highlights the positive effects of high social support and high sleep quality in the physiological mechanisms associated with negative emotional states. In particular, poor sleep quality/quantity contributes to allostatic load that makes the body more vulnerable to the impacts of stressors of life, enhancing the disruptive effects of stressful life events on emotional states (55). To the best of our knowledge, few studies have investigated the mediating effect of sleep quality on social support and negative emotional states caused by major life stress events such as COVID-19 outbreak. In this case, it's a new perspective on improving social support, which improves sleep quality and ultimately reduces stress, anxiety, and depression.

Furthermore, the most critical finding of the present study was that social support exerts an influence on negative emotional states is mediated by rumination and sleep quality among Chinese adolescents. Specifically, the pathway is social support → rumination → sleep quality → negative emotional state. COVID-19 outbreak is a very serious life stress event, which is likely to cause negative emotional states such as depression and anxiety (56). We hold the opinion that under the same conditions of stress events, individuals with a high level of social support tend to perceive a lower level of stress or be more effective at coping with stress (57), so they spend less time and mental effort ruminating about the epidemic and related life stress events, which buffers against the decline of sleep quality caused by stressful events, and better sleep protects against depression and anxiety (likely through various psychoneuroimmunological processes not assessed in this survey study). Social support as the protective factor of negative emotions should be taken into account at school settings because it could help researchers better understand the COVID-induced effect; Psychological First Aid and Skills for Psychological Recovery are recommended to facilitate inter-person interaction during isolation and are the adapted methods to respond to COVID-specific needs for what may be a long-term isolation and post isolation (58). The current study represents an important part of understanding the mechanisms underlying the link between social support and negative emotional states, and complement the allostatic load model with crucial psychological evidence.

Limitations

Several limitations of this study should be mentioned. Firstly, allostatic load is a well-researched theory that has been very influential in terms of the generation and development of negative emotions. However, due to the epidemic, this study could not collect the relevant physiological data of the allostatic load model. Secondly, this study did not rule out the existence of other potential mediating variables. Thirdly, social support was measured by self-report of perceived support, which could be influenced by one's state of emotions. Lastly, a cross-sectional examination of the mediation model was performed, which limits conclusions about causality.

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 authors.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethical Committee of Shenzhen University. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this

study in accordance with the national legislation and the institutional requirements.

Author contributions

LZ and TG participated in the design of the study and the manuscript editing. ZZ and TG participated in the manuscript drafting and data reduction/analysis. AT and DH contributed to data reduction/analysis and manuscript editing. AY and AK contributed to the interpretation of results and manuscript editing. All authors have approved the final version of the manuscript and agreed with the order of presentation of the authors.

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Conflict of interest

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Slovak parents' mental health and socioeconomic changes during the COVID-19 pandemic

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The changes in people's mental health have become one of the hot topics during the COVID-19 pandemic. Parents have been said to be among the most vulnerable groups in terms of the imposed anti-pandemic measures. The present paper analyzes the trends in mental health indicators in a sample of Slovak parents (N = 363) who participated in four waves of data collection over a year and a half of the COVID-19 pandemic. The mental health indicators were represented by general levels of depression and anxiety as well as COVID-related stress and anxiety. While there were only minor changes in depression and anxiety, the dynamic in COVID-related stress and especially anxiety was more noteworthy. Besides some exceptions, the results hold even after controlling for the socioeconomic situation. The gender differences in the mental health trends were found to be negligible. Overall, we observed no substantial deterioration in the mental health indicators across the four waves of the study.

KEYWORDS

parents, mental health, depression, anxiety, stress, COVID-19, pandemic, economic situation

Introduction

Since the beginning of the COVID-19 pandemic, its impact on mental health has been studied intensively [e.g., (1, 2)]. There have been worldwide measures put in place to curb the spread of coronavirus. However, these have disrupted the work and family-life routines of individuals. Social isolation, closure of educational institutions, financial insecurity, and changes in health and social care have impaired the lives of

families, especially those with children (3). In particular, parents have been exposed to more stressful situations which have concerned them as well as their children (4). Parents have also experienced difficulties in taking care of homeschooled children during online teaching in addition to keeping down their job. This has made them vulnerable to financial insecurity, income decrease or job loss (5). Thus, the negative impact of COVID-19 appears to have been much more significant for parents compared to non-parents (6).

The objective economic situation of many families has worsened significantly as a result of the pandemic. There has been a global increase in unemployment (7); note that jobs most-at-risk are concentrated in lagging regions, (8) in addition to no-pay leave, reduced working hours (9), liquidity constraints, income shocks and the related decrease in consumption (10). The economic slowdown has exacerbated the pre-existing health and socio-economic inequalities as the pandemic has progressed (11). In Slovakia, the unemployment rate peaked in April 2021 at 8.8% (12). In spite efforts to provide economic aid, particularly for parents with children (13), there was notably low satisfaction with the pandemic support in Slovakia and Slovaks also reported serious household difficulties making ends meet and the fear of future financial worsening (14).

Various studies have confirmed an association between both objective and subjective economic status and mental health issues [e.g., (15–19)]. Therefore, it is likely that the economic changes during the course of the pandemic have affected mental health, especially among parents. Higher levels of depression, anxiety, stress, parental burnout, and worsened family relationships have been mainly observed in parents who have suffered socio-economic hardship, low-income families and families that have experienced multiple hardships or economic losses (20–25). In addition, the deterioration of mental health has been more notable in mothers as their work-life balance has been particularly affected by the anti-pandemic measures (26–28).

Parents' struggles, such as an increased reliance on negative coping strategies (29) or mental health worsening (30), tend to get reflected in children's at-home education, their well-being, emotional regulation or, in severe cases, maltreatment (31–34). While it is undeniable that the pandemic has caused tremendous socio-economic changes and disrupted the functioning of many families, general evidence of how families adapt in the long term is still lacking (21). There has only been one study published (35) concerning the mental health of Slovak parents. However, the study deals with a specific context and sample (i.e., parents of children with autistic spectrum disorder, predominantly mothers). Furthermore, only a few studies have dealt with specific COVID-related measures of mental health. In some of these studies, single items concerning worry, fear, stress, or COVID-related stressors have been used (36, 37). In other studies, COVID-related mental health scales have been used [e.g., COVID-related stress or anxiety; (38–41)]. However, to the best of our knowledge, there is a lack of studies that target the dynamic of COVID-related mental health constructs in a sample of parents.

In order to address these gaps, complex and especially longitudinal evidence is needed. In contrast to cross-sectional data, a longitudinal design means it is possible to study the dynamics of mental health indicators and subsequently help to understand the rate of change. The present study thus aims to analyze the changes in Slovak parents' mental health over a year and a half of the COVID-19 pandemic, while also accounting for the effect of the objective, as well as subjective, economic situation. In particular, we will examine the trends will be examined in four mental health indicators out of which two are general (depression and anxiety), and the other two are COVID-related (COVID-related anxiety and COVID-related stress). The study focuses on a sample of parents from a representative sample of the Slovak population across four time points. The study also examines differences between mothers and fathers in these trends.

Materials and methods

Data collection and participants

A longitudinal design with four waves of online data collection (October 2020, December 2020, December 2021, and March 2022) was implemented. The first three waves were intentionally carried out during a period of lockdown or very strict measures. The fourth wave took place during a period of eased (almost non-existent) restrictive measures.

Before the first wave of data collection, the total number of positive cases in Slovakia since the beginning of the pandemic was approximately 10,000. By October 2020, when the first wave of data collection was carried out, the number of new daily cases had grown rapidly, and at the end of October, the total number of positive cases was almost 60,000. In December 2020, during the second wave of data collection, this number exceeded 150,000 (growing rapidly – at the end of December, it exceeded 180,000). In November and December 2021, after a relatively stable period, another increase of new positive cases emerged. During the third wave of data collection (December 2021) the total number of positive cases in Slovakia since the beginning of the pandemic had reached 840,000 (end of December). Up to March 2022, when the fourth data collection was carried out, this number had continued to grow rapidly. At the end of March, the total number of positive cases crossed 1,700,000. After that, the situation stabilized (42, 43). The vaccination rate in Slovakia was low at the time of the third and the fourth wave of data collection, and remains low even today. Vaccination against COVID-19 in Slovakia started at the end of 2020 (December 26), with priority given to at-risk groups. Vaccination for all people

aged 16 + was launched in May 2021. By the end of the summer, approximately 40% of the population had been fully vaccinated and by the end of 2021, the vaccination rate had reached almost 50%. In early 2022, vaccination almost stopped due to lack of interest and now, in the summer of 2022, the vaccination rate is approximately 51% (42); Ministry of Health of the Slovak Republic). For more details about the pandemic situation in Slovakia please see this overview https://osf.io/vjmfd/.

The current sample (N = 363) is a subset of a representative sample (based on quota characteristics for gender, age, education, and region) of Slovak inhabitants and consists of parents who, at the time of the third wave, had (or were taking care of) at least one child younger than 18 years. The participants took part in all four waves of data collection. About 52% of the participants were women and the mean age of the sample at T1 was 45.4 years (SD = 10.8). For more details on the demographic characteristics see **Table 1**.

Measures

The participants were asked about demographics, economic situation (personal and household income, number of household members).

The subjective socioeconomic status (SES) was measured using a visual ladder (MacArthur scale of subjective social status (44). The instruction describes that on the top of the ladder are people with the highest socioeconomic status whereas the bottom of the ladder represents those with the lowest socioeconomic status. The participants indicate where they would place themselves on the ladder using a 10-point scale (from 1 = the lowest socioeconomic status to 10 = the highest socioeconomic status).

Income was assessed as an equivalized total net household income per month. The equivalization was done using a slightly modified OECD formula (45). This assigns a coefficient of 1 to one adult member of the family, 0.5 to all other adult members, and 0.3 to all children living in the household (U18).

Depression was measured using a QIDS-16-SR (46) questionnaire. The items cover 9 depression symptoms according to the DSM-5 (e.g., depressed mood, loss of interest or pleasure, etc.). For each item, the participants expressed the degree of symptom severity during the last 2 weeks (from 1 to 4).

Anxiety was measured using the Generalized Anxiety Disorder Screener-7 [GAD-7; (47)*]* which assesses the severity of generalized anxiety disorder symptoms (e.g., feeling nervous, anxious or on edge). The participants evaluated how often they had been bothered by individual symptoms (from 1 = not at all to 4 = nearly every day) during the last 2 weeks.

Covid-related anxiety was measured using the Covid-related anxiety stress scale [items from PAS; (48)], and consecutively modified according to (49). The items are formulated as statements measuring anxiety related to COVID-19 (e.g., worries about catching COVID-19.) The participants answered on a 5-point Likert scale (from 1 = not at all to 5 = completely).

Covid-related stress was measured using the Covid-related stress scale [adapted from the COVIDiSTRESS survey; (50)]. The items are formulated as statements assessing the presence of concerns and difficulties in various areas possibly affected by the COVID-19 pandemic (e.g., concerns about the socio-economic situation, daily functioning, etc.). The participants answered on a 7-point Likert scale (1 = no concerns at all; 7 = great concerns).

TABLE 1 Demographic characteristics of the participants.

Variable	Percentage or Mean ± SD
Gender (female)	51.79%
Age	45.43 ± 10.82
Partner status (married/in relationship)	78.79%
Education (university degree)	31.96%
Residence (urban)	63.36%
Economic status (employed)	69.42%
Number of children	1.84 ± 0.89

Statistical analysis

Given the longitudinal nature of the data, the four waves of data collection were combined and the respondents who participated in all of them were matched. Out of the general population, participants who indicated they have (or take care of) at least one child under 18 years of age were selected. This item was available in the third wave of data collection. The data were screened for improbable values and careless participants as part of general data wrangling for the purposes of the research project APVV-20-0319 "Behavioural aspects of COVID-19: Mapping the COVID-related behaviours, and psychological, social, and economic consequences of the pandemic"). The reliabilities of the scales were checked using the omega total coefficient. The estimated omega total coefficients ranged from 0.84 to 0.96. We proceeded with calculations of a sum score for each of the mental health constructs at each timepoint and divided it by the number of items forming the construct. For descriptive purposes, descriptive statistics were also calculated, and the correlation matrix examined. To examine the sensitivity of our design to a range of hypothetical effect sizes, we carried out a power analysis and found that, given the sample size of N = 363, alpha level of 0.05, and the usage of two-sided test, our design had 48% power to detect an effect of r = 0.10, 97% power to detect an effect of r = 0.2, and almost 100% power to detect correlations larger than 0.3. For the mental health indicators, as well as for the socioeconomic indicators, a trend line was visualized for each participant and an average trend line was plotted (without any smoothing). In order to answer the research question (i.e., how the indicators of

parents' mental health changed over the four time points), three unconstrained linear growth models were run for each mental health indicator. The first of the three models did not include any of the covariates. In terms of accounting for one's socio-economic situation, a time-varying covariate represented by one's subjective perception of SES and the objective economic situation was included in the second and the third model, respectively. From each estimated model, the latent intercept, latent slope, their variances and intercept-slope covariance, including the SEs and *p*-values of these parameters were extracted. The models were estimated using the MLR estimator (Maximum Likelihood with Robust standard errors) and the missing data were imputed using FIML (Full Information Maximum Likelihood). The analysis was performed in R, using the lavaan package, version 0.6-8 (51).

Results

The descriptive statistics of the scales are available in **Table 2**. The correlation matrix with the diagonal representing the reliabilities of the scales is available in **Figure 1**. There are two things worth noting. Firstly, it is possible to see medium-to-high positive correlations between the mental health indicators. This indicates high comorbidity between the mental health issues and their (usually high) within-person stability in time. Secondly, there is a clear pattern of almost universally negative correlations between the socio-economic situation and mental health variables. The visualizations of the trend lines of mental health indicators, as well as participants' socio-economic situation, are presented in **Figure 2**.

In order to answer our research question (i.e., how the indicators of parents' mental health changed over the four time points), three linear growth models were run for each mental health indicator.

The results of the linear growth models suggest the following patterns. There was a very small decrease observed in the level of depression (slope = −0.02, $p = 0.006$). This became more visible when controlling for SES (slope = −0.13, $p < 0.001$). On the other hand, a very small increase in anxiety was observed across the four time points (slope = 0.04, $p < 0.001$). This increase was more pronounced when the model controlled for income (slope = 0.11, $p = 0.011$). There was a substantial decrease in COVID-related anxiety observed in the model without any covariates (slope = −0.25, $p < 0.001$) as well as for the model that controlled for SES (slope = −0.23, $p = 0.008$). The decrease was slower for parents with a high initial level of COVID-anxiety (I-S covariances ranged from −0.08 to −0.09, ps < 0.001). Conversely, a notable increase was observed in COVID-related stress (slope = 0.11, $p < 0.001$). This was further amplified when a covariate was added into the model (slopes = 0.31 and 0.37; ps = 0.001 and.135; note the high SEs when income was controlled for in these models). For more detailed results, see **Table 3**.

As an additional goal of the study, we examined the trends in the mental health outcomes separately for mothers and fathers. It was found that although mothers tend to score higher in most of the measures (models without a covariate), the group differences in changes in the mental health indicators over the course of the study were negligible. After accounting for SES, notable exceptions in this pattern occurred. In particular, depression in mothers decreased more sharply (slope difference = −0.10), anxiety decreased (slope difference -0.13), while the increase in COVID-related stress was less steep compared to fathers (slope difference = −0.11). After controlling for one's household income, mothers got lower scores in depression (intercept difference = −0.17) and anxiety (intercept difference = 0.52) compared to fathers. Fathers' scores for COVID-related anxiety (slope difference = 0.38) and COVID-related stress (slope difference = 0.69) rose compared to mothers. The observed increase was very steep, especially in the case of COVID-related stress. More detailed results are available in **Table 4**.

Discussion

Although the initial evidence has suggested a severe impact of the COVID-19 pandemic on mental health in the general population [e.g., (52–54), and parents in particular (23, 36, 55)], the present results have mostly indicated minor changes in parents' mental health over the course of the study. The notable exceptions are a decrease in COVID-related anxiety and an increase in COVID-related stress after controlling for parents' socio-economic situation.

At the beginning of the COVID-19 pandemic, there was little information about the virus or the situation in general available (56). In its initial phase, a worsening in mental health could be seen (57, 58). However, as both the amount of available information and people's experience with the virus has increased, people have likely adapted to the situation and their mental health has stabilized or improved (59). On top of that, some people have ceased to think about COVID-19 being a serious threat or re-evaluated their perspective as a result of increased fake news and politicization of the situation (60). Concerns about health have played an important role in mental health during the pandemic (61). Although the population of parents has experienced more stress compared to non-parents (4), similar to the general population (62), the stress got lower as the perceived threat and severity of the situation decreased. In addition, the availability of vaccines and their efficiency has likely lowered the worries about health (63), helping to mitigate the negative impact of the pandemic situation on mental health.

With regard to the specific aspects of mental health measured in the current study, the results have shown a small decrease in the level of depression. Several studies have reported an increase in the depression rate due to the COVID-19

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TABLE 2 Descriptive statistics and reliabilities.

	T1		T2		T3		T4			
Variable	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Possible range**	**Omega total range**
Depression	1.55	0.45	1.57	0.48	1.49	0.46	1.50	0.46	1–4	0.88–0.90
Anxiety	1.46	0.54	1.50	0.56	1.54	0.61	1.58	0.61	1–4	0.95–0.96
COVID anxiety	2.81	0.86	2.89	0.93	2.36	1.01	2.09	0.96	1–5	0.84–0.95
COVID stress	3.14	1.25	3.33	1.32	3.71	1.12	3.36	1.27	1–7	0.91–0.94
SES	5.15	1.46	5.18	1.49	5.56	1.49	5.62	1.52	1–10	–
Equivalized household income	761.71	370.11	772.81	382.41	752.77	375.23	763.59	451.71	–	–

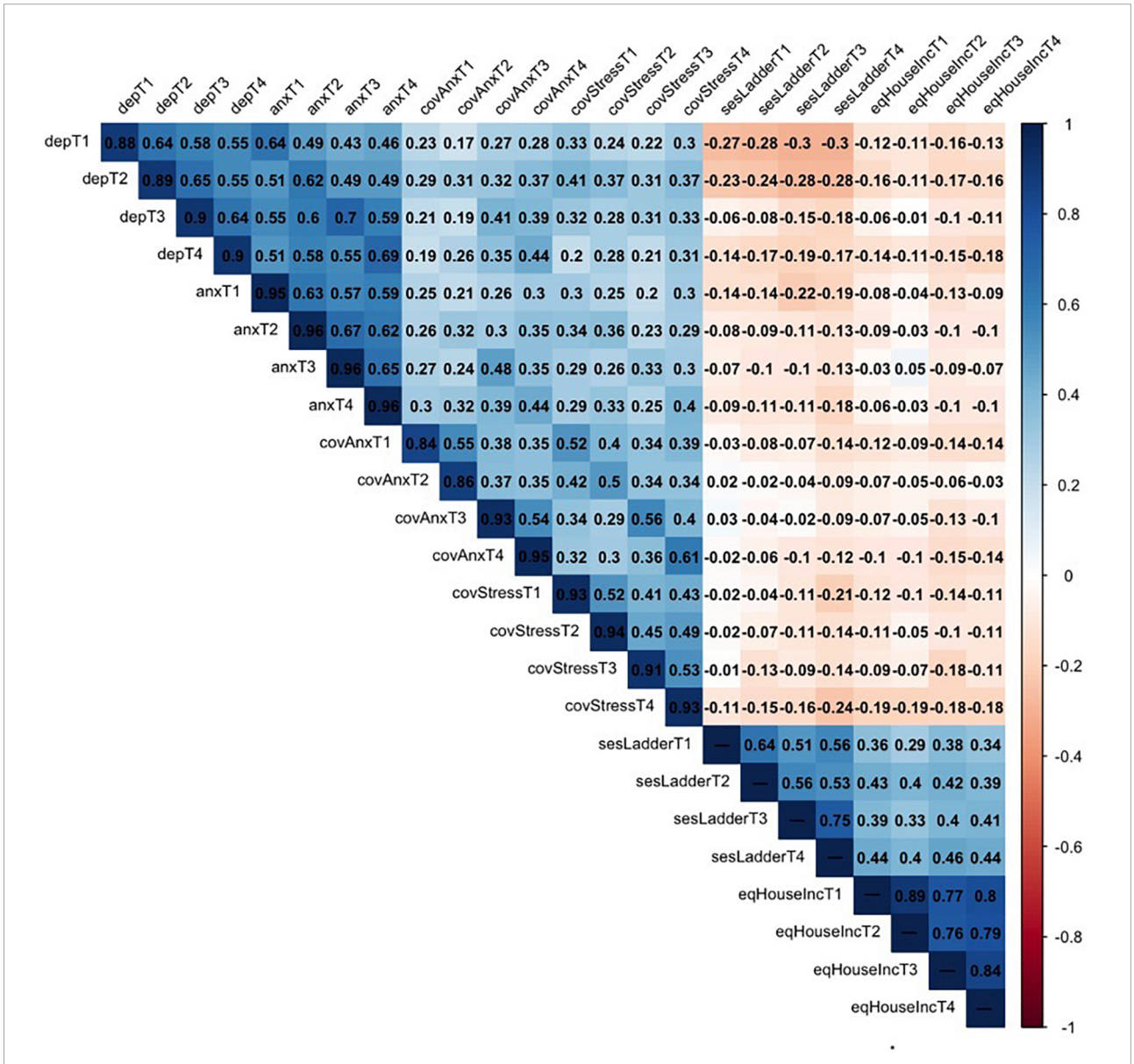

FIGURE 1
Correlation matrix and reliabilities. The reliablilities of the scales are presented on the diagonal.

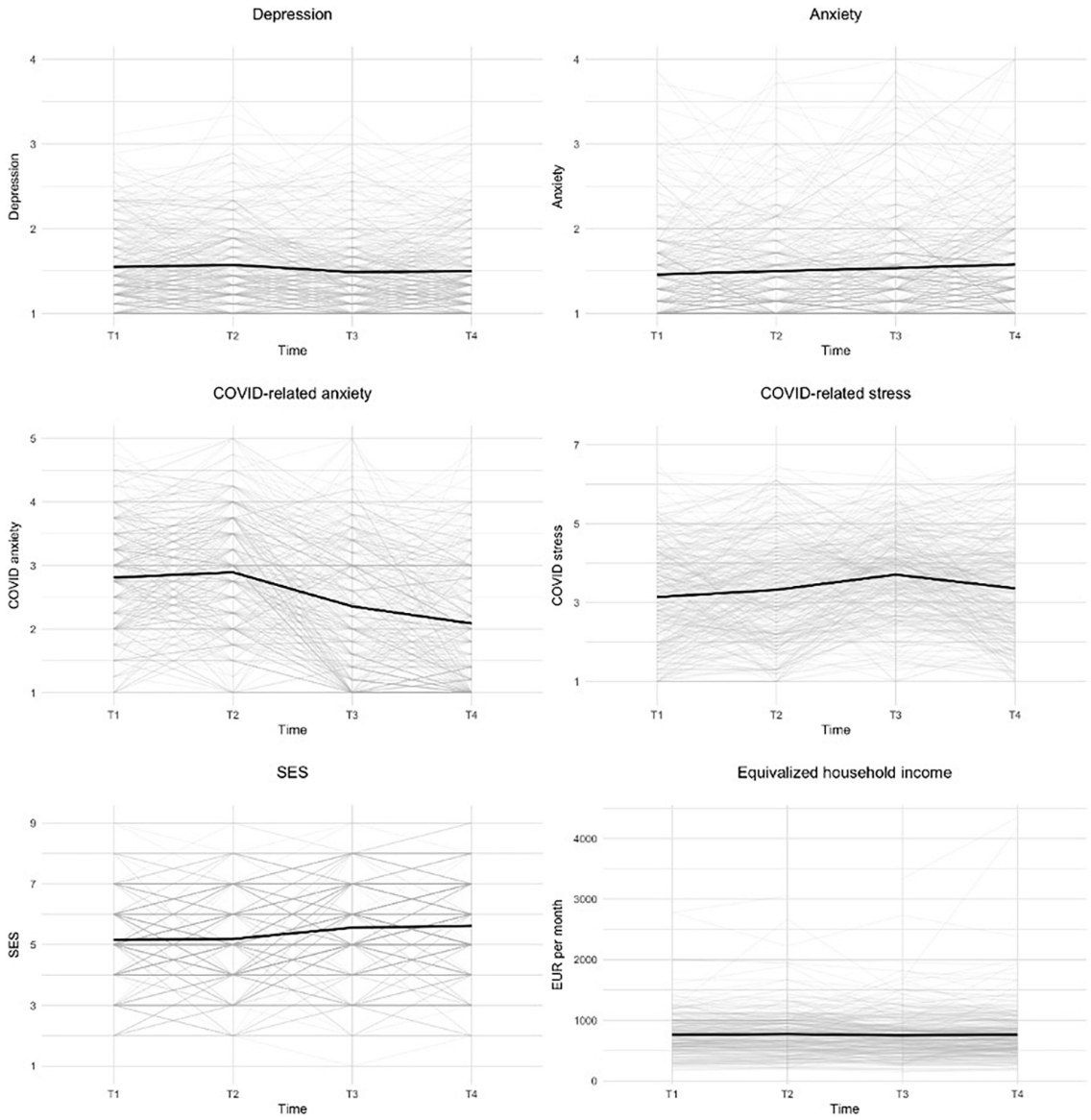

FIGURE 2
Visualization of the dynamic of mental health indicators and economic situation. Trend lines for each participant and average trend lines are plotted.

pandemic [e.g., (64–66)]. However, this increase was observed during the first few months of the pandemic. Fancourt et al. (67) have found that after depression peaked during the first few months, its level has tended to decrease and stabilize during later months. This is consistent with Kwong et al. (68) who observed no changes in the level of depression measured in April and May 2020, compared to the pre-pandemic level. The current results suggest that in the population of Slovak parents, reactive grief from an objective situation could have occurred instead of an increase in clinical depression. As such, the pandemic could be regarded as a temporary situation and people will learn how to cope with it. Although Martin et al. (69) have pointed out that people with higher pre-pandemic levels of depression are much more vulnerable to depression developing further, the study found no clear pattern suggesting that parents with higher initial levels of depression would get even worse or get better more slowly.

Valero-Moreno et al. (70) have found no increase in anxiety in the initial stages of the pandemic. Further evidence has also suggested a stabilization or even decline in the level of anxiety over time (67). In the present study, there was a small increase in anxiety observed across the four time points. Even though the results only indicate a minor impact of the pandemic on the changes in the level of anxiety, three important points can

TABLE 3 Results of the linear growth models.

Indicator	Covariate	Latent intercept	Latent intercept variance	Latent slope	Latent slope variance	Intercept - slope covariance
Depression	None	1.55***	0.14***	−0.02**	0.01*	−0.01
	SES	1.84***	0.13***	−0.13***	0.01*	−0.01
	Income	1.78***	0.14***	−0.05	0.01*	−0.01
Anxiety	None	1.46***	0.18***	0.04***	0.00	0.01
	SES	1.56***	0.18***	0.03	0.01	0.01
	Income	1.52***	0.18***	0.11*	0.00	0.01
COVID-anxiety	None	2.87***	0.50***	−0.25***	0.06***	−0.08**
	SES	2.91***	0.53***	−0.23**	0.07***	−0.09***
	Income	3.66***	0.52***	−0.18	0.06***	−0.09***
COVID-stress	None	3.22***	0.82***	0.11***	0.04	−0.06
	SES	3.15***	0.86***	0.31**	0.06**	−0.09
	Income	4.05***	0.82***	0.37	0.05*	−0.07

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

TABLE 4 Gender differences in (changes in) mental health indicators.

		Fathers			Mothers		
Indicator	Covariate	Latent intercept	Latent slope	I-S covariance	Latent intercept	Latent slope	I-S covariance
Depression	None	1.48	−0.03	−0.01	1.62	−0.01	−0.01
	SES	1.66	−0.07	−0.01	2.00	−0.17	0.00
	Income	1.92	−0.01	−0.01	1.75	−0.04	−0.01
Anxiety	None	1.34	0.03	0.00	1.56	0.05	0.01
	SES	1.34	0.11	0.00	1.73	−0.02	0.01
	Income	2.01	0.05	0.00	1.49	0.11	0.01
COVID-anxiety	None	2.71	−0.25	−0.06	3.02	−0.25	−0.10
	SES	2.65	−0.20	−0.08	3.13	−0.25	−0.10
	Income	3.28	0.08	−0.08	3.60	−0.30	−0.10
COVID-stress	None	3.01	0.12	−0.03	3.41	0.10	−0.08
	SES	2.84	0.37	−0.07	3.41	0.26	−0.11
	Income	2.70	0.79	−0.04	5.15	0.10	−0.09

be discussed. Firstly, the data collection for the present study started in late 2020. While an increase in mental health issues seems to have occurred in the initial phase of the pandemic, there is no data to support or contradict this claim. Following other studies (57, 58, 67), it can be assumed that after the initial increase in the level of anxiety, a stabilizing trend is likely to have occurred. On the other hand, the pandemic situation during the first months was significantly better in Slovakia (the infection rate was one of the world's lowest) compared to other countries. This might have caused a faster stabilization rate in the case of Slovakia.

Secondly, although stabilization was probably the most common mental health response to the pandemic, some subgroups may have also experienced worsening or improving mental health issues (71). As baseline data and information on pre-existing mental health status are not a part of the current study, interpretations should be made with some caution. While our data reflect a stabilizing trend, there is also a possibility that the levels of mental health issues found in the current study could reflect an increase which remained the same over time. More specifically, after the outbreak of the pandemic, an increase in mental health issues may have occurred and stayed at that higher level during our data collection. Alternatively, a worsening may have occurred in that subgroup of people with pre-existing mental health issues who were at higher risk of mental health deterioration (72). However, there is no data that could help clarify the possible heterogeneity of mental health responses to the pandemic in the current study (see limitations).

Thirdly, the measurement of mental health indicators should be taken into account. Many studies that have found modest changes in mental health during the COVID-19 pandemic assessed mental health using general measures [e.g.,

(71, 73, 74)]. However, it seems there is a qualitative difference between conventional mental health constructs and COVID-related mental health issues. This has been highlighted by Kubb and Foran (38) who discuss that findings concerning traditional measures of mental health should not be generalized to COVID-related mental health problems. The issue of COVID-related mental health and its consequences has been often neglected by researchers (75).

The present findings indicate a substantially higher dynamic of COVID-related mental health constructs compared to generally oriented depression or anxiety. In particular, the findings indicate that COVID-related anxiety started to decrease significantly after the first two waves of data collection. On the contrary, COVID-related stress increased over time, with its peak being observed in the third wave of data collection (late 2021). Stressors, their intensity as well as their qualitative aspects have changed during the pandemic (see (76, 77), and a fluctuation of stress related to the pandemic is thus natural (78). Consequently, there is a possibility of an interplay between COVID-related stress and COVID-related anxiety. In particular, the initial fear related to the pandemic can, through the inability to cope with stressors, develop into COVID-related anxiety. This is also supported by the strong bivariate relationships ($rs > 0.50$) between the constructs across all time points.

As COVID-related worries are determined by different stressors of different severity during different phases of the pandemic, COVID-related stress tends to get higher in the early phases of the pandemic or at its peak (78). In the current data, this is reflected by an increase in COVID-related stress in late 2021. This was when strict anti-pandemic measures were imposed in Slovakia and the infection and mortality rates were failing to decrease. More specifically, the infection rate and number of new daily cases were extremely high while the vaccination rate was low (see description of data collection). Furthermore, a new COVID-19 variant – Omicron – appeared in late 2021 and increased parents' worries about their children's vulnerability to this mutation (79). With an increased infection rate among children, parents were further exposed to the difficulties of ensuring care during the time of homeschooling, while also meeting other work-related needs. The available evidence has confirmed that children being in quarantine and parents' difficulties in managing quarantine contributed to an increase in parental stress (33). With isolation from the wider family and teachers, parents were often left alone to take care of and educate their children. Childcare without sufficient external support is known to be stressful (80). The instability of the current pandemic situation and the associated difficulties in daily life has likely exacerbated the stress further (6).

We further analyzed the trends in mental health also after controlling for the subjective economic status and equivalized household income. The results indicate that a decrease in depression became more visible when the model controlled for the subjective SES. This result corresponds with the findings of Hoebel et al. (81) who have pointed out that the association between the objective economic situation and depressive symptoms is partially mediated through subjective SES for both men and women. The increase in general anxiety was more pronounced when the model controlled for income. For COVID-related anxiety, it seems that controlling for the socioeconomic situation does not affect its dynamics. On the other hand, a notable increase in COVID-related stress was amplified by both subjective SES and income. Various studies have confirmed the association between the economic situation and mental health issues during the initial phase of the pandemic (see (82). Indeed, parents tend to question their role and ability to take financial care of their family (83, 84).

In terms of the bivariate correlations between the constructs, it can be concluded that the relationships between the economic situation and mental health issues are almost uniformly negative. Valero-Moreno et al. (70) have noted a higher level of stress in parents at the beginning of the pandemic. The present data do not cover the initial phases of the pandemic and thus it is not known the extent to which parents' level of stress at the end of the year 2020 differed from the levels in the early months. This raises the question as to whether the stabilization of COVID-related stress will follow the stabilization of the economic situation. This is especially after people have realized that economic worsening may not be as damaging as expected (85) or that it is reversible as the pandemic situation can improve [for example during the summer, even if the improvement is temporary; (86, 87)].

Given the aim of the study, gender differences can be discussed in the context of changes in depression, anxiety and stress separately. The results have confirmed that mothers tend to score higher in most measurements (models without covariates) and this corresponds to epidemiological data from 23 EU countries which all report a higher incidence of depression in women (88). On the other hand, the group differences between fathers and mothers in changes in mental health indicators during the pandemic were negligible although gender differences are observable when SES is taken into account. This may relate to socio-economic stratification across genders resulting from a variety of factors including differences in education choices, preferred job and industry, horizontal and vertical occupational gender segregation, work experience, number of hours worked, breaks in employment (such as for bearing and raising children), as well as gendered income disparity [see, e.g., (89, 90)]. The reduction in the symptoms of depression of mothers compared to fathers can be explained by the higher level of involvement in the education of their children during the pandemic period. The improvement in maternal depressive symptoms can be further explained by the higher presence of the father in the family (88) which is connected to better social support in their partnership (91). The results further showed that COVID-related anxiety and COVID-related stress increased in the group of fathers after

controlling for household income. The increase was very sharp, especially in the case of COVID-related stress. It is likely that cultural expectations of the role of the father in the family in terms of providing income for the family will put more pressure on fathers.

Limitations

The limitations of the present study can be interpreted on several levels such as limits related to the design of data collection, parental characteristics, social and personal context, and children's characteristics. Participants were not asked about their pre-morbid status such as pre-existing mental health issues, medication or using supplements. Therefore, the evaluation of changes in people with pre-existing mental health issues [e.g., worsening of symptoms; recurrence, etc.; (92) is lacking in the present analyses]. Despite the longitudinal design of this study, the findings are limited to the changes that happened after the first several months of the pandemic and do not capture the initial dynamic in parents' mental health (93). Furthermore, even though the data collection procedure was set to collect data from a representative sample of the Slovak population (based on quota characteristics for gender, age, education, and region), parents with lower SES (94) or parents below the poverty threshold are less likely to participate in the survey as they are known to have limited access to technology and internet. Moreover, specific financial concerns that could have affected the levels of (especially) stress were not assessed in detail. Future research could thus focus on these variables and examine which financial constraints have the strongest effect on parents' mental health. At the same time, there was also no data on social support in the context of partnerships (80) nor on the level of resilience (95). These could both have affected the levels of stress and anxiety. It is possible that in some families the differences are caused by the parental role rather than by gender (96). Broader environmental and contextual factors could also have shaped the results. For instance, the strict anti-pandemic measures, including the obligatory quarantine, likely caused higher levels of mental health issues in the first two or possibly three waves of data collection. Moreover, factors like personal experience with the virus (e.g., the severity of the course of the infection, hospitalization, death of a close one, etc.) would have had an impact on one's mental health but were not captured in the present study. For future research, it would be useful to take a look at social isolation due to the obligatory periods of quarantine. If a person has a positive attitude toward quarantine (considers it as protection from the virus), it might help them to cope with the situation better. The reduction in social activities has lowered the likelihood of getting infected. Thus, people that were more likely to adhere to the anti-pandemic measures, like social distancing, could have experienced less stress and fear about their health (97). Moreover, some people could have changed their lifestyle to handle the situation and stress related to the pandemic, restrictions, or lockdown (see (98). In addition, it could be of interest to examine if information about COVID-19 has been correctly presented. Clear and unbiased information and instructions can serve as a protective factor in alleviating mental health issues (65, 99, 100). Lastly, parents' mental health could be determined by the characteristics of their children. In particular, the level of experienced stress in parents is associated with the perceived failure in taking care of their children, even more so if the child has special needs.

Implications

The presented findings provide several fundamental proposals that could help improve health and social policies. We highly recommend paying more attention to parents' mental health and especially to those who have a high baseline level of mental health issues. Moreover, parents' mental health is mirrored in the well-being of their children. In terms of social policies, it seems to be of importance to pay extra attention to parents' feelings and worries as their level of stress increases once they get concerned about their children's safety, work-life balance and household income (20, 36, 84). Overall, the imposed anti-pandemic measures should also take into account the factors related to people's mental health. In addition, governments should ensure easily accessible psychological or psychiatric aid to help alleviate the growing levels of stress. Social support programs, stress management training, and easy-to-implement interventions on emotional regulation strategies [e.g., reappraisal interventions; (101)] could positively affect parents' ability to cope with the pandemic situation.

Conclusion

Throughout the COVID-19 pandemic, societies and individuals have had to deal with a long-term crisis and intensive demands on safety and quality of life. This period of time has been accompanied by financial insecurity, job loss, or income reductions that could have occurred as a consequence of the pandemic. As parents' mental health can have a wider impact, especially on their children (31), the current study aimed to look at the mental health of parents over a year and a half of the COVID-19 pandemic. In addition, differences between mothers and fathers were analyzed. The current results do not support the initial notions that the pandemic has a huge impact on mental health [e.g., (102–105)]. Indeed, the longitudinal evidence, including the presented study, has suggested that the deterioration of mental health has been small or negligible in both the general population (74) and population of parents (70). These results indicate that, in general, parents have adapted to the pandemic situation. In comparison to

pre-pandemic times, a decrease in mental health issues has also been observed (64). The current study mostly found minor changes in parents' mental health over the course of the study. Gender differences were also mostly negligible. There were some exceptions observed after controlling for the subjective and especially objective economic situation. However, more attention should be paid to COVID-related mental health issues and stressors which are likely to change over the course of the pandemic.

Data availability statement

Data and the analytic script can be found at https://osf.io/epmt7/.

Ethics statement

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

Author contributions

LV: data curation, conceptualization, investigation, writing – original draft, and writing – review and editing. GM: conceptualization, investigation, writing – original draft, and writing – review and editing. DF: conceptualization, investigation, supervision, writing – original draft, and writing – review and editing. ML: investigation, writing – original draft, and writing – review and editing. JB: conceptualization, writing – original draft, and writing – review and editing. MŠ: writing – original draft and writing – review and editing. PB: data curation, conceptualization, and writing – review and editing. IR: formal analysis, methodology, and writing – review and editing. MA: conceptualization, investigation, supervision, formal analysis, methodology, and writing – review and editing. All authors contributed to the article and approved the submitted version.

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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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Supplementary material

A detailed description of measures can be found at https://osf.io/bskr4/. A chronological overview of the pandemic situation and anti-pandemic measures in Slovakia is available at https://osf.io/vjmfd/. The full version of **Table 3** is available at https://osf.io/ydq56.

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Factor structure and measurement invariance of the Chinese version of the COVID-19 Phobia Scale in depressive symptoms sample during COVID-19 closure: An exploratory structural equation modeling approach

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The COVID-19 Phobia Scale is an instrument for measuring the phobia of coronavirus. It has a stable four-factor structure and good reliability and validity in other countries and regions. In order to expand related research, this study aims to test the reliability and validity of the COVID-19 Phobia Scale in Chinese adolescents with depressive symptoms. The C19P-SC was translated into Chinese by the method of forward and back translation and tested in 1933 Chinese adolescents with depressive symptoms. Confirmatory factor analysis (CFA) and exploratory structural equation modeling (ESEM) were used to test and compare the four-factor model of the C19P-SC. Then we tested the measurement invariance of the C19P-SC across gender and time. Finally, the reliability was measured with the McDonald's omega coefficients. Consistent with previous studies, the C19P-SC showed a stable four-factor structure. The results showed that ESEM was better than CFA and more reasonable. In addition, the results of multi-group ESEM showed that the C19P-SC met the strict invariance at male and female and partial longitudinal strict invariance. The Mcdonald's omega coefficients of the C19P-SC total scale and each subscale reached the expected acceptable level. In short, the reliability and validity index of C19P-SC has reached an acceptable level, and the measurement invariance of different genders and different time points was established, but the cross-factor phenomenon of individual items was abnormal, and a further revision and testing are still needed.

KEYWORDS

COVID-19 Phobia, exploratory structural equation modeling, measurement invariance, longitudinal invariance, depressive symptoms

Introduction

Corona Virus Disease (COVID-19) is a new acute respiratory infectious disease at the end of 2019, and it has become a major global public health event (1). Compared with severe acute respiratory syndrome coronavirus (SARS) and Middle East respiratory syndrome coronavirus (MERS), COVID-19 is a highly infectious disease (2). On January 20, 2020, Chinese government classified COVID-19 as a Class B infectious disease and treated it as Class A infectious diseases (3). COVID-19 will not only causes physical and mental pain at the individual level of the infected person, but also the psychological stress caused in other populations can also lead to a variety of unfavorable factors (4). On January 26, 2020, the National Health Commission issued guidelines for emergency psychological crisis intervention for people affected by COVID-19 (5). Psychological crisis intervention under the COVID-19 epidemic is not only for confirmed patients, suspected patients, and quarantined people, but also for all medical staff and some social workers (6).

Since the outbreak of the COVID-19, the number of infections has continued to increase, posing a great threat to people's lives and safety (7). The panic and fear of COVID-19 is called "corona phobia," because the unpredictability of this disease causes people's mental distress (8). Corona phobia can be classified as a special type of DSM-V specific phobia (9). Consistent with studies on SARS and MERS during the previous virus epidemic (10, 11), the COVID-19 pandemic will also cause people to have great fear, anxiety and reaction (9). Evidence of rising levels of people's phobia found in COVID-19-related research (12). Simultaneously, some studies have found that phobia of COVID-19 is an important predictor of increasing people's active isolation, implying that fear plays an important role in preventing COVID-19 (13). As a global public health emergency, the COVID-19 epidemic can lead to psychological crises such as post-traumatic stress disorder, anxiety and depression (14). Adolescent depression is a group of chronic psychological disease syndromes whose symptoms can last until adulthood (15). The Report on National Mental Health Development in China (2019–2020) shows that the detection rate of depression among adolescents is 24.6% (16). Among them, the detection rate of depression in junior high school is about 30%, the detection rate of depression in high school is nearly 40%. The proportion of Chinese adolescents with depression is on the rise, and its incidence is increasing with age (17). Adolescents are in the growing stage of physical and psychological development, and are prone to depression and even suicidal behavior (18). At present, the prevention and control of the COVID-19 in China has become normal, and the work of returning to school for students nationwide is also accelerating (19). Due to the large scope and strong contagion of the COVID-19, students have a fear of COVID-19, and the pressure of isolation can lead to mental disorders such as anxiety and depression (20, 21). Therefore, it is necessary to assess the corona phobia among adolescents with depressive symptoms.

As people become more and more affected by the COVID-19, measurement instruments for corona phobia of COVID-19 have also been developed. Arpaci et al. (9) compiled the COVID-19 Phobia Scale (C19P-S), the C19P-S has 20 items and four dimensions: Psychological, Psycho-Somatic, Economic, Social. So far, the C19P-S has been verified in Turkey, the United States, Korea, and Iran (9, 22–24), all of them showed a stable four-factor structure. However, there is currently no corresponding measurement tool for assessing people's corona phobia in China. For this reason, in order to expand related research, this research aims to test the applicability of the C19P-S in the Chinese cultural context.

Confirmatory factor analysis (CFA) has been widely used in the C19P-S studies (9, 22–24), but CFA was considered to have great limitations when used to test multi-factor measurement models (25). Exploratory structural equation modeling (ESEM) integrates the functions of exploratory factor analysis (EFA) and CFA (26–29). In addition to estimating the load on the main factor of the subject, ESEM also estimates the load of some other factors that are relatively small, which shows us a more realistic situation (30, 31). When validating factor models, ESEM is easier to fit compared with traditional CFA and obtains closer to the real results, thus making some advanced statistical analysis more smoothly (31). Compared with CFA, ESEM seems more reasonable, which has been supported by empirical studies (32). In particular, the advantages of ESEM in testing measurement invariance have also been supported by many empirical studies (26, 27, 31, 33–36).

In order to supplement the research instrument of corona phobia in China and provide more directions for researchers, this study aims to revise the Chinese version of the C19P-S in Chinese adolescents with depressive symptoms and examine its reliability and validity. In addition, few studies have examined an important psychometric feature of C19P-S, namely the measurement invariance of the scale (37). Therefore, this study attempts to use the ESEM method to analyze the structural validity of the C19P-SC. Meanwhile, gender and longitudinal measurement invariance are studied in the ESEM framework. On the one hand, it verifies the structural validity of the C19P-S, on the other hand, it demonstrates the application effect of ESEM method through specific questionnaire data.

Method

Participants

This study was complied with the moral standards of the 2013 Helsinki Declaration, and it was approved by the committee of the School of Psychology of Guizhou Normal University. Participants were invited to participate voluntarily

between October 2020 and April 2021. In order to facilitate the collection of data for the second test, participants can voluntarily write down their student ID and name when answering the first time. According to the participants' scores on the Patient Health Questionnaire-9 (PHQ-9) (38), including five points and higher in this study. In the first test, after excluding the participant with the PHQ-9 score lower than 5, 1933 adolescents with depressive symptoms were obtained. After 6 months, the questionnaires were send again to participants with student ID and name, 519 participants with PHQ-9 score of five or higher were obtained. Because the screened "depressed adolescents" may also include some adolescents who are not really diagnosed with depression, the screened depressed adolescents in this study refer to non-clinical depressed adolescents, namely adolescents with depressive symptoms.

Measures

The COVID-19 Phobia Scale

The COVID-19 Phobia Scale (C19P-S) was compiled by Arpaci et al. (9) based on the diagnostic criteria of DSM-V's specific phobia (300.29). The scale contains a total of 20 items, used to assess the level of phobia of the COVID-19, using a Likert 5-point scale, "1" means "strongly disagree," "5" means "strongly agree." There was no reverse scoring, the higher the total score, the higher the level of phobia symptoms. In previous studies, the subjects were all adults (9, 22–24).

After obtaining authorization from the original author, the English version of the C19P-S was translated. The translation was done collaboratively by two researchers. First, the first researcher will translate the scale from English into Chinese to form the first draft of the Chinese version. Another researcher will translate it back into English and compare it with the original scale. The researchers adjusted the translation of the Chinese version of the first draft based on the comparison of the difference between the back translation scale and the original scale, to ensure that the expression of each item was clearer, and conforms to the Chinese language habits. Finally, the researcher asked a psychologist to review the last Chinese translation of the C19P-S (C19P-SC). The C19P-SC was then pilot-tested with a small sample of thirty school-aged adolescents recruited from elementary, middle, and high schools. Since the school was closed during the COVID-19 epidemic, we contacted the school's psychology teachers by phone or video and sent them the electronic version of the questionnaire, and sent them the electronic file of the questionnaire, and explained the precautions for filling out the questionnaire. With the help of a psychology teacher, the C19P-SC test was completed on thirty adolescents, and most of the adolescents confirmed that all items on the C19P-SC were easy to read and understand, and it took about 10 min to complete.

The patient health questionnaire-9

PHQ-9 is a concise self-evaluation questionnaire for depression compiled by Kroenke et al. (38). The nine items of this questionnaire are based on the nine diagnostic criteria in the DSM-IV major depressive episode (32.2) diagnostic criteria. The items are rated on a 4-point Likert scale ranging from 0 (not at all) to three (nearly every day), and no reverse scoring. Its total is the sum of the scores of each item, the theoretical score is 0–27 points, and the scores of 5, 10, and 15 represent mild, moderate, and moderately severe depression, respectively. In this study, the McDonald's omega coefficient was 0.735.

Procedure

Since the school is still in a closed period, after obtaining the informed consent of the school, students' parents and teachers, paper questionnaires were sent to the contacted psychological teachers by express delivery, and the class was taken as the unit for collective test. Questionnaires were distributed to primary, junior and senior high schools in Guizhou, China. Common method biases are minimized through procedural control. The psychological teacher reads out the guidance in a unified way to reduce the deviation of guessing methods and control methods for the purpose of measurement (39). The teachers explained the questions that the students did not understand during the period, so as to reduce the measurement error caused by the students' understanding deviation. Before the participants filled in the questionnaires, the teachers explained the purpose and method of this study to the students, and emphasized the authenticity and confidentiality of the answers. The questionnaires were answered by the students in the classroom. At the end of the answer, the teachers collected the questionnaires and sent them back to our research team. We carefully checked the returned questionnaires and excluded those that responses, incomplete responses, unrecognized and abnormal (such as age 45).

Data analysis

SPSS v25 software was used to primary analysis. The ratio of missing values was analyzed. Descriptive statistics were used to analyze the demographic characteristics and the scores of the C19P-SC and PHQ-9. The distribution of the data was analyzed by calculating the skewness and kurtosis levels of the data. Item statistics including mean score, standard deviation, and corrected item-total correlation.

Mplus v8.3 software was used for CFA, ESEM and measurement invariance (40). First, in terms of normality testing, the result showed that our data was normal. Hence, the Maximum Likelihood (ML) estimator was adopted. Then ESEM was performed to verify the structure of the C19P-SC. Using geomin oblique rotation, parameter estimation uses the

TABLE 1 Descriptive statistics of the C19P-SC items.

Item	Mean	SD	Skewness	Kurtosis	Corrected item-total correlation	Alpha ifitem deleted
1	2.96	1.22	−0.058	−1.001	0.587	0.889
2	4.04	1.12	−1.303	1.032	0.381	0.894
3	3.13	1.19	−0.210	−0.874	0.627	0.888
4	3.03	1.20	−0.105	−0.938	0.635	0.887
5	3.05	1.21	−0.117	−0.981	0.632	0.887
6	3.17	1.25	−0.216	−0.912	0.291	0.897
7	1.68	0.96	1.568	2.208	0.377	0.894
8	1.63	0.89	1.583	2.361	0.426	0.893
9	1.79	1.04	1.303	0.954	0.490	0.892
10	1.85	1.08	1.187	0.557	0.508	0.891
11	2.25	1.28	0.731	−0.650	0.516	0.891
12	2.58	1.26	0.268	−1.072	0.621	0.888
13	2.61	1.25	0.221	−1.081	0.620	0.888
14	2.59	1.31	0.289	−1.178	0.423	0.894
15	2.52	1.25	0.408	−0.902	0.590	0.889
16	2.96	1.24	−0.055	−1.045	0.628	0.887
17	3.57	1.18	−0.695	−0.365	0.441	0.893
18	3.42	1.21	−0.513	−0.645	0.456	0.893
19	2.30	1.18	0.667	−0.443	0.479	0.892
20	2.56	1.21	0.341	−0.829	0.614	0.888

maximum likelihood method. In addition, we also compared the CFA results with the ESEM results. To test the fit index of all models, select chi-square value (χ^2), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), Standardized Root Mean Square Residual (SRMR). CFI > 0.90, TLI > 0.90, SRMR close to (or less than) 0.08, RMSEA < 0.08 was an acceptable fitting model; CFI > 0.95, TLI > 0.95, SRMR < 0.08, RMSEA < 0.06 (41, 42). Next, we used ESEM to test the invariance of the C19P-SC across gender and time. Four models were established, that is, configural, metric, scalar and strict invariance, and gradually seek equivalence from loose to strict methods. The evaluation indicators for measurement invariance were as follows: ΔCFI < 0.010, ΔTLI < 0.010, and ΔRMSEA < 0.015 (43, 44). Finally, according to Revelle and Zinbarg (45) argue that McDonald's omega in fact provides a more accurate approximation of a scale's reliability. The McDonald's omega coefficients (46) was calculated in the Jamovi v2.3.16 software (47).

Results

Missing data

The missing rate of all variables in the current study was below 3%, and the full-information maximum likelihood method was used to settle the missing values (48).

Descriptive statistics

Among the 1933 participants, 887 (45.9%) male and 1,033 (53.4%) female, the missing value was 13 (7%), and the mean age was 14.28 (range: 9–21, SD = 2.39). Four hundred (26.4%) from primary school, 321 (16.6%) from junior high school, and 1,090 (56.4%) from high school, the missing value was 12 (6%).

Then the descriptive statistics of the total scores of the participants in the C19P-SC and PHQ-9 were estimated. For the subscale of the C19P-SC, the mean score of the psychological was 19.15 (range: 5–30, SD = 5.28), psychosomatic was 9.13 (range: 4–25, SD = 3.94), economic was 10.21 (range: 3–40, SD = 3.87), and the social was 14.74 (range: 3–25, SD = 4.29). The mean score of the PHQ-9 was 9.48 (range: 5–27, SD = 4.23), and 722 participants (37.35%) were diagnosed with possible severe depressive symptoms (cutoff score ≥ 10).

As shown in Table 1, the mean (and standard deviation) of items of the C19P-SC ranges from 1.63 to 4.04 (0.89 to 1.31), and the absolute value of skewness (kurtosis) of each item ranges from 0.055 to 1.583 (0.365 to 2.361). Therefore, the research data can be considered as an acceptable normal distribution (49). The correlation coefficients between each item and the other 19 items (i.e., the corrected Item-total Correlation) were between 0.291 and 0.635, which were lower than 0.80, indicating without multicollinearity (50).

TABLE 2 Comparison of fitting indexes between CFA and ESEM.

Model	χ^2	*df*	TLI	CFI	SRMR	RMSEA (90% CI)
CFA	1821.368	164	0.878	0.895	0.067	0.072 (0.069, 0.075)
ESEM	715.594	116	0.938	0.962	0.023	0.052 (0.048, 0.055)
ESEM (male)	428.619	116	0.929	0.957	0.025	0.055 (0.050, 0.061)
ESEM (female)	430.293	116	0.939	0.963	0.025	0.051 (0.046, 0.056)
CFA-ESEM	1105.774	48	−0.06	−0.067	0.044	0.050 (0.021, 0.020)

χ^2, chi-square goodness of fit; df, degrees of freedom; TLI, Tucker–Lewis index; CFI, Comparative Fit Index; SRMR, Standardized Root Mean Square Residual; RMSEA, Root Mean Square Error of Approximation; 90% CIs, 90% confidence intervals for RMSEA. Same below.

TABLE 3 Correlation between factors of the C19P-SC in CFA model and ESEM model.

Factor	F1	F2	F3	F4
F1	1	0.319***	0.524***	0.559***
F2	0.358***	1	0.405***	0.297***
F3	0.585***	0.485***	1	0.567***
F4	0.656***	0.437***	0.741***	1

Under the diagonal is EFA, and above the diagonal is ESEM. ***$P < 0.001$.

C19P-SC factor structure

We compare the applicability of CFA and ESEM to the C19P-SC to check the necessity of using ESEM. According to Marsh et al. (51), if the goodness-of-fit indices of CFA and ESEM were similar, CFA should be more parsimonious. On the contrary, if the ESEM was better than CFA, the provision of no cross-load is indeed an over restrictive condition.

As shown in Table 2, the fitting index of CFA was: $\chi^2 = 1821.368$, $df = 164$, TLI = 0.878, CFI = 0.895, SRMR = 0.067, RMSEA (90% CI) = 0.072 (0.069, 0.075), the fitting index of ESEM was: $\chi^2 = 715.594$, $df = 116$, TLI = 0.938, CFI = 0.962, SRMR = 0.023, RMSEA (90% CI) = 0.052 (0.048, 0.055). The fitting index of the CFA model is lower than 0.90, indicating that the model fits the data poorly, while the fitting indexes of the ESEM were up to the ideal level, which shows that the data and the model fit well. Since the CFA model can be nested in the ESEM, their comparison is meaningful (26).

In the ESEM model, the four factors of the C19P-SC showed a low to moderate correlation (Table 3), indicating that the factors can be clearly distinguished. Marsh pointed out that because CFA fixed the cross-factor load at zero, the load of the corresponding factor was overestimated (27).

The partial factor load within the factors of the ESEM model and the correlation coefficient between factors are lower than the CFA model, but the fit of the ESEM model to the data was higher than that of the CFA model. Therefore, the results of ESEM were more in line with the actual situation of data. But at the same time, it should be noted that the performance of some items in the ESEM model results was abnormal (Table 4), which is mainly reflected in that the main factor load of the item was lower than that of its sub-factor load, and these high-order factor loads mainly occur on the adjacent factors of the main factor.

Gender and longitudinal measurement invariance

Configural invariance

In the configural invariance test, various parameters are allowed to be estimated freely, and the fitting index obtained is shown in the configural invariance model in Tables 5, 6. All fitting indexes meet the requirements of psychometrics ($\chi^2_{gender} = 861.171$, $df_{gender} = 232$, $TLI_{gender} = 0.934$, $CFI_{gender} = 0.960$, $RMSEA_{gender} = 0.053$; $\chi^2_{Longitudinal} = 1068.118$, $df_{Longitudinal} = 596$, $TLI_{Longitudinal} = 0.946$, $CFI_{Longitudinal} = 0.959$, $RMSEA_{Longitudinal} = 0.039$), the configural invariance was established, and can be used as the baseline model for the metric invariance test.

Metric invariance

Based on the configural invariance model, the factor load invariance was set, namely, the factor load of the same index was equal in different gender and different measurement time points. The fitting results of gender metric invariance test (see Table 5 metric invariance model) showed that ΔCFI and ΔRMSEA were −0.002 and −0.005, respectively, which were < 0.01. Although the standard of ΔTLI = 0.011>0.01, the gender metric invariance model was also acceptable considering the results of the other two indicators. The fitting results of longitudinal metric invariance test (see Table 6 metric invariance model) show that ΔCFI, ΔTLI and ΔRMSEA were −0.004, +0.001 and 0, respectively, which are < 0.01. This result supports the establishment of the metric invariance across gender and time.

Scalar invariance

On the basis of the second step test, the intercept of observation variables was set equal in male and female group

TABLE 4 Factor loading of the C19P-S-C items on CFA and ESEM model.

Items	CFA	ESEM			
		F1	F2	F3	F4
1	0.738	0.691	0.024	0.002	0.061
2	0.516	0.534	−0.120	−0.019	0.059
3	0.821	0.831	0.021	0.013	−0.034
4	0.827	0.830	0.012	−0.012	0.006
5	0.783	0.732	0.009	0.080	−0.001
6	0.337	0.313	−0.018	−0.020	0.066
7	0.739	−0.002	0.803	−0.072	−0.018
8	0.808	−0.051	0.878	−0.049	0.007
9	0.797	0.032	0.745	0.052	−0.007
10	0.721	0.036	0.623	0.115	0.029
11	0.475	0.052	0.254	0.394	0.026
12	0.806	0.028	−0.019	0.862	−0.022
13	0.825	−0.004	−0.019	0.814	0.048
14	0.489	−0.086	0.086	0.297	0.270
15	0.593	0.026	0.205	0.169	0.413
16	0.753	0.067	0.013	0.063	0.685
17	0.584	−0.036	−0.081	−0.063	0.761
18	0.546	0.027	−0.029	−0.038	0.619
19	0.520	0.015	0.236	0.155	0.263
20	0.687	0.135	0.165	0.155	0.370

F1, Psychological; F2, Psycho-somatic; F3, Economic; F4, Social. Same below.

TABLE 5 Multi-group ESEM comparison nested model fitting index (gender invariance, $N = 1{,}933$).

Model	χ^2	*df*	TLI	CFI	RMSEA (90% CI)	ΔTLI	ΔCFI	ΔRMSEA
Configural invariance	861.171	232	0.934	0.960	0.053 (0.050, 0.057)	—	—	—
Metric invariance	959.889	296	0.945	0.958	0.048 (0.045, 0.052)	+0.011	−0.002	−0.005
Scalar invariance	1009.684	312	0.946	0.955	0.048 (0.045, 0.052)	+0.001	−0.003	0
Strict invariance	1153.221	332	0.940	0.947	0.051 (0.048, 0.054)	−0.006	−0.008	−0.003

ΔTLI, change in TLI; ΔCFI, change in CFI; ΔRMSEA, change in RMSEA. Same below.

and two measurement time points. The fitting indices (see scalar invariance model in Tables 5, 6, respectively) indicate that the model fits well. The ΔCFI, Δ TLI and ΔRMSEA of the gender invariance model were −0.003, +0.001 and 0, respectively; the ΔCFI, ΔTLI and ΔRMSEA of the longitudinal invariance model were −0.001, −0.001 and 0, respectively, which were < 0.01. These results show that the gender and longitudinal invariance were established.

Strict invariance

On the basis of the third step test, the error variance was set equal. The fitting index were shown in the strict invariance model in Tables 5, 6, respectively. The strict invariance model of across gender was established (ΔCFI = −0.008<0.01, ΔTLI = −0.006<0.01, ΔRMSEA = −0.003<0.015). Established a partial longitudinal strict invariance model (ΔCFI = −0.018>0.01, ΔTLI = −0.018>0.01, ΔRMSEA = 0.006<0.015).

Reliability assessment

The McDonald's omega coefficient of the C19P-SC was 0.897. The McDonald's omega coefficients were 0.842, 0.836, 0.778, and 0.760 for Factor 1 (Psychological), Factor 2 (Psycho-somatic), Factor 3 (Economic) and Factor 4 (Social), respectively.

TABLE 6 Multi-group ESEM comparison nested model fitting index (longitudinal invariance, $N = 519$).

Model	χ^2	*df*	TLI	CFI	RMSEA (90% CI)	ΔTLI	ΔCFI	ΔRMSEA
Configural invariance	1068.118	596	0.946	0.959	0.039 (0.035, 0.043)	—	—	—
Metric invariance	1178.209	660	0.947	0.955	0.039 (0.035, 0.042)	+0.001	−0.004	0
Scalar invariance	1212.421	676	0.946	0.954	0.039 (0.036, 0.043)	−0.001	−0.001	0
Strict invariance	1434.018	696	0.928	0.936	0.045 (0.042, 0.049)	−0.018	−0.018	+0.006

Discussion

Many applied studies have shown that the use of CFA to find that the model does not fit the data, and the ESEM method was more appropriate (27). Some researchers suggest that the ESEM model can better characterize the data (52), this research demonstrates this claim. In the present study, adolescents with depressive symptoms were selected as samples to test the validity and reliability of the COVID-19 Phobia Scale (C19P-S) in China. Previous studies have found that ESEM can overcome the problem of "too strict fitting standard" in traditional methods, and organically integrate the functions of EFA and CFA (31). The results of this study show that the ESEM model has more advantages than the CFA model. The specific performance was that higher fitting indicators are correlated with lower factors, and the reduction of factor correlation can improve the discriminative validity of the questionnaire. It shows that ESEM does provide a more flexible and reliable tool for analyzing scale structure.

In previous studies, the four-factor structure of the C19P-SC was obtained through exploratory factor analysis (9, 22–24). However, the fitting index of the model verified by CFA in this study was not good, which may be because there were many cross-load factor items in the C19P-SC in China. For the C19P-SC factor structure, we first used the CFA to test the four-factor model. The results showed that none of the CFA models reached acceptable levels. For the CFA model, the correlation between individual factors was too high, but this result may be due to the limitations of the confirmatory factor analysis method. Therefore, the ESEM model was used to further test the four-factor model of the C19P-SC. The study found that the ESEM model fitting results were good and the correlation between factors was significantly reduced to a low to moderate level. This method was considered to be one of the current effective methods to solve the limitations of CFA (26), by allowing the existence of cross-factor situations in the multi-factor model, the hypothetical multi-factor measurement model was more in line with the real situation. This presents the relationship between items and factors more realistically, but also faithfully presents the relationship between factors.

The ESEM model fits well, however, the cross-factor situation of some items was abnormal (i.e., item 11 and 15), that is, the main factor load of some items is lower than the sub-factor load. Most of the sub-factor were the neighboring factors of the main factor. For example, the load of item 11 "Coronavirus makes me so tense that I find myself unable to do the thing I previously had no problem doing" in its main factor "Psycho-somatic" was significantly lower than that of its sub-factor "Psychological," while the load of item 15 "After the coronavirus pandemic, I do not feel relaxed unless I constantly check on my supplies at home" in its main factor "Economic" was significantly lower than that of its sub-factor "Social." These cross-factor anomalies may be caused by the unclear distinction between the items due to the subtle differences between the main factors and sub-factors of the items. These results may also imply that some items have unclear measurement direction. The factor results of item 11 and item 15 were different from those of other studies (9, 22–24), in addition to the different statistical method (ESEM) used, it is also possible that the sample of this study is non-clinical depressed adolescents. The samples used in previous studies to verify the C19P-S were adults (9, 23, 24) and patients with anxiety disorders (22). Some studies have shown that psychological factors may be the main risk factors of depressive symptoms in adolescents (53, 54). For adolescents with non-clinical depressed, psychological problems are more important than physical problems. This may explain why the factor loadings of the 11 items are higher on the psychological factors than on the psycho-somatic factors. This suggests that from the beginning of primary school enrollment, we can conduct psychological screening for every child and adolescent and establish psychological files. Through early monitoring and other measures, the high-risk group of adolescent depression tendency can be found in advance. In addition, we should not only provide psychological counseling to adolescents with depressive symptoms in normal times, but also pay more attention to such groups during the period of COVID-19. The main body of the sentence in item 15 is more inclined to adults or people living alone, while most adolescents live with their parents or guardians. Adolescents may seldom experience "After the coronavirus pandemic, I do not feel relaxed unless I constantly check on my supplies at home." It is also possible that the sentence order of item

15 (After the coronavirus pandemic, I do not feel……) and items 16 and 17 (After the coronavirus pandemic, I feel……, After the coronavirus pandemic, I actively……) is similar, which is easy to misunderstand by adolescents. In future studies of the C19P-SC, researchers can try to rewrite sentences for better research results. It is worthy of the attention of future researchers that the main factor loads of abnormal item 11 and items 15 in the confirmatory factor analysis results of this study and existing studies were both higher than 0.40 (22, 24), indicating that the relationship between these items and their main factors is still very significant. Although the item 11 and item 15 factor loads were abnormal in our study, we still chose to keep them, because the C19P-SC may be applicable to other samples in China. When conducting other sample studies in the future, Chinese researchers can decide whether to delete the item according to the actual situation of the study.

In addition, this study preliminarily verified the gender and longitudinal measurement invariance of the C19P-SC. It was found that strict invariance can be achieved in different groups (male and female) and partial strict invariance can be achieved at different time points, which indicates that the C19P-SC has invariance in Chinese adolescents with depressive symptoms (55). The results of single-group ESEM show that the four-factor structure of the C19P-SC fits well in the total, the male and the female sample. Meanwhile, based on the above results, the four-factor structure of the C19P-SC can be used as the baseline model for further research on the measurement invariance. The results of multi-group ESEM show that the four-factor structure of the C19P-SC in this study meets the model requirements of configural invariance. This indicates that the C19P-SC measured the same structure in male, female and different time points. On the basis of the configural invariance model, a metric invariance model with equal factor load was established. The establishment of metric invariance indicates that the potential characteristics and observed indicators of the 20 items of the C19P-SC have the same meaning in different genders and two time points. This study shows that the intercepts of the observed variables of the C19P-SC were equal, that is, the observed variables of different genders and time points have the same reference point (scalar invariance). The establishment of strict invariance indicates that the error variances of the C19P-SC measurement in different genders were equivalence. In previous studies, few researchers explored whether the four-factor structure model of the C19P-SC had measurement bias in longitudinal comparison. Millsap believed that configural, metric, scalar and strict invariance were all valid, which indicated that cross group comparison of the scale was meaningful (56). The above four invariances were established, indicating that the C19P-SC has gender and longitudinal measurement invariance in adolescents with depressive symptoms. The observation scores of the C19P-SC can be reasonably compared in different genders and time points.

The results of reliability analysis show that the Mcdonald's omega coefficients of the C19P-SC total scale and each subscale reached the expected acceptable level. The results of this study are consistent with the research of the C19P-S in other countries (9, 22–24), it provides effective support for the reliability of the Chinese version of the C19P-S.

In summary, the C19P-SC has good reliability and validity in adolescents with depressive symptoms, and can be used to assess the phobia of coronavirus in Chinese adolescents with depressive symptoms. But there are still some shortcomings in this study: First, the samples in this study did not pass the clinical evaluation, and the level of depressive symptoms may affect the results of the study. Secondly, this study is the first one to test the construct validity of the C19P-S by using the exploratory structural equation model. So it is impossible to analyze some fuzzy results in this study by comparing with the existing studies. Therefore, it is impossible to clearly provide an accurate explanation for the real reasons for the abnormal cross-factor phenomenon in these items. It is worthy of further discussion in the future.

Conclusion

This study conducted a preliminary discussion on the psychometric properties of the C19P-SC used in adolescents with depressive symptoms in China. The results of the ESEM model provide support for the four-factor model. However, some items have cross-factor anomalies, suggesting that some items need to be further revised in future research. Thus, in future studies, it is necessary to test the C19P-SC structural validity and item performance when using the C19P-SC, and consider its deletion or modification based on item performance. In addition, the applicability of the C19P-SC in normal sample needs to be tested.

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 Committee of the School of Psychology of Guizhou Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

WC concepted the article and provided framework of the manuscript. QL and JS collected the data. TY analyzed the data and drafted the manuscript. WC offered suggestions and guidance for revising the data analysis of this manuscript. The final version was approved by WC. All authors contributed to the article and approved the submitted version.

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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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The changes in family functioning and family happiness during the COVID-19 pandemic: The situation in Thailand

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Background: The effects of the COVID-19 pandemic on family well-being and functioning were generally a concern for healthcare providers in many countries.

Objectives: To explore the changes in family functioning and family happiness during the pandemic in Thailand and to investigate factors associated with the changes in family happiness.

Methods: This was a cross-sectional study conducted between November and December 2021. Online questionnaires regarding family functioning, family happiness, domestic violence, and COVID-19-related experiences were used.

Results: A total of 485 participants were included in this study. The perceived family happiness slightly decreased from 8.19 (pre-pandemic score) to 7.62 (post-pandemic score). In contrast, the general family functioning (SCORE-15 index), strength, and communication subscale scores after the onset of the COVID-19 pandemic were significantly lower than those of the pre-pandemic period. Moreover, the prevalence of verbal and physical violence significantly reduced during the pandemic. In addition, the change in family functioning was the strongest factor associated with the change in family happiness.

Conclusion: In general, family functioning slightly improved; however, perceived family happiness decreased during the pandemic. In addition, the change in family functioning was the strongest factor associated with the change in family happiness.

KEYWORDS

family functioning, family happiness, COVID-19, coronavirus, pandemic

Introduction

The COVID-19 pandemic started in China in late 2019; however, later the World Health Organization (WHO) globally reported more than 500 million confirmed cases and more than 6 million deaths by May 2022 (1). Several preventive measures, including physical distancing, quarantines, lockdowns, school closures, and working from home,

were enforced in many countries during the pandemic. It profoundly impacted individuals, families, communities, and healthcare systems from the direct effects of the pandemic and also the indirect effects of measures taken. In addition, several studies demonstrated an increased prevalence of mental health problems such as substance use, feeling of loneliness, and depressive and anxiety disorders (2–5). Moreover, some studies reported an increase in domestic violence and child maltreatment during the COVID-19 pandemic (6–9). As a result, the effects of the COVID-19 pandemic on family well-being and functioning were generally a concern for healthcare providers.

Several studies revealed the association between the COVID-19 situations and the well-being of families; for example, Lee and colleagues (10) reported social determinants of health had direct effects on COVID-19-related stress, family stress, and family discord in North Carolina, USA. Another study from the USA (11) demonstrated a large deterioration in parent and child mental and behavioral health during the first months of the pandemic in children internalizing and externalizing problems and parent depression. The proportion of children rated in the clinical range increased by 2.5 and 4 times in internalizing and externalizing problems, respectively, from pre-pandemic levels. Moreover, an Australian study compared before and during the pandemic datasets regarding family situations and showed higher levels of parenting irritability and lower levels of family-positive expressiveness during the pandemic. However, the evidence for couple verbal conflict was inconclusive according to this study (12). In addition, Zeng and colleagues (13) conducted research on Chinese college students and found that family cohesion was negatively related to stress related to COVID-19. Congruently, a study from South Korea (14) reported that family cohesion had a significant mediating effect on the relationship between positive psychological capital and health promotion behaviors during the COVID-19 pandemic.

In general, family functioning is defined by several dimensions, including the quality of relationships among family members, the effectiveness of family communication and problem-solving, family cohesiveness, and family adaptability (15). Family function possibly indicates family situations, challenges, adjustments, and resilience during abnormal circumstances. Although some studies revealed family situations and well-being during the COVID-19 pandemic, few studies actually focused on using standard measurements that are specific to family functioning assessments. Moreover, the comparisons of family functioning before and during the pandemic are rarely reported in previous studies. In addition, the COVID-19 situations and preventive measures enforced in each country were different. Therefore, this present study aims to explore the changes in family functioning and family happiness before and during the pandemic and to investigate factors associated with the change in family happiness in the Thai population.

Materials and methods

Sampling and data collection

This was a cross-sectional study that used an online survey because the Thai government generally asked for cooperation to stay at home when this study was conducted. The survey was conducted between November and December 2021. At that period, the COVID-19 situations in Thailand were serious. There were about 18,400–56,000 confirmed cases and 140–460 deaths weekly (16). The questionnaire was distributed *via* the Internet on the official website and Facebook pages of the Department of Psychiatry, Ramathibodi Hospital. Moreover, the questionnaire link was sent to famous Facebook pages regarding mental health and psychology in Thailand. The inclusion criteria were (1) age $\geq$ 18 years, (2) informed consent, and (3) ability to understand the questionnaire in Thai.

Measurements

Sociodemographic characteristics and COVID-19-related experiences

The participants were invited to answer questions regarding gender, age, marital status, region, education, occupation, income, and underlying disease. Moreover, they were asked to rate the fear of COVID-19 infection from 0 to 10 and to report if they had any of these COVID-19-related experiences during the pandemic (yes/no): (1) history of being infected with COVID-19, (2) having close persons infected with COVID-19, (3) having close persons died of COVID-19, (4) having quarantine experiences, and (5) having financial problems because of the COVID-19 pandemic. Exposure to each category of experiences was counted as one point, and the number of COVID-19-related experiences (range: 0–5) was summed up to reflect the degree to which a person was affected by the pandemic.

Family functioning and family happiness

The 15-item Systemic Clinical Outcome and Routine Evaluation (SCORE-15) is a self-report questionnaire completed by family members aged 12 years and older. It records perceptions of the family from each member and measures both overall functioning and specific aspects of family functioning, including the following three domains: family strengths, difficulties, and communication (17). It includes 15 Likert scale items. The SCORE-15 Thai version was developed following the translation protocol of the SCORE team as previously reported (18). The test–retest reliability was excellent, with an intraclass correlation coefficient of 0.94. The criterion validity study revealed that the effect sizes of score differences between clinical and non-clinical Thai samples were large (0.90–1.85) (18). In addition, the recent study generally exhibited good

internal reliability and convergent validity of the SCORE-15 Thai version in the Thai population (19). All available items in each domain were averaged to indicate the domain index (range: 1–5) only if the number of missing items in that domain was no more than one. Only if all three domain indexes were not missing, all available SCORE-15 items were averaged to indicate the SCORE-15 index (range: 1–5). The greater SCORE-15 index reflects poorer family functioning.

In this present study, the participants were invited to answer 2 sets of questions on the SCORE-15 Thai version with different lead-in phrases. For the assessment of family functioning before the pandemic, the lead-in phrase was "please answer the following questions by considering your situations before the COVID-19 epidemic," and for the assessment of family functioning during the pandemic, the lead-in phrase was "please answer the following questions by considering your situations during the COVID-19 epidemic." Moreover, three additional questions regarding physical violence, verbal violence, and happiness within the family were added at the end of the SCORE questionnaire. The 0–10 rating scale was used to assess perceived family happiness.

Ethical standards

This present study's procedures were approved by the Ethics Committee of Ramathibodi Hospital, Mahidol University. The participants were provided an information statement and asked to give online informed consent for the research in accordance with the Declaration of Helsinki. In addition, all data and documents have been anonymized, and the datasets were non-personally identifiable.

Statistical analysis

Data analyses were performed using Stata version 13.0. Out of the 487 responses, two failed to complete either set of questionnaires regarding pre- or post-pandemic happiness and were thus excluded from further analyses. The sociodemographic characteristics of the included participants and their experiences related to the COVID-19 pandemic were presented using descriptive statistics. The bootstrapping approach was used to determine the significance of inferential statistics and estimate 95% bias-corrected and accelerated bootstrap (BCa) confidence intervals (CIs) of the parameters. More specifically, to determine the change in family atmosphere, the percentages of physical and verbal violence in families before and after the onset of the COVID-19 pandemic were compared using the bootstrap chi-square, and the scores of perceived family happiness and family functioning were compared likewise using bootstrap paired *t*-test. The association between each variable and the changes in family happiness score, generated by subtracting the pre-pandemic happiness scores from the post-pandemic scores, was evaluated using bootstrap unpaired *t*-test for two categorical variables, bootstrap ANOVA for more than two categorical variables, and bootstrap Pearson's correlation for continuous variables. Statistical significance was set at a *P*-value of <0.05. Factors significantly associated with the changes in family happiness in univariate analyses were then included as independent variables in subsequent bootstrap multiple linear regression analyses. All re-samplings were iterated 2,000 times while allowing for sample replacement.

Results

Sample characteristics

Of the 485 participants included in this study, the majority were women ($N = 441$, 90.9%). The age ranged from 19 to 67 years (mean = 41.7, SD = 8.62). Most participants had a bachelor's degree ($N = 247$, 50.9%) or above ($N = 201$, 41.5%) as their highest education. Of the participants, two-thirds ($N = 323$) earned more than 40,000 THB/month, whereas 12.6% ($N = 61$) earned <20,000 THB/month. Regarding COVID-19-related experiences, the average score for fear of infection was 7.4 (range 0–10, SD = 2.3). Of the participants, one-fourth (26.2%) had quarantine experience, but only 12 (2.5%) reported a history of COVID-19 infection. Approximately 37% ($N = 178$) had close persons infected with COVID-19, and 11.0% ($N = 53$) reported having close persons died of COVID-19. Around two-thirds ($N = 331$) reported having financial problems during the COVID-19 pandemic. Overall, most participants experienced one to two COVID-19-related events (Mdn = 1, IQR = 1–2, Table 1).

Changes in the family atmosphere during the COVID-19 pandemic

The prevalence of physical violence significantly reduced from 14.3% (95% bootstrap CI: 68.2–76.3%) during the pre-COVID-19 pandemic period to 6.2% (95% bootstrap CI: 4.1–8.4%) after the onset of the pandemic (bootstrap $P = 0.034$). The prevalence of verbal violence was far more prevalent than physical violence but similarly decreased from 72.3% (95% bootstrap CI: 68.2–76.3%) to 51.3% (95% bootstrap CI: 46.7–56.0%) (bootstrap $P = 0.001$). The perceived family happiness slightly decreased from 8.19 (pre-pandemic score) to 7.62 (post-pandemic score). In addition, the general family functioning (SCORE-15 index), strength, and communication subscale scores after the onset of the COVID-19 pandemic were significantly lower than those of the pre-pandemic period (all bootstrap $P < 0.05$, Table 2). On the contrary, the difficulty subscale score of family functioning did not significantly change during the pandemic (bootstrap $P = 0.783$, Table 2).

TABLE 1 Characteristics of the participants.

	Total	*N* (%)
Demographic characteristics		
Age, Mean (SD)	481	41.7 (8.6)
Female	485	441 (90.9)
Marital status	484	
Single		120 (24.8)
Married		340 (70.2)
Divorced/widowed		24 (5.0)
Buddhist	485	456 (94.0)
Education	485	
Below bachelor degree		37 (7.6)
Bachelor degree		247 (50.9)
Above bachelor degree		201 (41.5)
Work status	485	
Studying		13 (2.7)
Employed with regular income		277 (57.1)
Employed with non-regular income		96 (19.8)
Unemployed or non-paid working		99 (20.4)
Monthly income	484	
<20,000 THB		61 (12.6)
20,000, 40,000 THB		100 (20.7)
>40,000 THB		323 (66.7)
Underlying illness or health problems	485	173 (35.7)
Experiences related to COVID-19		
Fear of infection (0–10), Mean (SD)	484	7.4 (2.3)
COVID-19 infection	485	12 (2.5)
Close persons infected with COVID-19	485	178 (36.7)
Close persons died of COVID-19	482	53 (11.0)
Quarantine	484	127 (26.2)
Financial problems	485	331 (68.2)
Number of COVID-19-related experiences	481	
None		80 (16.6)
1–2		319 (66.3)
3 or more		82 (17.1)

Factors associated with changes in family happiness score

Univariate analyses demonstrated that a decrease in happiness score tended to be larger among women compared to men, but the association did not pass the threshold of statistical significance (bootstrap $P = 0.087$). No significant associations between happiness score change, and marital status, religion, education, work status, income, or health problems were found (all bootstrap $P > 0.05$, Table 3). Experiencing a loss of close persons from COVID-19 (bootstrap $P = 0.052$) and having financial problems (bootstrap $P = 0.036$) were associated with a larger decrease in family happiness score but neither the experiences of COVID-19 infection (oneself or close persons) nor the experiences of quarantine were associated with changes in family happiness (Table 3).

For continuous variables, the change in family happiness was positively correlated with age (rho = 0.12, 95% BCa CI: 0.03 – 0.20, $N = 481$, $P = 0.007$), but negatively correlated with family happiness before the pandemic (rho = −0.22, 95% BCa CI: −0.31 to −0.12, $N = 485$, $P < 0.001$), the number of COVID-19-related experiences (rho = −0.13, 95% BCa CI: −0.22 to −0.05, $N = 481$, $P = 0.002$), and the changes in SCORE-15 scores (rho = −0.34, 95% BCa CI: −0.47 to −0.22, $N = 479$, $P < 0.001$). No significant correlation between the change in family happiness and fear of the infection was observed (rho = −0.05, 95% BCa CI: −0.14–0.05, $N = 484$, $P = 0.281$).

Factors associated with the changes in perceived family happiness in univariate analyses were subsequently tested in multiple linear regression analyses. As shown in Table 4, age was significantly associated with the changes in family happiness in both models (Model 1: Beta = 0.02, bootstrap $SE = 0.01$, $P = 0.011$; Model 2: Beta = 0.02, bootstrap $SE = 0.01$, $P = 0.018$), but sex was not (Model 1: Beta = −0.14, bootstrap $SE = 0.21$, $P = 0.482$; Model 2: Beta = −0.18, bootstrap $SE = 0.20$, $P = 0.389$). Perceived family happiness before the pandemic (Model 1: Beta = −0.20, bootstrap $SE = 0.04$, $P < 0.001$; Model 2: Beta = −0.20, bootstrap $SE = 0.04$, $P < 0.001$) and changes in the SCORE-15 index (Model 1: Beta = −1.60, bootstrap $SE = 0.24$, $P < 0.001$; Model 2: Beta = −1.57, bootstrap $SE = 0.24$, $P < 0.001$) also consistently showed significant negative associations with the changes in family happiness. The experience of financial problems during the pandemic was significantly associated with a 0.29-point reduction of perceived family happiness after controlling for other factors (Model 1: Beta = −0.29, bootstrap $SE = 0.12$, $P = 0.014$), whereas the experience of close persons died of COVID-19 infection only showed a trend of association without reaching the threshold of statistical significance (Model 1: Beta = −0.29, bootstrap $SE = 0.16$, $P = 0.071$). However, each additional exposure to COVID-19-related experiences was associated with a 0.14-point decrease in family happiness scores as shown in Model 2 (Beta = −0.14, bootstrap $SE = 0.05$, $P = 0.009$; Table 4).

Discussion

This study aims to explore the changes in family happiness and family functioning after the COVID-19 pandemic and to

TABLE 2 Family atmosphere and family functioning before and after the COVID-19 pandemic.

	Mean [95% BCa CI]		Bootstrap *P*-value
	Before	After	
Verbal violence, *N (%)* [95% bootstrap CI]	349 (72.3) [68.2, 76.3]	249 (51.3) [46.7, 56.0]	0.001
Physical violence, *N (%)* [95% bootstrap CI]	69 (14.3) [11.1, 17.4]	30 (6.2) [4.1, 8.4]	0.034
Perceived family happiness	8.19 [8.01, 8.36]	7.62 [7.43, 7.81]	<0.001
Family functioning index (SCORE-15)	2.22 [2.16, 2.28]	2.18 [2.12, 2.24]	0.007
Strength subscale	1.98 [1.93, 2.05]	1.94 [1.88, 2.01]	0.022
Difficulty subscale	2.40 [2.33, 2.48]	2.40 [2.31, 2.48]	0.783
Communication subscale	2.28 [2.22, 2.35]	2.20 [2.13, 2.27]	<0.001

identify factors associated with the change in family happiness in the Thai general population. Expectedly, we found that perceived family happiness significantly decreased during the pandemic. Surprisingly, the reported prevalence of verbal and physical violence in families during the pandemic period appeared lower than that of the pre-pandemic period, and the overall family functioning was improved during the period, as reflected by the significant reduction of the SCORE-15 scores. The identification of associated factors revealed that those who had close persons who died of COVID-19 or had financial problems showed a larger decrease in perceived family happiness compared to those without these experiences; however, the former issue lost its statistical significance after adjustment for other factors. Interestingly, we found a one-point increase in the SCORE-15 index, which reflects worsening family functioning, was associated with around a 1.6-point decrease in perceived family happiness, whereas each additional exposure to COVID-19-related experiences was associated with only a 0.14-point decrease in family happiness scores.

In general, the COVID-19 pandemic possibly caused many stressful environments, for example, quarantines, social isolation, economic instability, deaths, and loss. These stressors inevitably affected family systems. Unsurprisingly, we found a decrease in perceived family happiness during the COVID-19 pandemic. Several studies revealed an increase in stress and psychological problems in families during the pandemic, especially during lockdown periods (10, 12, 20, 21). For example, Giannotti and colleagues (21) investigated family adjustment to the COVID-19 lockdown in Italy. The results showed that parental stress, especially in mothers, and child externalizing behaviors increased during the lockdown period. In addition, Westrupp and colleagues (12) reported higher rates of parental depression, anxiety, and stress; higher parenting irritability; lower family-positive expressiveness; and higher alcohol consumption in Australia during the COVID-19 pandemic compared to pre-pandemic estimates. However, this study highlighted the importance of family functioning in terms of influences on family happiness over situational factors, such as losing close persons and financial problems. In fact, family functioning *per se* reflects the adaptation of families, which can be measured in several dimensions such as communication and problem-solving ability (22). Therefore, the change in family functioning potentially demonstrated a stronger association with the change in family happiness during the COVID-19 pandemic than other factors that directly represented stressors *per se*.

Focusing on family functioning, we found that general family functioning, strength subscale, and communication subscale of family functioning significantly improved during the COVID-19 pandemic. These results might be explained by the timing of data collection, which was around the late second wave of the COVID-19 outbreak in Thailand. People might have learned how to cope with the outbreak since the first wave; as a result, they might function better in terms of intrapersonal adjustment as well as interpersonal adjustment which is reflected in family functioning. In contrast, Hussong and colleagues (23) reported a decrease in open family communication, parental support of youths, and family satisfaction during the pandemic in the USA, according to child reports, although no changes were found in parent reports of family functioning. In addition, Zeng and colleagues (13) found family cohesion was negatively related to stress consequences among Chinese college students during the pandemic. Moreover, regarding the mechanism by which family cohesion helped decrease stress consequences, they demonstrated that affective empathy had a moderating effect on the stress consequences. However, it was possible that family functioning and stress related to the COVID-19 pandemic had bidirectional relationships. Moreover, Yang and colleagues (24) reported that generalized anxiety disorder and trait anxiety had mediating effects between family functioning and state anxiety. However, other potential mediators and moderators might play important roles in the relationship between family functioning and anxiety/stress related to the COVID-19 pandemic.

TABLE 3 Associations between participants' characteristics and changes in perceived family happiness.

	Happiness changes Mean [95% BCa CI]	*P*-value
Demographic characteristics		
Gender		
Male	−0.25 [−0.63, 0.10]	0.087
Female	−0.59 [−0.72, 0.47]	
Marital status		
Single	−0.49 [−0.72, −0.26]	0.833
Married	−0.59 [−0.75, −0.45]	
Divorced/Widowed	−0.58 [−1.18, −0.08]	
Religion		
Buddhism	−0.55 [−0.68, −0.43]	0.478
Non–Buddhism	−0.72 [−1.24, −0.30]	
Education		
Below bachelor degree	−1.03 [−1.68, −0.48]	0.348
Bachelor degree	−0.44 [−0.61, −0.27]	
Above bachelor degree	−0.63 [−0.82, −0.46]	
Work status		
Studying	−0.69 [−1.20, −0.25]	0.939
Employed with regular income	−0.57 [−0.73, −0.43]	
Employed with non–regular income	−0.55 [−0.83, −0.29]	
Unemployed or non–paid working	−0.53 [−0.88, −0.19]	
Monthly income		
< 20,000 THB	−0.75 [−1.28, −0.25]	0.151
20,000 to 40,000 THB	−0.92 [−1.24, −0.60]	
> 40,000 THB	−0.42 [−0.54, −0.30]	
Underlying illness or health problems		
Yes	−0.58 [−0.76, −0.41]	0.850
No	−0.55 [−0.72, −0.39]	
Previous violence		
Yes	−0.41 [−0.78, −0.03]	0.361
No	−0.59 [−0.72, −0.46]	
Previous verbal violence		
Yes	−0.54 [−0.69, −0.40]	0.571
No	−0.63 [−0.89, −0.39]	
Experiences related to COVID−19		
COVID−19 infection		
Yes	−1.17 [−2.22, −0.40]	0.171
No	−0.55 [−0.67, −0.43]	
Close persons infected with COVID−19		
Yes	−0.65 [−0.84, −0.46]	0.308
No	−0.51 [−0.67, −0.36]	
Close persons died of COVID−19		
Yes	−0.91 [−1.25, −0.56]	0.052
No	−0.53 [−0.66, −0.40]	
Quarantine		
Yes	−0.73 [−1.01, −0.48]	0.116
No	−0.50 [−0.63, −0.36]	
Financial problems		
Yes	−0.65 [−0.81, −0.49]	0.036
No	− 0.38 [−0.57, −0.20]	

(Continued)

TABLE 3 (Continued)

Regarding family violence, some studies reported a high prevalence of domestic violence during the COVID-19 pandemic. For example, the community-based survey in India (6), which involved 209 married women aged 18–55 years, revealed the prevalence of domestic violence during the pandemic and lockdown to be 25.8%, and in particular the prevalence of severe domestic violence to be 6.2%. Recently, systematic reviews (25, 26) reported an increase in domestic violence cases all over the world; however, some studies demonstrated the opposite direction. For instance, Halford and colleagues (27) revealed a decrease in domestic abuse (−45%) according to daily counts of recorded crime data from a UK police service by comparing the data in 2020 to the expected rates based on crimes recorded in the previous 4 years. Moreover, McLay (28) reported domestic violence cases collected from the Chicago Police Department slightly decreased from 2,367 cases in March 2019 (pre-pandemic) to 2,251 cases in March 2020 (pandemic). Although these results showed a decrease in the rate of domestic violence, they were more likely to be underreported or have changes in help-seeking behaviors than an actual decline. According to the systematic review by Kourti and colleagues (25), an increase in domestic violence was noted globally during the first week of the lockdown. Surprisingly, we found a significant decrease in both verbal and physical violence in families during the COVID-19 pandemic. However, there was not a complete lockdown in Thailand at the time of this survey, but the government generally asked for cooperation to stay at home due to the serious outbreak. Perhaps living arrangements or home confinement might play an important role in domestic violence. In addition, regarding the COVID-19 situation in Thailand, the time when we conducted this survey was during the late second wave of the epidemic in Thailand. Most people inevitably had to deal with stressful situations and possibly

TABLE 4 Multiple linear regression of factors associated with changes in perceived family happiness.

	Model 1		Model 2	
	Beta [95% BCa CI]	*P*-value	Beta [95% BCa CI]	*P*-value
Age	0.02 [0.004, 0.03]	**0.011**	0.02 [0.003, 0.03]	**0.018**
Female	−0.14 [−0.49, 0.32]	0.482	−0.18 [−0.52, 0.31]	0.389
Family happiness score before the pandemic	−0.20 [−0.29, −0.13]	**<0.001**	−0.20 [−0.29, −0.12]	**<0.001**
Changes in SCORE−15 index	−1.60 [−2.07, −1.13]	**<0.001**	−1.57 [−2.04, −1.13]	**<0.001**
Close persons died of COVID−19	−0.29 [−0.66, 0.01]	0.071		
Financial problems	−0.29 [−0.52, −0.06]	**0.014**		
Number of COVID−19–related experiences			−0.14 [−0.25, −0.04]	**0.009**
Constant	0.70 [−0.09, 1.61]	0.097	0.70 [−0.10, 1.58]	0.100

Statistically significant results ($P < 0.05$) were presented in bold.

gained their coping skills since the first wave of the COVID-19 epidemic, when there were lockdowns in several regions of Thailand, especially Bangkok.

Strengths and limitations

The strengths of this study included using the standard assessment of family functioning, which was directly designed to assess both general functioning and specific dimensions of family functioning. In addition, this study was timely conducted during the serious period of the COVID-19 pandemic in Thailand. Moreover, we accounted for and gathered data regarding COVID-19-related experiences, including the history of COVID-19 infection, the experiences of losing close persons, quarantine, and financial problems.

However, this study has several limitations. First, pre-pandemic data were retrospectively gathered; as a result, recall bias was inevitably avoided. Second, family functioning and the pandemic situations were dynamic over time. It was impossible to demonstrate patterns of change over time by using a cross-sectional design. Third, this study probably had low generalizability because the study design was an online survey *via* the links on the official website and educational Facebook pages. Therefore, the majority of the study population were women in middle to upper socioeconomic classes who were easily accessible to the Internet. Further studies should be conducted in a broader variety of populations, including those with lower socioeconomic backgrounds. Finally, the COVID-19 situation in Thailand generally tended to be less severe compared to many countries in Europe and the USA in terms of the prevalence of infection and mortality. Consequently, it was difficult to compare the results of this study to the studies from other countries which encountered different situations, public health systems, and social contexts.

Conclusion

Regarding the situation in Thailand, the perceived family happiness slightly decreased during the COVID-19 pandemic. In contrast, the prevalence of verbal and physical violence in families significantly reduced. In addition, the results demonstrated that the general family functioning, strength subscale, and communication subscale of family functioning significantly improved during the pandemic. Interestingly, the change in family functioning was the strongest factor associated with the change in family happiness.

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 Ethics Committee of Ramathibodi Hospital, Mahidol University. The patients/participants provided their written informed consent to participate in this study.

Author contributions

NL designed, conducted the study, mainly drafted, and finalized the manuscript. TP designed the study, performed statistical analysis, and wrote some sections of

the manuscript. PW performed data collection and statistical analysis. All authors contributed to the article and approved the submitted version.

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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The world is coming to an end! COVID-19, depression, and anxiety among adolescents in Malawi

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Introduction: This paper assessed the effects of Covid-19 on adolescent mental health in Malawi. There is minimal research on adolescent mental health in Africa, Malawi in particular. The study shows a link between the pandemic and mental health. Some factors that may have contributed to this link include; Covid-19 preventive measures, media exposure and the increase in unemployment.

Methods: The study used a mixed methods approach, quantitative and qualitative methods. It was conducted in Malawi's four districts (Blantyre, Mangochi, Lilongwe and Karonga).

Results: Overall 22%, 21%, and 23% of the respondents had depression, anxiety and post-traumatic stress disorder, respectively. The Chi-square test showed that significantly more adolescents with secondary education (28%) had anxiety than those with primary education (14%). Further, regression analysis revealed that adolescents with anxiety were 18 [95%CI: 9.34, 35.8] times more likely to have depression compared to those who did not have anxiety. The study found no significant differences in the proportions of adolescents with the three outcomes when comparing different groups within the explanatory variable. The ratio of female and male adolescents with depression and anxiety was the same.

Discussion: The adolescents expressed that Covid-19 affected their social, academic, and financial status. These effects had a significant bearing on their mental health in that they led to depression, anxiety, fear of the unknown, and stress. During the Covid-19 pandemic, adolescents' mental health diminished and posed a considerable risk to productivity of adolescents. As a result, adolescents may not fully realize their potential, form and maintain good relationships, contribute to their community and become resilient. These effects have devastating consequences for this young generation without proper coping strategies.

KEYWORDS

mental health, adolescents, COVID-19, Malawi, depression, anxiety

Background

The study aims to assess the effects of COVID-19 on mental health among adolescents in Malawi. The COVID-19 pandemic has affected people globally indiscriminately. To take measures against the spread of the virus, governments put restrictions such as restricted movements worldwide. This led to social isolation and adversely affected mental health (1). Everyone was affected by the COVID-19 regulations, especially adolescents. This is because adolescents are at the developmental stage, which relies heavily on peer connections for emotional support and social development (2). Further, these restrictions have been particularly difficult for adolescents, who need peer connections most (3). Adolescence is a crucial transitional stage marked by physical, social, and cognitive development. Hence, the disruptions caused by the pandemic may have had a long-term impact on adolescents' growth and well-being. Evidence shows that half of the mental health conditions begin to manifest at 14 (4). Evidence shows "the potential long-lasting impact of quarantine measures on mental health, which include depression, post-traumatic stress, anger and emotional exhaustion" (1).

In March 2020, the Government of Malawi declared a national disaster in response to COVID-19. The country adopted several measures, including closing schools and universities and limiting church and public gatherings to 50 people only for 1 h or less. The Government also implemented COVID-19 screening at national border posts. In addition, the Ministry of Health encouraged the adoption of protective behaviors such as regular hand washing, physical distancing, using face masks, and working from home. A national lockdown was announced on April 18 2020; however, its implementation was prevented by the Malawi High Court (5). Being landlocked and underdeveloped, the Government of Malawi could hardly sustain lockdown measures. So, even though schools were closed, people were not restricted to their homes, as markets and other public gatherings were still crowded. In addition, there was panic, especially among adolescents, as the Government initiated these measures without massive awareness of the disease to the general public.

On the global scene, studies show that the most prevalent mental health problems associated with COVID-19 are stress, anxiety and Depression (6). Research has found that fear may lead to anxiety and depression. For instance, a study from China indicated that 8.4% of the general population reported severe pressure, while 4.3% reported severe Depression (7). Mental health adversities include being single, unemployed, at risk of health complications, job loss, and financial distress due to the pandemic (8). Besides COVID-19 being a global pandemic and public health crisis, it has severely affected the global economy and financial markets. Specifically, the pandemic has reduced income, increased unemployment, and disrupted transportation, service, and manufacturing industries. These are some consequences of the disease mitigation measures implemented in many countries (9). Women, adolescents and other vulnerable groups may be at the most risk of COVID-19.

The COVID-19 pandemic resulted in fear, anxiety and concern in many nations. Apart from the fear of the pandemic itself, the other sources of worry and concern included; reduced social interaction and support, restrictive public health measures, travel bans, border closures, quarantine measures, and physical distancing that contributed to increased levels of loneliness, anxiety and Depression (10). In an article that systematically reviewed the general population's mental health status, Xiong et al. (11) found that a higher prevalence of adverse psychiatric symptoms had been reported than before the pandemic. The review found that the COVID-19 pandemic represents an unprecedented threat to mental health in high, middle, and low-income countries (11).

World Health Organization estimates that approximately 6–8% of young people live with depression. However, there is limited published literature on the prevalence of mental disorders among adolescents in Malawi and sub-Saharan Africa. Despite the lack of adequate evidence in our setting, some research established that among youth aged 12–24 years of age, there is a 20–25% annual risk of having a mental health diagnosis. Therefore, Matandika et al. (12) studied the prevalence of common mental disorders (CMD) and the factors associated with mental disorders among children and adolescents in Blantyre- Urban, Malawi. They found that the overall prevalence of mental disorders was 5.9% and was higher in males (7.1%) than in females (4.7%). Hence, more research is needed in sub-Saharan Africa to understand the scale of adolescent mental health problems.

Mental health problems are a well-known problem in Malawian society; the problem is primarily understood from cultural and religious beliefs, not as a health condition caused by biological, psychological and social issues. Thus, for many people, mental health is essentially a cultural issue. This is why mental health conditions are not seen as illnesses like malaria or Tuberculosis (13). However, there is currently no consensus on the actual meaning of mental health, although the problem is recognized in the community. Despite the recognition of the problem, those affected by mental health problems do not always come forward for fear of being stigmatized, which makes it difficult to manage mental health timely (13).

Depression and anxiety are some of the mental health problems faced in Malawi. Udedi (14) found a depression prevalence rate of about 30% in attendees of the Matawale Health Center in Zomba, whereas Kauye et al. (15) reported a rate of 19% in attendees of other clinics. In a study of pregnant women and young mothers (many of whom are teenagers), Stewart et al. (16) found rates of depression ranging between 10.7 and 21.1%. Kim et al. (17) report a Depression

rate of 20% in adolescents attending HIV/AIDS clinics. These data are similar to those reported in Nigeria (18) and Kenya (19), where in-school adolescent Depression rates are 21.2 and 26.4, respectively (20). In people living with HIV and AIDS (PLWHA), the prevalence of depression has been documented to be as high as double that of the general population. In the few studies in Africa, estimates of the prevalence of Depression in PLWHA range between 12 and 60% (21). One cross-sectional study aimed at estimating the prevalence of depression amongst a sample of HIV-positive adolescents in Malawi showed the results of 21.6% in females and 15.4% in males (17). Another study in Malawi on Adolescents living with HIV (ALHIV) revealed a depression prevalence rate of 18.9% (22).

In terms of training mental health professionals, the colonial Government did not invest in training native Malawian mental health professionals. But when Malawi became independent, it started sending its people to train as psychiatric nurses abroad in Britain. This training has significantly assisted in increasing the number of mental health nurses in Malawi. Later on, St John of God College of Health Sciences was established in 2003 and started offering a University Diploma in Counseling. In 2004, a bachelor's degree in Mental Health-Psychiatric Nursing was introduced to upgrade nurses who wanted to specialize in mental health. In 2008, the college introduced a Bachelor's degree in Clinical Medicine specializing in mental health. In 2004, the Catholic University of Malawi started training social workers at a bachelor's degree level. These are essential human resources for the community mental health care of patients. However, there is still a demand for more trained professionals. According to WHO (23), for every 100,000 people in the country, there are 0.01 psychiatrists, 0.22 mental health nurses and 0.01 social workers (24).

Following this background, the study aimed to address the following research questions; what is the knowledge of mental health and mental health illness among adolescents in Malawi? How did COVID-19 affect the mental health of adolescents? What is the prevalence of depression and anxiety among adolescents during the COVID-19 pandemic?

Theoretical framework-operant conditioning theory

Operant conditioning is one of the behavioral theories that explain the development and persistence of depressive symptoms as the result of decreased environmental reward, associated reductions in positively reinforced healthy behavior, reinforcement of depressive or passive behaviors, and punishment of healthy behaviors (25, 26). It states that depression is caused by removing positive reinforcement from the environment (25). Certain events, such as losing your job, induce depression because they reduce positive reinforcement from others. Further, this tends to reinforce maladaptive behavior. This eventually alienates even close friends leading to even less support and increasing social isolation and unhappiness.

In addition, if the person lacks social skills or has a very rigid personality structure, they may find it challenging to make the adjustments needed to look for new and alternative sources of reinforcement (25). As such, they get locked into a negative downward spiral. Behavioral avoidance coping occurs when a problem is avoided through participation in alternative activities, temporarily satisfying albeit maladaptive behaviors, or overtly displaying unpleasant emotions' manifestations (27). Considering that COVID-19 is a public health issue, the study thought that the burdens brought about by COVID-19 removed some positive reinforcement in adolescents. Overstressing the negative thoughts related to COVID-19 may have contributed to anxiety and depression. In addition to misinformation being shared on social media, many conspiracies were developed during the pandemic. This brought fear and anxiety among adolescents and the general population. The helplessness associated with contracting the virus left most people worried and depressed. Worry could both exacerbate and be exacerbated by existing anxiety and depressive symptoms (28). In addition, many adolescents used negative coping strategies, including abusing alcohol and other substances. Socially, people were encouraged to practice social distancing. Hence access to social support was not easy for most young people and the general population. Most social gatherings that promote connection and a sense of belongingness were banned. Worse still, they lost their loved ones. These are risk factors for mental health illnesses, including anxiety and depression.

Methodology

Study design

This study used a mixed-methods approach, combining qualitative and quantitative data. Data were collected from Blantyre, Mangochi, Lilongwe and Karonga, representing the country's southern, eastern, central and northern regions. Lilongwe and Blantyre were selected because they are major cities in Malawi with a high urban adolescent population and registered high numbers of COVID-19 cases. Mangochi was chosen because it is a lakeshore district, which attracts tourists, and Karonga was selected because it is a border district, which makes it a possible entry point for imported cases.

Qualitative data were collected in all four districts using Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs). Four FGDs (one in each district) discussions were conducted with adolescents. To observe COVID-19 social distancing restrictions, FGDs were limited to 6 people per

group and held outside in the open. Participants were recruited through Youth Organizations working in the respective areas. We used convenience sampling to identify these participants: 12 KIIs targeted parents, teachers, community leaders and social workers. In addition, we interviewed a Head Teacher, a community leader, a parent, and a Social Worker in each of the four districts. Again, purposive sampling was used to select the key informants. Qualitative research enabled us to explore the complexity of adolescent behavior and generate a more profound understanding of the COVID-19 pandemic behavior.

Quantitative data was collected from 340 adolescents using structured individual questionnaires. This data was used to explore the relationship between basic demographics and levels of depression and anxiety in the study population. This sample was calculated using the finite population sample size formula (29) and based on the national population of people 10–19 years, as reported in the 2018 Malawi census report. We initially planned to use probabilistic sampling approaches, but convenience sampling was utilized after realizing that probabilistic sampling would be hard to attain. This was partly due to the COVID-19 restrictions put in place during the time of the study. However, our sample is still informative for our study questions, and the results and discussions are mainly based on and strengthened using qualitative data.

The study data was collected from May to June 2021, after the second wave of COVID-19 in Malawi, which was more devastating than the first wave (30).

Data collection tools

Interview guides were used to conduct KIIs and FGDs. The Key informant interview guides were adapted to the key informant and comprised the following general questions: How has the COVID-19 pandemic affected adolescents? In your observation, has the adolescent felt restless, wound up, or on edge in relation to COVID-19? Has the adolescent displayed any hopelessness or helplessness in their outlook on life? Has the adolescent been showing any lack of energy and an overwhelming feeling of fatigue? FDG guides comprised the following questions; What words or feelings come to mind when you think about the COVID-19 pandemic? How has your life changed due to COVID-19? Have you experienced little interest or pleasure in doing things during the pandemic? Ever since the coming of COVID-19, have you had trouble falling asleep, staying asleep, or sleeping too much?

The study utilized the Generalized Anxiety Disorder (GAD-7) Patient Health Questionnaire (PHQ-9) (31–33) to collect quantitative data. The two questionnaires have been used and validated in various populations as brief screening measures for depression and anxiety. Additionally, the PHQ-9 has been validated in Malawi (14). PHQ-9 has nine items which measure depression on a scale of 1–27. Scores of 5, 10, 15, and 20 represent cut-off points for mild, moderate, moderately severe and severe depression, respectively (34). The GAD-7 measures anxiety and has seven questions with options ranging from 0 (not at all) to 3 (nearly every day), with an overall scale of 0–21. Scores of 5, 10, and 15 represent cut-off points for mild, moderate, and severe anxiety, respectively (35). Internal reliability of the PHQ-9 and GAD-7 was high and moderate, respectively ($\alpha = 0.72$ and $\alpha = 0.61$). As a rule of thumb, Cronbach's alpha of the scale and subscale should be above 0.600 (36, 37).

Data analysis

All recorded interviews and FGDs were transcribed and translated into English. The study used the thematic data analysis method. Thematic analysis is a method for analyzing qualitative data in many disciplines and fields and can be applied to different datasets to address various research questions—"it also involves interpretation in selecting codes and constructing themes" [(38), P1]. The thematic analysis was conducted using six stages outlined by Braun and Clarke (39). The six stages of the framework include; 1) familiarization with data, 2) generation of initial codes, 3) searching for themes, 4) reviewing themes, 5) defining themes, and 6) analysis and writing up. This method allowed the researchers to closely examine the data to identify common themes—topics, ideas and patterns of meaning that come up repeatedly; it allowed the researchers to analyze the data in five broad steps, namely: familiarization; coding; generating themes; reviewing themes, and defining and naming themes.

Quantitative data entry, cleaning and analysis were done using STATA version 17. Descriptive data are presented as graphs, frequency/percentage distribution and numerical summary tables. In addition, Pearson Chi-square tests were used to explore if depression and anxiety were associated with population characteristics. All analyzes were done at a 95% confidence level.

Ethical consideration

The study was conducted with complete adherence to ethical standards expressed in the Declaration of Helsinki. Before the commencement of the study, relevant authorization and approval were sought from the University of Malawi Research Ethics Committee (UNIMAREC) (No. P/03/21/53), Mangochi, Blantyre, Lilongwe, and Karonga district commissioners. Permission to conduct the study was also sought from Village and Group Village Heads of areas where data were collected. In addition, a consent form was read to adolescents and parents and guardians of adolescents under 18 who agreed to participate in

TABLE 1 Demographics, depression, and anxiety outcomes.

Variable	Total	Depression[a]	Anxiety[a]	Depression	Anxiety
	N (%)			% difference [CI][b]	
Gender					
Male	185 (54.4)	41 (22.2)	35 (18.9)	−0.4 [−9.3, 2.9]	−3.7 [−12.3, 5.0]
Female	155 (45.6)	35 (22.6)	35 (22.6)		
Education level					
Primary	186 (54.9)	34 (18)	26(14)	−9.2 [−18.2, −0.1]*	−14.1 [−22.8, −5.4]*
Secondary	153 (45.1)	42 (27)	43 (28)		
Age					
<18 years	139 (41)	28 (20)	22 (16)	−3.7 [−12.6, 5.2]	−8.1 [−16.5, 0.4]
≥18 years	201 (59)	48 (24)	48 (24)		
District					
Lilongwe	150 (44.1)	34 (22.7)	31 (20.7)		
Blantyre	91 (26.8)	20 (22.0)	17 (18.7)		
Mangochi	66 (14.4)	15 (22.7)	14 (21.2)		
Karonga	33 (9.7)	7 (21.2)	8 (24.4)		
	Mean (SD) [Min, Max]				
Age in years					
Male	17.2 (1.9)	17.6 (1.5)	17.7 (1.3)		
Female	17.1 (1.8)	17.5 (1.4)	17.5 (1.4)		
Total	341 (100)	76 (22.4)	70 (20.6)		

[a]Proportion with an outcome in a particular category.
[b]Chi-square test of equality of proportions with an outcome comparing the categories; Male-Female, Primary-Secondary, <18–≥18 years.
*Significant difference.

the study and provided written informed consent to participate in the study.

Methodological limitations

The study has two methodological limitations. First, although the study has used mixed methods, combining quantitative and qualitative methods, this paper has heavily relied on qualitative data for its analysis and conclusions. Secondly, because we employed convenience sampling techniques, the results may not represent the mental health of adolescents in Malawi.

Results

The results are discussed in three thematic areas- COVID-19 and Depression, COVID-19 and anxiety, and mental health-related effects of COVID-19.

Basic demographics and outcomes

As indicated in Table 1, most of the respondents were from Lilongwe (44.1%), whilst the minority were from Karonga (9.7%). There was a similarly equal distribution between males and females. Most participants were primary school-going adolescents (54.9%), and more respondents were over 17 years old (59%).

COVID-19 and depression

The results show that approximately 22% of the respondents were depressed. This proportion remained almost constant among various groups of people of different genders and education levels and from other districts (Table 1). Results on depression levels among depressed respondents show that slightly more females (85%) had mild depression than males (73%) (Figure 1). In comparison, more males (26.8%) than females (14.3%) showed moderate depression levels. However, these differences were not statistically significant (Table 1).

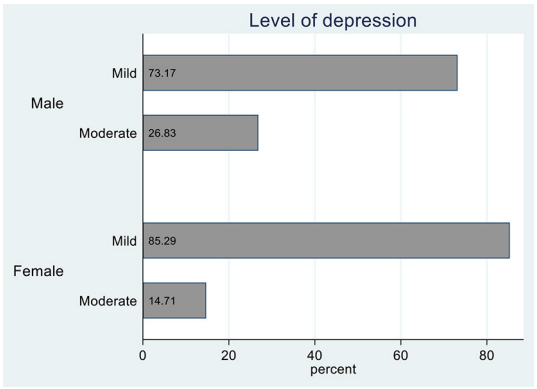

FIGURE 1
Depression levels segregated by gender.

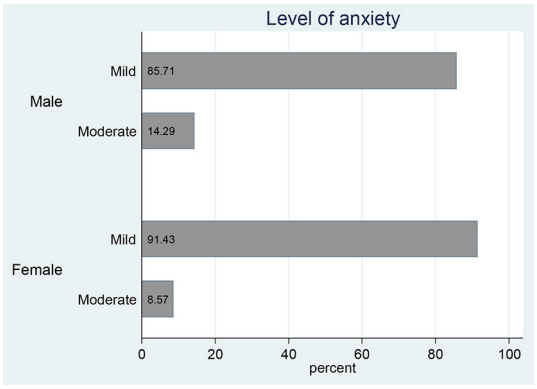

FIGURE 2
Anxiety levels segregated by gender.

There was one outlier, one female respondent, who depicted severe depression. The chi-square test results show that significantly more adolescents with secondary education (27%) were depressed than those with primary education (18%).

Multiple factors can explain these results, including school closures, disruption of socioeconomic routines, isolation, and concerns about several factors affecting families, including illness, loss of loved ones and economic impacts. For example, at a focus group discussion in Blantyre, respondents highlighted that COVID-19 had induced fear among family and community members. People had become uncertain about contacting others for fear of contracting or spreading COVID-19. Uncertainties like this and the inability to associate with familiar people may also be linked to anxiety.

The COVID-19 preventive measures counter most cultural and social practices—particularly social distancing and isolation. These measures necessitated the closure of schools, recreation facilities, entertainment places, places of worship and other places where people ordinarily gather. These places allow people to socialize, share experiences and unwind. Thus, one of the recurrent themes that have come up in the findings is anger among the participants. The adolescents reported having developed anger issues due to frustration over the preventive measures that were put in place. Due to the anger, some adolescents committed offenses against the preventative measure, particularly restricting socializing with others. For most adolescents, schools where most socialization happens, new friends are sought and made, but these places were closed, making the adolescents more frustrated. Some adolescents expressed anger toward COVID-19 for disturbing their way of living. During KIIs, some caregivers indicated that *"the adolescents were showing anger, especially when you advise them to observe coronavirus preventive measures such as wearing masks"* (KII Parent).

They also show that respondents had a sense of hopelessness and a lack of interest in social activities due to COVID-19. This led to a loss of hope for the future, as people were unsure if COVID-19 would ever be controlled and returned to their ordinary ways of living. This was expressed during a focus group discussion in Lilongwe: "*Yes, we feel hopeless because we fail to reach our desires regarding our education. Schools are being closed, which makes us doubt that our dreams will ever be fulfilled*" (FGD Lilongwe). Caregivers of adolescents observed that even after relaxing some COVID-19 measures, some adolescents found it challenging to re-adapt. One key informant said: *"Most of the adolescents have not yet returned to school. Most of those that have returned have shown little interest in school"* (KII Head Teacher).

COVID-19 and anxiety

The results indicate that approximately 21% of the respondents had anxiety (Table 1). In contrast to the depression outcome, the proportions of respondents with anxiety varied across different groups. For example, 19% of males and 23% of females reported anxiety symptoms, even though these proportions were not significantly different. The anxiety levels segregated by gender show that 85.7% of males and 91.4% of females had mild anxiety disorder symptoms (Figure 2). To a smaller extent, five males (14.3%) and three females (8.5%) reported moderate anxiety symptoms. The chi-square test results show that significantly more adolescents with secondary education (28%) had anxiety compared with those that had primary education (14%).

Anxiety was observed in the adolescents' statements stating they were no longer confident in their future. They explained that they were not motivated to pursue anything with uncertainties around them because the future was uncertain. Adolescents pointed out persistent rumors that the world would end; hence there was no point in doing anything, including going to school. In Malawi and elsewhere, one of the main

motivating factors for people to go to school is to prepare themselves for a better future—education provides life chances more than anything else. One adolescent during a focus group discussion in Karonga said, *"… many people are dying due to this virus, and it has no cure or treatment. So, the thought of coronavirus makes me think that the world is ending"* (FGD Karonga).

Adolescents' anxiety is also manifested through fear. The participants were so fearful of contracting the virus, stating that they were not ready to die. This fear emanated from experience as some lost family members and close friends to the COVID-19 pandemic. These first-hand experiences heightened concerns from the rumors that the world was ending. The stories had cultural resonance, particularly those that people hold dear. For example, participants said there were rumors that those who got the COVID-19 vaccine would never have children. Failure to have children in African communities, especially women, makes one a laughingstock of their community. Culturally, having children is the ultimate goal.

The other fear was the isolation one had to go through if one ever tested positive for COVID-19. They were terrified of being separated from their family members, making them feel like they were not loved, even so, that family members could visit them to cheer them up, as is customary in African cultures. As one focus group participant in Mangochi narrated:

> *"When we hear about COVID-19, some people bring up the issue of 666 that is associated with the COVID-19 vaccine. They imply that the world is about to end. So, when people talk about the 666 signs, as a youth, I feel like I have no future, mainly in education. I feel it will be meaningless even if I go to school since the earth will end soon"* (FGD Mangochi).

The adolescents also expressed reduced levels of concentration. Most participants said that they regularly had sleepless nights. This was due to fear of the likelihood of contracting the virus during the day and anxiety about what the next day would bring. This contributed to fatigue, which led lack of concentration the next day and poor performance in various activities. For example, focus group participants in Lilongwe said:

> *"There are other times we spent sleepless nights thinking of the coronavirus. When I went to sleep, I would start thinking about my day and all the people I interacted with. This would be worse if I noticed that I coughed at any point. This led to spending the whole night without sometimes sleeping"* (FGD Lilongwe).

We further looked at the relationship between anxiety and depression. The regression results showed that adolescents with anxiety were 18 [95%CI: 9.34, 35.8] times more likely to have depression compared to those who did not have anxiety. The regression model was adjusted for gender, age, education level and district of residence, and none of these variables significantly impacted the outcome.

COVID-19, mental health, and related effect

The pandemic has also taken a toll on the education of adolescents. One of the teachers expressed concern about the pandemic's adverse effects on adolescents' schooling. In her explanation, she said;

> *"COVID-19 pandemic has caused many problems in the lives of many youths. For instance, due to the school closure, many students, especially the standard eight female students who registered to write their final exams, dropped out of school because they were pregnant. On top of that, even after the schools were opened, many students had little interest in school, resulting in poor performance in examinations"* (KII Parent).

One of the key informants expressed concern that the pandemic made the students consider school useless. This was because schools kept being closed and re-opened. This view is reflected by one of the adolescents who said the following after being asked how the pandemic had affected her: *My life changed when I started hearing about COVID-19. First, my education was affected because I lost interest and stopped working hard (FGD 2).*

When asked how COVID-19 had affected the lives of adolescents, they expressed their frustration with how much damage COVID-19 did financially. One respondent said:

> *"With the measures put in place, life has not been the same; we are restricted from public gatherings, and businesses are not operating as they used to. This has also impacted our parents financially. They are having difficulties paying our school fees"* (FGD Karonga).

As presented above, anxiety, depression and stress were commonly reported experiences among adolescents during COVID-19. However, participants expressed that none of them sought mental health help. The headmasters, teachers, and guardians interviewed also said that they had not offered mental health guidance to adolescents under their care, as expressed by a headteacher in Lilongwe; "We must be honest; we do not have any mental health programs set aside." Further, they expressed a lack of knowledge on identifying mental health cases. Through experience, they notice mental health cases; however, they claim to have received no formal or systematic training on mental health.

The lack of seeking mental health services may also be related to the community's perception of mental health. A faith leader expressed that many communities in this country still do not take mental health issues seriously. He stressed that mental

health patients are often ignored because mental health issues are not regarded as problems. When asked why this was the case, the Faith Leader (Karonga) explained that "a person ill with other diseases can easily be recognized by the symptoms they show, unlike a mental health patient." He further said that mental health issues are hard to be recognized by an ordinary person. One other reason associated with low mental health services utilization is stigmatization. A parent in Mangochi explained that "because of stigmatization, people may not want their mental health issues to be made known to others."

Discussion

The paper examined the effects of the COVID-19 pandemic on the mental health of adolescents in Malawi. The results show that many adolescents in Malawi experience signs and symptoms of mental health problems or disorders, mostly without knowing it. The lack of knowledge means that those affected could not seek help. The lack of adequate knowledge correlates with a study by Crabb et al. (40), which established a knowledge gap on mental health issues among Malawians. The lack of knowledge worsens the problems as it negatively affects help-seeking behavior among adolescents experiencing mental health problems in the country.

The lack of knowledge may emanate from the fact that mental illness is not openly discussed In Malawi, in the same way as other illnesses, such as Tuberculosis, which means most people lack basic knowledge about mental illness. The lack of knowledge leads to misconceptions, falsehoods and misinformation about mental health, which may lead to stigma and discrimination against people with mental illness. For instance, if one is unaware of the causes of mental health problems and that mental health matters the same way physical health does, one may feel isolated and misunderstood by society. Furthermore, people with wrong perceptions and beliefs about people with mental illnesses tend to judge and treat them from a place of ignorance. As Crabb et al. (40) discussed, these are some of the reasons many cases of mental illnesses in Sub-Saharan Africa are treated are either ignored or treated punitively.

The study also indicates that a good percentage of adolescents experienced anxiety. However, when anxiety is left untreated, it can have long-term consequences that can lead to impairment in daily life. Anxiety disorder can manifest in different ways, including; poor performance in school, behavioral problems, dropping out of school, poor self-worth, low self-esteem, teen pregnancy, missing out on social engagements, substance use, and abuse. Comparatively, females showed a higher percentage of anxiety symptoms than males. This is consistent with several studies on gender differences in different anxiety disorders. According to Hou et al. (41), females suffer from anxiety more than males and are diagnosed with the most anxiety disorders. Studies have consistently shown that one of the factors contributing to this is that males have better resilience to stress than females.

Another way COVID-19 may have affected adolescents' mental health was through depression. Just like the case of anxiety, slightly more females showed symptoms of depression than males. This may be because, in African societies, females are the primary caregivers and home keepers and are at greater risk for psychological problems than their male counterparts (41). They found that the overall prevalence of mental disorders was 5.9% and was higher in males (7.1%) than in females (4.7%). Hence, more research is needed in sub-Saharan Africa to understand the scale of adolescent mental health problems (12). In addition, untreated depression may lead to adverse effects. People who suffer from depression may end up experiencing low self-esteem, alcoholism, substance abuse, academic problems, difficulty maintaining relationships, social isolation, self-harming behaviors, and Suicide. Another study on a Chinese population during the COVID-19 epidemic showed more depression and severe anxiety symptoms in females than males (41). However, these results are contrary to Matandika et al. (12). Matandika et al. (12) found that the prevalence of mental disorders was higher in males than in females. Hence, more research is needed in sub-Saharan Africa to understand the scale of adolescent mental health problems. These contrary results may be attributed to a difference in measurement tools in that Matandika et al. used a general tool for assessing mental health disorders and demographic characteristics of the sample in that Matandika's sample was primarily urban.

Recent studies have also shown that COVID-19 affect mental health outcomes such as anxiety, depression, and post-traumatic stress symptoms (42). One of the adverse effects of anxiety is that when it is above average, it weakens the body's immune system and consequently increases the risk of contracting the virus (6). Misinformation and flooding of COVID-19-related information on social media contributed to anxiety among adolescents. Information shared among adolescents during the pandemic may have contributed significantly to the anxiety they experienced. One common misinformation was that the world was coming to an end. Adolescents believed that COVID-19 was one of the signs that the world was coming to an end, hence. They experienced anxiety in different ways; whilst some adolescents experienced a lack of concentration, others were constantly afraid that something terrible would happen to them or their families, and yet others were apprehensive when someone they knew tested positive for COVID-19. The misinformation that the world is ending has resonance beyond COVID-19. Malawi is a hugely Christian nation in which most people are familiar with biblical tales such as the last days and the scourge of diseases that will appear on planet earth. This makes it easy for people to buy into misinformation about the world ending. Misinformation always takes cultural resonance, which is why it varies worldwide.

The pandemic took a toll on the education of adolescents as well. During the pandemic, young people lost interest in concentrating on their studies. Some believed that the world was ending, others anticipated that school would keep being open and closed, whilst others decided to invest their interest in other things like marriage or being pregnant. The COVID-19 pandemic worsened many pre-existing crises, including an education emergency that has resulted in high out-of-school rates, particularly among adolescents and young people. Despite Malawi not being under total national lockdown, young people experienced financial setbacks because schools were closed and social gatherings reduced to small numbers, and there was less time for interaction. Adolescents' most significant concerns during the COVID-19 crisis were disrupting their social interactions, losing their loved ones, contracting the virus, and not being able to complete their education and others.

All in all, the measures taken to ensure that the spread of the virus was reduced were the ones that caused more distress than the disease itself. Interestingly, results showed that significantly more secondary school adolescents were depressed than primary school adolescents. This may be explained by two contextual factors, knowledge and responsibility. First, higher education level is associated with comprehension. So, secondary school adolescents may have understood the dangers of COVID-19 more than primary school adolescents, which may have led to more depressive symptoms. Secondly, as age comes with more responsibilities in Africa, secondary school adolescents may have assumed different duties from the burden of the pandemic, hence more depressive symptoms.

The current study found a relationship between those who were depressed and those who had anxiety. This result is not surprising as research has shown that these mental health problems are very related and form comorbidities of each other. For instance, a study by Nwafor et al. (10) found high levels of depression (45.2%) and anxiety (37.5%) among pregnant women. Further, the study suspected that the prevalence of such disorders might have been aggravated during the coronavirus disease 2019 (COVID-19) pandemic because pregnant women may have experienced restricted access to mental health services (10).

The current study has shown that COVID-19 may have contributed to the mental health state of adolescents. This may be because adolescence is a transitional physical and psychological development stage, with social connection playing a fundamental role. To contain the spread of COVID-19, requirements like physical distancing were put in place. Unfortunately, this might have contributed to the absence of many regular sources of social connection in people's lives. The lack of these positive reinforcements may have caused adolescents to experience mood swings, over-eating etc., which are symptoms of depression and anxiety. Nevertheless, the COVID-19 pandemic may have contributed positively to adolescent mental health; during and after the pandemic, more adolescents have talked about mental health issues more freely than before (43). In addition, there has been a rise in mental health awareness campaigns and advocacy, and most importantly, many adolescents are now seeking mental health professional help.

Conclusion

Although adolescents are often overlooked in the COVID-19 discourse, as COVID-19 significantly affects older people, this study has found that COVID-19 involved adolescents as much as it affected the adult population. COVID-19 may have contributed to the mental health of adolescents in Malawi, although most of them were probably unaware of the signs and symptoms of depression and anxiety that they had. These signs emanated from COVID-19 preventive measures, especially social distancing and self-isolation, introduced by the Government to contain and control the spread of COVID-19. Although Malawi did not institute a national lockdown, unlike most African countries, self-isolation and social distancing inevitably led to the closure of schools and recreation facilities, which are familiar sources of social connection for adolescents. Further, these measures affected economic income leading to worries about survival and attainment of basic needs. Adolescents, although not homeowners, were equally affected by seeing their parents struggling to provide for them. The study's results also highlight contextual factors and experiences of adolescents during COVID-19 and how that affected their mental health. This study's findings significantly contribute to the current research on mental health among adolescents in Africa and Malawi. There are limited data and statistics on mental health and mental disorders in Africa; this study has contributed to the availability of mental health-related data.

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 University of Malawi Research Ethics Committee (UNIMAREC). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

CM, YN, JK, SN, FK, MM, and LM conceptualized the idea and reviewed the manuscript. CM, YN, and FK analyzed the data. CM, YN, and JK drafted the paper. All authors contributed to the article and approved the submitted version.

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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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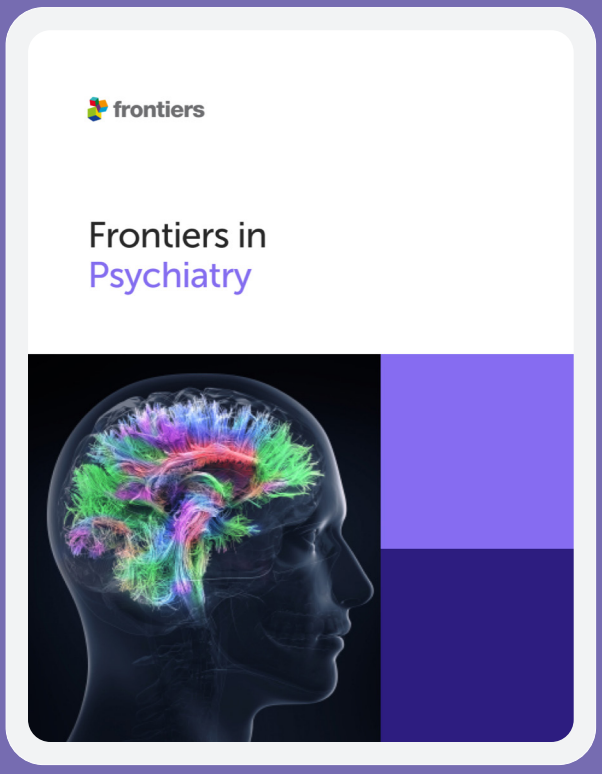

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