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Research paper

An investigation of mental health status of children and adolescents in China during the outbreak of COVID-19

Li Duang, Xiaojun Shaoa, Yuan Wangc, Yinglin Huangc, Junxiao Miaod, Xueping Yangd, Gang Zhua,e,⁎

a Department of Psychiatry, The First Affiliated Hospital of China Medical University, Shenyang 110001, China
b School of Nursing, Chengde Medical University, Chengde, Hebei 067000, China
c Department of Psychiatry, Shengjing Hospital of China Medical University, Shenyang 110020, China
d Department of Psychology, The People’s Hospital of Liaoning Province, Shenyang 110016, China
e Central Laboratory, The First Affiliated Hospital of China Medical University, Shenyang 110001, China

A B S T R A C T

Objective: The sudden outbreak of Coronavirus Disease 2019 (COVID-19) has had a dramatic impact on the mental health of the public. In the present study, we demonstrated the psychological effects on children and adolescents associated with the epidemic.

Methods: By using convenience sampling method, questionnaires, such as Spence Child Anxiety Scale, Child Depression Inventory and Coping style Scale, were distributed to participating 359 children and 3254 adolescents online.

Results: The anxiety levels of children and adolescents were (23.87 ± 15.79) and (29.27 ± 19.79), respectively. 22.28% respondents were suffering from depressive symptoms. Seven significant factors associated with increased levels of anxiety, including female, resident in urban regions, emotion-focused coping style. Nine factors associated with increased levels of depression, such as smartphone addiction (OR 1.411, 95% CI 1.099–1.180), Internet addiction (OR 1.844, 95% CI 1.209–2.811), and resident in Hubei province (OR 3.107, 95% CI 1.252–7.708). Two additional factors associated with decreased levels of depressive symptoms: hours spend on Internet per day before the epidemic (OR 0.652, 95% CI 0.609–0.697) and tendency to apply problem-focused coping style (OR 0.937, 95% CI 0.923–0.951).

Conclusion: Our findings indicate that the COVID-19 outbreak has had a significant psychological impact on children and adolescents. Findings of current levels of anxiety and depression not only highlight the need to address emotional distress for children and adolescents during the epidemic but also provide researchers with scientific fundamentals to formulate targeted interventions based on the significant influencing factors.

Introduction

Since the outbreak of the COVID-19 at the end of 2019, a series of effective epidemic preventive and control strategies have been developed and conducted by the Chinese government to curb the spread of the virus. The general public, especially the high-risk group (e.g., elderly people with chronic underlying diseases, children, and others with lower immunologic function), are suggested to stay indoors in quarantine at home, which is recognized as the best way to eliminate chances of being infected. However, due to the long period of separation from the outside world, the impact of multi-channel negative information, excessive fears of being infected, and even the shame and guilt for the infection, many people across China, particularly residents at the epicenter of the outbreak in Wuhan, are experiencing fear, loneliness, panic, anxiety and depression amid the coronavirus outbreak (Duan and Zhu, 2020; Xiang et al., 2020). These negative physical and psychological costs have also been reported in previous studies, such as suicide, substantial anger and sleep disorders (Barbisch et al., 2015; Rubin and Wessely, 2020; Wang et al., 2019). For children and adolescents, due to the lower incidence of infection and mortality than adults, professionals were less focusing on the unique clinical features of COVID-19 and mental health status in children (Ma et al., 2020). Furthermore, evidence has shown that children and adolescents who experienced disasters might suffer from greater stress and trauma because of the lack of development of proper emotional reactions and coping techniques (Lazarus PJ, 2003; Roussos et al., 2005). When emotional support and spiritual guidance from family members, teachers, as well as other significant peers and adults in their lives could not be met due to home confinement, deferred back-to-school and lifestyle changes, it adversely affected the mental health of children and adolescents (Sprang and Silman, 2013).

Additionally, according to the latest data from the China’s National Health Commission, the overall situation in the Chinese mainland is somewhat coming to a plateau (National Health Commission of China, 2020).
China, 2020a). The number of new confirmed cases has dropped dramatically, but authorities are warning that strict prevention measures should stay in place to prepare for a potential comeback of the virus. Therefore, in order to effectively cooperate with the government's epidemic prevention work, more than 220 million children and adolescents were confined at home and informed to postpone the start of the spring semester until further notice (Wang et al., 2020). Meanwhile, online studying courses which was delivered by TV broadcasts and the Internet have been opened gradually to students to guarantee their needs of learning, according to a guideline released by the China's Ministry of Education (Ministry of Education of China, 2020). However, due to lack of monitoring and evaluation of students participating in online courses, the inefficiency of the experience of these courses, unstable network signals, and often no networks in remote rural areas, many parents, students, and teachers have complained of the poor effectiveness of online learning. These effects can be compounded by adverse consequences of reduced vision, as well as unconscious smartphone/Internet addiction, and may further contribute to mental distress in children and adolescents.

Here, we assessed the current status of mental health issues among children and adolescents affected by the epidemic and analyzed its influencing factors to provide scientific guidance to psychological professionals and the government in formulating targeted policies.

Methods

Participants

This study was designed as a cross-sectional online questionnaire survey that was administered during the spread of COVID-19 in China. We developed the online questionnaires on the official website of “Questionnaire Star,” which is recognized as a professional online questionnaire survey, evaluation, and voting platform. A set of self-rating questionnaires were distributed to children and adolescents who ranged from Grade One in primary school to Grade Three in high school (aged from 7 to 18 years) in mainland China by employing convenient sampling method. With the help of directors in Education Bureau, we distribute e-questionnaires to teachers and told them the purpose, significance and announcements of this survey in details. Then, they assigned it to school-students and their guardians. Before completing questionnaires, all participants and their guardians were debriefed on the study purpose and contents. Once consented, participants began filling out the set of questionnaires online. We also included our email addresses and phone number to the first page of questionnaires so that participants could consult and interact with us at any time.

Measurements

The set of questionnaires involved in this study were mainly composed of seven sections.

- Sociodemographic characteristics were self-designed and included questions regarding sex, age, place of residence, number of siblings, region, family status, education level, and number of electronics owned.
- COVID-related questions were developed by our research team and assessed the current situation of the respondents’ family members involved in anti-epidemic work, the degree of concerns about the epidemic, the implementation of the precaution and control measures, the impact of the epidemic on their course of study and graduation, as well as the electronic products/Internet use patterns before and during the epidemic.
- The Chinese Version of Spence Child Anxiety Scale (SCAS) is a 44-item self-report Likert's scale that measures anxiety in children and adolescents (Zhao et al., 2012). Spence (Spence, 1997) first developed it by using community samples, and it has since been used widely in other countries (Essau et al., 2011). This study evaluated the anxiety status of participants affected by the epidemic on a 6-factor scale, including items such as separation anxiety, physical injury fear, social phobia, panic disorder, obsessive disorder, and generalized anxiety.
- The Child Depression Inventory (CDI) is a 27-item self-report measure designed to evaluate the severity of depressive symptoms in children and adolescents (Kovacs and Beck, 1977) and has demonstrated satisfactory levels of reliability and validity in the Chinese population (Wang et al., 2015). In general, the total score of CDI is 19 or higher can be identified as possessing clinical depressive symptoms, while scores of 12–18 indicate subclinical depression, and scores of 12 or lower are considered normal (Stewart and Sun, 2007). In this study, we classified respondents with clinical depressive symptoms with scores 19 or higher.
- The Short Version of Smartphone Addiction Scale (SV-SAS) is a 10-item self-rated developed by Kwon et al., 2013 and is recognized as a valid screening tool for the prevalence of smartphone addiction. It uses cut-off points by sex, where 31 and 33 classify “excessive smartphone uses in male and female users,” respectively.
- The Internet Addiction Scale (IAS) consists of 20 items derived from the DSM-IV-TR (Cooper, 2001) [Diagnostic and statistical manual of mental disorders (4th edition, text revised)] in order to identify diagnostic criteria of pathological gambling and the degree of pre-occupation and compulsiveness to go online. According to Young (Young, 1998), three types of Internet-user groups were identified as Internet addicts (scores of 70 or higher), possible Internet addicts (scores 40–69), and non-addict (39 or lower). In this study, we defined participants with Internet addiction with scores 70 or higher.
- The Coping Style Scale (CSS) was developed by Chen et al. in 2000 based on the theory of social interaction and self-regulation and measures middle school students’ competence in coping with stress (Chen et al., 2000; Folkman et al., 1986). This 36-item self-rate scale can be divided into two subscales of problem-focused coping and emotion-focused coping. The former consists of three dimensions, including solving problems, seeking social support, and positive rationalizations, while the later contains four dimensions, including endurance, avoidance, expressing emotions, and fantasy/denial.

Statistical analysis

All data were analyzed using SPSS (Version 18.0, SPSS Inc., Chicago). Apart from descriptive statistics and frequency analysis of demographic characteristics and COVID-related information, t-test and analysis of variance (ANOVA) were used to analyze the difference in levels of respondents’ anxiety. Moreover, multiple linear regression and bivariate logistic regression analyses were used to assess the association between outcome variables (the reported level of anxiety and clinical depressive symptom) and potential predictors (e.g. concerns related to the epidemic, smartphone/internet addiction, and coping style) while adjusting for other identified explanatory variables. In the process of running models, the forward stepwise selection algorithm was used, and variables in the model were screened based on significance levels of the Wald inclusion test statistic being less than 0.05. Moreover, Pearson’s correlation analysis was performed to analyze the associations among SCAS, CDI, smartphone/internet addiction, and coping style, and the statistical significance level was set at 0.05.

Results

The sample size of our survey recruited online included 3613 Chinese students. As Table 1 shows, the study participants comprised 1812 males (50.15%) and 1801 females (49.85%) collected from 20 provinces in mainland China. However, considering that Hubei is the hardest-hit place of this epidemic, we classified the sample sources by residential areas, namely 27 (0.75%) in Hubei Province and 3586
Participants reported that the epidemic has affected their
implemented protective measures (e.g., wear mask, wash hands, or
most the same proportion (93.86%) reported that they have strictly
(0.55%) of the participants stated that their family members, friends, or
care professionals (e.g., frontline doctors and nurses). A total of 20
173 (4.71%) respondents reported that their family members were in-
26.99% (859/3183), followed by computer 30.19% (961/3183) and tablets
years, and the highest rate of smartphone penetration was 90.76%
tronics before 7-year-old. Furthermore, an in-depth analysis of 3183
respondents who possessed electronic devices showed that the average
age at which they started owning electronic devices was 12.14±2.66
Additionally, there were 128 (4.01%) respondents who already had elec-
tics before 7-year-old, whereas study, as the main reason for internet use, became more sig-
ificant during the epidemic. After conducting surveys on the will-
ingness to engage in medicine in the future, we found that more people
were a little uncertain after the outbreak.

After analyzing the information related to the epidemic (Table 2),
173 (4.71%) respondents reported that their family members were in-
volved in the anti-epidemic work, and 49 (28.32%) of them were health
care professionals (e.g., frontline doctors and nurses). A total of 20
(0.55%) of the participants stated that their family members, friends, or
other acquaintances had been infected with coronavirus. In all, 91.06% of
respondents clearly reported concerns about this epidemic, and also
almost the same proportion (93.86%) reported that they have strictly
implemented protective measures (e.g., wear mask, wash hands, or
avoid public places and crowds). Moreover, 1976 (54.69%) and 1288
(35.65%) participants reported that the epidemic has affected their
learning and graduation, respectively. Average time per day spent on
Internet during the epidemic was also much longer than before,
whereas study, as the main reason for internet use, became more sign-
ficant during the epidemic. After conducting surveys on the will-
ingness to engage in medicine in the future, we found that more people
(18.74%) were determined to work in healthcare than those (7.67%)
who were a little uncertain after the outbreak.
Abbreviation: SCAS, The Chinese Version of Spence Child Anxiety Scale; CSS, Coping Style Scale.

Among all respondents, 805 (22.28%) and 218 (6.03%) of them had scores above the threshold for clinical depressive symptoms (19 or higher) and Internet addiction (70 or higher). As for SAS, due to the gender differences in cutoff values for smartphone addiction, it was found that the prevalence rates of smartphone addiction in male and female respondents were 10.30% and 13.06%, respectively (Table 2). Additionally, as shown in Table 4, we analyzed the current situation of female respondents were 10.30% and 13.06%, respectively (Table 2).

Moreover, the level of respondents' clinical depressive symptoms in children and adolescents were significantly higher than those of children (F = 62.07, P < 0.01), and the total scores of SCAS for females were significantly higher than those of males (F = 10.59, P < 0.01). The anxiety levels of males and females in each group of children and adolescents are listed in Table 3.

In Table 4, results of ANOVA and t-test analyses showed that there were 18 variables had significant difference in SCAS scores (levels of anxiety) (P < 0.05). Additionally, in order to further analyze the significant factors associated with the level of respondent anxiety, we conducted multiple linear regression analysis and obtained the following factors to construct a multiple linear regression model of anxiety: clinical depression levels, implementation of the precaution and control measures, sex, family member or friend was infected with coronavirus, occupation of the mother involved in the epidemic, region (e.g., rural, urban), and emotion-focused coping style, which accounted for 31.0% of the total variance (Table 5).

As shown in Table 6, logistic regression analysis identified nine factors as being significantly associated with increased levels of respondents’ clinical depressive symptoms: smartphone addiction (OR 1.411, 95% CI 1.099–1.180), Internet addiction (OR 1.844, 95% CI 1.209–2.811), resident in Hubei province (OR 3.107, 95% CI 1.252–7.708) and urban areas (OR 1.324, 95% CI 1.025–1.709), family members or friends infected with coronavirus (OR 3.736, 95% CI 1.009–13.833), graduation affected by the epidemic (OR 1.310, 95% CI 1.019–1.685), levels of separation anxiety (OR 2.074, 95% CI 1.348–3.193), physical injury fear (OR 2.126, 95% CI 1.503–3.007), and emotion-focused coping style (OR 1.090, 95% CI 1.077–1.104). However, there were two factors significantly associated with decreased levels of clinical depressive symptoms: the average time per day spend on Internet before the epidemic (OR 0.652, 95% CI 0.609–0.697) and problem-focused coping style (OR 0.937, 95% CI 0.923–0.951).

Finally, results of Pearson’s correlation analysis revealed that the level of respondents’ anxiety (SCAS scores) was significantly positively correlated with clinical depressive symptoms (CDI scores) (r = 0.581, p < 0.01), smartphone addiction (r = 0.399, p < 0.01), Internet addiction (r = 0.441, p < 0.01) and emotion-focused coping style (r = 0.358, p < 0.01), but negatively correlated with problem-focused coping style (r = −0.0085, p < 0.01). Moreover, the level of respondents’ clinical depressive symptoms was significantly correlated with smartphone addiction (r = 0.398, p < 0.01), Internet addiction (r = 0.492, p < 0.01), problem-focused coping style (r = −0.343, p < 0.01), and emotion-focused coping style (r = 0.345, p < 0.01) (Table 7).

Discussion

Anxiety symptoms are the most common clinical diagnoses in children and adolescents and can act as a significant risk factor for contributing to other psychiatric disorders in adulthood. Moreover, it may worsen by facing the increasingly complex social milieu, and being a cause of impairments in various life domains and can increase societal costs for families (Bodden et al., 2008; Essau et al., 2008). Similarly, clinical depressive symptoms in children and adolescents are common and recurrent diseases associated with memory impairments (Günther et al., 2004), poor interpersonal relationships (Lam et al., 2003), and even high-risk suicidal behaviors (Yorbik et al., 2015). With the sudden outbreak and rapid spread of COVID-19 at the end of 2019, the mental health of children and adolescents in China has been put at risk. According to the results of our investigation, we found that levels of anxiety in children and adolescents during the epidemic were much higher than before (Zhao et al., 2012). As shown in Table 3, the overall scores of five dimensions (including separation anxiety, physical injury fear, social phobia, panic disorder, and generalized anxiety) were higher than before the outbreak, especially the fears of physical injury in children and social phobia in adolescents. This finding may be due to the fact that at the initial stage of the outbreak, protective and therapeutic responses were not yet in place, and the surge in the number of confirmed cases and deaths led children to become excessively concerned about physical damage to themselves and their family caused by exposure to coronavirus. In addition, Dong et al. (Dong et al., 1994) reported that Chinese adolescents demonstrated higher levels of social-evaluative fears than adolescents in western countries. Moreover, negative reports on domestic and foreign social media regarding COVID-related discrimination and unfair treatment of Chinese people, as well as rumors and misinformation around origins of the infectious disease may be an important reason for worsening their social phobia and other mental disorders (Calisher et al., 2020). The findings were in line with previous research indicating that anxiety, depression, and feelings of helplessness can be worsened by SARS-related social discrimination in public places (Zheng et al., 2005).

Having a family member or friend infected with coronavirus was also significantly associated with increases in anxiety levels. This may be due to the fact that respondents are concerned about the health of the infected and simultaneously afraid of being a suspected or confirmed case, given their level of direct contact. We suggest that the increased awareness of infection control in respondents is consistent with their psychological state of anxiety, thereby reducing the risk of infection. In traditional Chinese culture, fathers often assume the role of breadwinners, while mothers tend to perform the bulk of housework and childcare and have more emotional interaction with their children (Lee, 2002). This appeared to be an important factor affecting the
Table 4
Results of t-test/ANOVA analysis of the level of respondents’ anxiety during the outbreak of COVID-19 (N = 3613).

| Variables                                    | SCAS (± s) | t/F | P Value |
|----------------------------------------------|------------|-----|---------|
| Sex                                          |            |     |         |
| Male                                         | 25.18 ± 18.97 | 3.882 | 0.048   |
| Female                                       | 32.34 ± 19.36 |     |         |
| Age (years)                                  |            |     |         |
| 7–12                                         | 23.87 ± 15.79 | 23.955 | <0.001  |
| 13–18                                        | 29.57 ± 19.79 |     |         |
| Region                                       |            |     |         |
| Urban                                        | 31.08 ± 20.21 | 15.878 | <0.001  |
| Rural                                        | 26.41 ± 18.47 |     |         |
| Only child status                            |            |     |         |
| Yes                                          | 26.99 ± 18.82 | 4.535 | 0.033   |
| No                                           | 30.48 ± 20.01 |     |         |
| Family status                                |            |     |         |
| Nuclear family                               | 28.03 ± 19.15 | 4.433 | 0.004   |
| Extended family                              | 29.76 ± 20.23 |     |         |
| Single-parent family                         | 32.37 ± 20.17 |     |         |
| Etc. (e.g. step-families)                    | 30.75 ± 18.72 |     |         |
| Education level                              |            |     |         |
| Primary school                               | 22.71 ± 0.40 | 6.931 | <0.001  |
| Secondary school-fresh                       | 29.64 ± 20.05 |     |         |
| Secondary school-repeat                      | 32.04 ± 20.04 |     |         |
| High school-fresh                            | 28.31 ± 19.04 |     |         |
| High school-repeat                           | 26.00 ± 24.45 |     |         |
| Owning electronics devices                   |            |     |         |
| Yes, independently                           | 28.62 ± 19.25 | 7.710 | <0.001  |
| No                                           | 33.12 ± 21.67 |     |         |
| Other siblings                               |            |     |         |
| No                                           | 27.07 ± 19.53 |     |         |
| Occupation of the mother involved in anti-epidemic | | | |
| Medical personal                             | 19.31 ± 13.38 | 6.213 | 0.014   |
| Non-medical staff                            | 29.52 ± 20.81 |     |         |
| Family member or friend infected             |            |     |         |
| Yes                                          | 44.15 ± 34.89 | 28.027 | <0.001  |
| No                                           | 28.65 ± 19.35 |     |         |
| Degree of concern about the epidemic         |            |     |         |
| Very concerned                               | 36.75 ± 37.85 | 4.276 | 0.002   |
| Concerned                                    | 31.88 ± 20.75 |     |         |
| Average                                      | 28.93 ± 18.75 |     |         |
| Not concerned                                | 27.77 ± 19.50 |     |         |
| Very                                         | 26.20 ± 28.29 |     |         |
| Implementation of precaution and control measures | | | |
| Strictly enforced                            | 41.94 ± 33.08 | 6.718 | <0.001  |
| Sometimes                                    | 33.30 ± 20.43 |     |         |
| Occasionally                                 | 28.40 ± 19.30 |     |         |
| Never                                       | 18.50 ± 19.49 |     |         |
| Graduation affected by the epidemic          |            |     |         |
| Yes                                          | 32.86 ± 20.55 | 16.125 | <0.001  |
| No                                           | 26.45 ± 18.50 |     |         |
| Average time per day spent on Internet       |            |     |         |
| before the epidemic                          |            |     |         |
| ≤ 1 h                                        | 25.16 ± 18.49 | 32.790 | <0.001  |
| before the epidemic                          |            |     |         |
| ≤ 3 h                                        | 28.93 ± 18.56 |     |         |
| ≥ 5 h                                        | 32.57 ± 28.02 |     |         |
| Average time per day spent on Internet       |            |     |         |
| during the epidemic                          |            |     |         |
| ≤ 1 h                                        | 21.84 ± 18.02 | 32.790 | <0.001  |
| during the epidemic                          |            |     |         |
| ≤ 3 h                                        | 27.03 ± 18.04 |     |         |
| ≥ 5 h                                        | 29.07 ± 18.40 |     |         |
| Willingness to engage in medicine            |            |     |         |
| Always                                       | 27.79 ± 20.09 | 3.043 | 0.028   |
| A little uncertain after the outbreak        | 30.83 ± 19.88 |     |         |
| Very willingly after the outbreak            | 29.83 ± 18.93 |     |         |
| Never                                       | 28.89 ± 18.77 |     |         |
| Clinical depressive symptoms                 |            |     |         |
| Yes                                          | 46.84 ± 22.71 | 211.383 | <0.001  |
| No                                           | 23.54 ± 14.85 |     |         |
| Smartphone addiction                        |            |     |         |
| Yes                                          | 38.63 ± 21.80 | 43.228 | <0.001  |
| No                                           | 25.72 ± 17.67 |     |         |
| Internet addiction                           |            |     |         |
| Yes                                          | 47.20 ± 27.42 | 88.916 | <0.001  |
| No                                           | 27.55 ± 18.25 |     |         |

Abbreviation: SCAS, The Chinese Version of Spence Child Anxiety Scale.
The results of Pearson’s correlation analysis among the total scores of each assessment tool (r).

| Variables | SCAS | CDI | Smartphone addiction | Internet addiction | Problem-focused coping | Emotion-focused coping |
|-----------|------|-----|-----------------------|--------------------|------------------------|-----------------------|
| SCAS      | 1.000|     |                       |                    |                        |                       |
| CDI       | 0.581⁎ | 1.000|                       |                    |                        |                       |
| Smartphone addiction | 0.399⁎ | 0.398⁎ | 1.000 |                      |                        |                       |
| Internet addiction | 0.441⁎ | 0.492⁎ | 0.790⁎ | 1.000 |                        |                       |
| Problem-focused coping | −0.085⁎ | −0.343⁎ | −0.070⁎ | −0.126⁎ | 1.000 |                      |
| Emotion-focused coping | 0.358⁎ | 0.345⁎ | 0.411⁎ | 0.521⁎ | 0.145⁎ | 1.000 |

⁎ p < 0.01

NOTE: ‘r’ represents Pearson Correlation Coefficient. SCAS, the Chinese Version of Spence Child Anxiety Scale; CDI, the Child Depression Inventory.
Declaration of Competing Interest
None.

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Author Statement
No conflict of interest exits in the submission of this manuscript, and manuscript is approved by all authors for publication. I would like to declare on behalf of my co-authors that the work described was original research that has not been published previously.

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