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Research paper

Mental health concerns and network structures of psychological helpline help-seekers during the COVID-19 pandemic in China: Pandemic stage differences

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ABSTRACT

Background: The present study aimed to investigate the pandemic stage differences of mental health helpline help-seekers emotional responses, psychiatric symptoms, and related network structures during the COVID-19 pandemic in China.

Methods: The data was collected by a large-scale psychological helpline in response to the COVID-19 pandemic in mainland China. Counselor-reported information about the help-seekers pandemic-related emotional responses and psychiatric symptoms were recorded. A total of 26,870 callers’ data from February 28, 2020, to April 23, 2021, were collected in the present study. A linear probability model and network analysis were conducted to determine the differences in help-seekers mental health concerns and network structures between the pandemic stage I, from February 28, 2020, to April 28, 2020, N = 9821 and the regular prevention and control period stage II, from April 29, 2020, to April 23, 2021, N = 17,049.

Results: Results revealed that anger, sadness, and obsession symptoms increased in stage II while symptoms of anxiety, somatization, and feelings of fear and stress were relieved. The network analysis results demonstrated both stage I and II networks centered on anxiety firmly. In stage II, the connection between anxiety and hypochondria and fear’s strength centrality descended significantly.

Limitations: The mental health outcomes of callers only included the counselor-reported data.

Conclusions: The mental health concerns of helpline callers showed pandemic-related stage differences.

1. Introduction

The emergence of the COVID-19 pandemic has raised many mental health concerns worldwide (Pfefferbaum and North, 2020). COVID-19 symptoms, worry about being infected, economic pressure and social isolation have resulted in unprecedented mental problems such as anxiety, depression and trauma-related disorders (Luo et al., 2020). Meta-analyses have demonstrated that the prevalence of anxiety (6.33 % to 50.9 %), depression (14.6 % to 48.3 %), and post-traumatic stress symptoms (7 % to 53.8 %) is relatively high in the general population during the COVID-19 pandemic across various countries (Liu et al., 2021; Xiong et al., 2020). Longitudinal evidence also demonstrated that people’s mental health deteriorated after the pandemic. In a large-scale longitudinal survey conducted in the United Kingdom, researchers found that mental health had deteriorated compared with pre-COVID-19 trends by late April 2020 (Brunoni et al., 2021). The results are consistent with other longitudinal studies, which revealed that mental problems increased significantly at the start of the COVID-19 outbreak (Daly et al., 2020; Kim et al., 2021; Penner et al., 2021). Santomauro et al. (2021) directly related COVID-19 impact indicators to anxiety and depressive disorders by a meta-regression. They found that decreased human mobility and daily SARS-CoV-2 infection rate predicted increases in the prevalence of major depressive disorder and anxiety disorders, indicating that the COVID-19 pandemic had a negative impact on mental health. In contrast, persons with pre-existing mood disorders were at higher risk of COVID-19 hospitalization and death (Ceban et al.,...
There is mixed evidence despite the abundant research on pandemic-related deterioration in psychopathology. For instance, the results of Dutch longitudinal population-based surveys revealed no increase in the prevalence of anxiety and depression symptoms (van der Velden et al., 2022). Brunoni et al. (2021) evaluated the rates of common psychiatric symptoms and depressive, anxiety, and common anxiety disorders between pre-pandemic waves (i.e., 2008–2010, 2012–2014, and 2016–2018) and three pandemic assessments in 2020 (i.e., May–July, July–September, and October–December) based on a Brazilian longitudinal study. They found no consistent evidence of the increasing prevalence of mental disorders, and the psychiatric symptoms slightly decreased in 2020. One possible reason is that the impacts of COVID-19 on mental health are different in various countries, which may be influenced by government responses (Lee et al., 2021; Wang et al., 2021). Moreover, the influences of the pandemic may be changeable over time. A recent meta-analysis of longitudinal cohort studies showed an overall increase in mental health symptoms observed during March–April 2020 that significantly declined over time and became non-significant compared with pre-pandemic levels (May–July) (Robinson et al., 2022).

This result may represent an acute and normal response of the help-seekers to an unforeseen and distressing traumatic event, followed by a period of psychological adaptation and recovery (Robinson and Daly, 2021). However, it’s noted that the changes in symptoms over time vary depending on the type of mental health concerns. For example, in contrast to anxiety and general mental health, increases in depression and mood disorder symptoms after the pandemic tended to be larger and remained significantly elevated in the late pandemic (Robinson et al., 2022). Renaud-Char est et al. (2021) also found a high frequency of clinically significant depression and depressive symptoms associated with post-COVID-19 syndrome following recovery from COVID-19 for >12 weeks. Consistently, another longitudinal survey in April and September 2020 showed that depressive symptoms and suicidal thoughts and behaviors increased significantly, but acute stress symptoms decreased over time (Veldhuis et al., 2021). This indicates the change in symptoms over time varies depending on the type of mental health concerns.

Nevertheless, Robinson and Daly (2021) observed a high degree of unexplained heterogeneity among the studies investigating mental health changes during the COVID-19 pandemic. Besides, most previous research only focused on the individual changes in several mental health symptoms or emotional responses and ignored the interconnections among symptoms and emotions. C. Wang et al. (2020), J. Wang et al. (2020), and Y. Wang et al. (2020) conducted a network analysis across anxiety and depression symptoms during the outbreak and the after-peak stages. They found that psychomotor symptoms had high centrality in both stages and irritability and loss of energy played an essential role in the network after the pandemic’s peak, indicating some possible changes of interconnections among symptoms with stages. Therefore, more research is needed to determine the progress of various mental problems and the overall psychological structures with the development of the COVID-19 pandemic, which is vital to understanding the public’s mental health concerns integrally and applying proper mental health care in various stages of the COVID-19 pandemic.

Recent research has demonstrated that psychological helplines are effective sources of real-time information on public mental health (Brüllhart et al., 2021; Brüllhart and Lalive, 2020). Due to the easy availability and low cost, the helplines have been widely applied in response to the COVID-19 pandemic in many countries (Bu et al., 2021; Choi and Ko, 2020; Presti et al., 2020; J. Wang et al., 2020). Brüllhart et al. (2021) collected data on 8 million calls from 19 countries, focusing on the change in total call volumes and call topics. They found that the call volumes exceeded the pre-pandemic level by 35%, and the increase was driven mainly by fear, loneliness, and concerns about physical health. However, this study only compared the call volumes and topics before and after the pandemic without tracking the changes in different stages and capturing the interconnections among callers’ emotional responses and symptoms.

Network theory proposes that symptoms should be conceptualized as mutually interacting and reinforcing components of a complex network rather than a common latent factor (Borsboom and Cramer, 2013). Compared with traditional methods, the network approach is good at analyzing and visualizing complex relationships among psychopathology symptoms (McNally, 2021). In addition, network analysis is particularly useful for finding the main symptom, which has the strongest overall connectivity with other symptoms in a network. The central symptom may have a more significant influence on the system than the peripheral symptoms (Levinson et al., 2017). To sum up, it’s necessary to investigate the changes in mental health help-seekers’ symptoms or emotions from a network perspective.

As the first country to respond to the pandemic that was still in its early stages, China showed typical features of pandemic-related mental health. During the initial phase of the COVID-19 outbreak in China, more than half of the respondents rated the psychological impact as moderate-to-severe, and about one-third reported moderate-to-severe anxiety (C. Wang et al., 2020). Especially, COVID-19 and psychiatric patients had higher levels of depression, anxiety and stress, also higher acceptance and willingness to pay for the COVID-19 vaccine than healthy controls (Hao, Tam, et al., 2020; Hao, Tan, et al., 2020; Hao et al., 2021). A longitudinal study revealed a significant reduction in psychological impact 4 weeks after the COVID-19 outbreak. Returning to work had not caused a high level of psychiatric symptoms in the workforce following the recovery from COVID-19 (Tan et al., 2020). However, more research is needed on the changes in specific psychiatric symptoms and network structures, for persons with mental problems, particularly.

The present study utilized extensive sample data collected from a psychological helpline in response to the COVID-19 pandemic in China to explore the changes in callers’ emotional reactions and psychiatric symptoms from the early pandemic to the stage of regular prevention and control. A linear probability model was used to explore individual emotion and symptom changes across stages. Additionally, network analysis was utilized to investigate the relationship changes among emotions and symptoms with time.

2. Methods

2.1. Data collection

The data was collected by The Ministry of Education-Central China Normal University (MOE-CCNU) Mental Health Service Platform, which was established and guided by the Ministry of Education in China. The platform was formally built on 24th February 2020 in Wuhan and provided free psychological support to the public, especially the medical staff, patients and their relatives, police officers, and security professionals. The MOE-CCNU platform also offered counselors training and professional supervision. See Zhao et al. (2020) for more details about the platform.

A total of 1968 professional mental health counselors and 133 registered supervisors from universities and institutions were recruited based on qualifications from 4492 candidate volunteers. The Inclusion criteria for counselors include (1) having counseling-related qualification certificates; (2) having professional study and training, adequate counseling experience (over 200 h) and supervised experience; (3) engaging in counseling works at the moment. Most counselors were female (79.07%). They all had ethics training, and most had training about trauma and crisis intervention (96.7%). The counselors were well-experienced in counseling (>2000 h: 35.25%, 1000–1999 h: 27.66%, 500–999 h: 28.56%, 300–499 h: 7.28%, <300 h: 0.24%). Most of them were aged 40–49 (38.07%) and 30–39 (37.70%), following those over 50 years old (20.26%).
Each time the counselor ended a conversation with a help-seeker, they got an internet link to questionnaires to record the caller’s information. Except for the primary demographic data of age, gender, and identities, the counselors were asked about the callers’ direct emotional responses and psychiatric symptoms. Eight common emotional reactions (including anger, hopelessness, guilt, sadness, stress, fatigue, fear, worry) and six types of psychiatric symptoms (including obsession, insomnia, somatization, depression, anxiety, hypochondria) were contained in the questionnaires. Each emotion or symptom was treated as a forced binary item with two choices (0 = No related, 1 = Related). Binary questions were common in psychopathology measurements with simplicity, stability, and validity (Dolnicar et al., 2011; Rothaug et al., 2013). We used Kuder and Richardson Formula 20 (KR-20) to evaluate the reliability of the binary measurements (Carey and Gottessman, 1978). The KR-20 was 0.70 in the present study, representing a reasonable internal consistency reliability level.

According to the whitepaper titled “Fighting COVID-19: China in Action,” published by China’s State Council Information Office on June 7, 2020 (State Council of The People’s Republic of China, n.d.), during the period from December 27, 2019, to April 28, 2020, China was in a challenging and critical battle with the COVID-19 pandemic and had an initial victory. Since April 29, 2020, China has entered the stage of regular prevention and control. Only sporadic cases were reported on the mainland, and inbound cases were generally under control. The positive momentum in COVID-19 control has thus been locked in, and nationwide virus control was being conducted on an ongoing basis. China has made vigorous efforts to resume work and reopen schools. Therefore, we divided the helpline calls into two stages. Stage I was the pandemic period (from February 28, 2020, to April 28, 2020), and stage II (from April 29, 2020, to April 23, 2021) referred to the regular prevention and control period. In sum, a total of 26,870 callers’ data was included in the present study (62.90 % female). We excluded the data so in this study, we will mainly report the results of strength and closeness and betweenness will be presented in the supplementary materials. The centrality metrics were calculated by the qgraph package (Epskamp et al., 2021). (4) Group comparisons. We used Network Comparison Test (Van Borkulo et al., 2022) to investigate the differences between the stage I and the stage II networks. This technique assesses the differences in global connectivity and local edges between two networks. (5) Estimate accuracy and stability of networks. Firstly, we conducted non-parametric bootstrapping with 2000 samples to estimate the accuracy of edge-weights by drawing bootstrapped Cs. Secondly, we investigate the stability of centrality indices by case-dropping subset bootstrap with 2000 iterations. We used the correlation stability coefficient (CS-coefficient), a quantified metric, to measure the stability of centrality indices. The previous simulation study showed that a CS-coefficient above 0.25 indicated good centrality stability, and above 0.50 was preferable. The accuracy and stability analyses were also conducted in the bootnet package. All the analysis was performed in R 4.0.2 (R Core Team, 2020).

3. Results

3.1. The changes in callers’ emotional responses and psychiatric symptoms

The results of the linear probability model are shown in Table 1 and illustrated in Fig. 1. The emotional responses of anger (coefficient = 0.084, 95%CI: 0.068, 0.099, p < 0.001), sadness (coefficient = 0.061, 95%CI: 0.046, 0.076, p < 0.001), and symptoms of obsession (coefficient = 0.011, 95%CI: 0.003, 0.019, p < 0.01) increased significantly in stage II compared to stage I. While symptoms of anxiety (coefficient = −0.097, 95%CI: −0.117, −0.077, p < 0.01) decreased significantly.

| Outcome       | Coefficients | SD   | 95 % CI | t    | p     |
|---------------|--------------|------|---------|------|-------|
| Emotional responses |              |      |         |      |       |
| Anger         | 0.084        | 0.008| 0.068, 0.099 | 10.686 | <0.001|
| Hopelessness  | 0.006        | 0.006| −0.005, 0.018 | 1.144 | 0.257 |
| Guilt         | 0.001        | 0.005| −0.009, 0.012 | 0.288 | 0.774 |
| Sadness       | 0.061        | 0.008| 0.046, 0.076 | 8.066 | <0.001|
| Stress        | −0.031       | 0.006| −0.044, 0.019 | −5.000 | <0.001|
| Fatigue       | 0.006        | 0.006| −0.006, 0.018 | 1.005 | 0.319 |
| Fear          | −0.051       | 0.007| −0.065, 0.037 | −7.104 | <0.001|
| Worry         | 0.001        | 0.009| −0.016, 0.018 | 0.156 | 0.876 |
| Psychiatric symptoms |              |      |         |      |       |
| Obsession     | 0.011        | 0.004| 0.003, 0.019 | 2.851 | <0.01 |
| Insomnia      | 0.006        | 0.005| −0.005, 0.016 | 1.033 | 0.306 |
| Somatization  | −0.029       | 0.004| −0.037, −0.021 | −7.376 | <0.001|
| Depression    | −0.016       | 0.011| −0.037, 0.006 | −1.464 | 0.149 |
| Anxiety       | −0.097       | 0.010| −0.117, −0.077 | −9.572 | <0.001|
| Hypochondria  | −0.005       | 0.006| −0.016, 0.006 | −0.894 | 0.375 |
to 0.38, showing no very high overlaps between variables (see Supplementary Material, Table 1). The psychological networks of subgroups and total samples are displayed in Fig. 2(a)–(c). The stages I, II, and entire networks showed relatively consistent psychological structures of help seekers, including two hubs (Depression centered and anxiety-fear centered). Edge weights ranged from $-0.78$ (worry – anger) to $1.76$ (fear – hypochondria) in the stage I network. Edge weights ranged from $-0.86$ (worry – anger) to $1.65$ (worry – anxiety) in the stage II network.

The centrality indices of the networks are shown in Fig. 3. Anxiety is the most vital center of emotional responses and psychiatric symptoms, with the highest strength, betweenness, and closeness in stage I or II (see Supplementary Material, Fig. 1). The global invariance test within the

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NCT procedure demonstrated no significant difference in global connectivity between stage I and stage II networks (Estimate = 4.42, p = 0.158). The local edge of hypochondria-anxiety had the maximum differences between stage I and stage II networks, showing decreasing connection over time (Estimate = 0.74, p < 0.05). Besides, the strength centrality of fear is more prominent in stage I than that in stage II (p < 0.001) (see Supplementary Material, Table 2).

Bootstrapped edge weights CIs are drawn in Fig. 4. The weak overlaps of weights CIs among edges indicated stable networks. Besides, the CS-coefficients were 0.67 and 0.75 for stage I and stage II networks, respectively. Results also revealed good stability of the networks (see Supplementary Material, Fig. 2).

4. Discussion

The present study tracked the changes in large-sample psychological helpline callers’ mental health concerns over time in China. Various pandemic-related emotional responses, psychiatric symptoms, and inter-connections were captured, revealing a more comprehensive picture of the callers’ mental health concerns in different stages of the COVID-19 pandemic.

4.1. The changes in callers’ various mental health concerns over stages

In line with previous research, the current results showed that callers’ anxiety, fear, stress, and somatization decreased over time (Bendau et al., 2021; Robinson et al., 2022). At the initial stage of the pandemic, most psychological helpline callers seek help to fight against the negative mental impacts of the COVID-19 crisis (Shakya, 2020; Zhao et al., 2020). The pandemic-related acute stress responses such as fear, anxiety, and somatization were the public’s primary mental health concerns, which triggered people to seek online mental health services (Humer et al., 2021; Usher et al., 2020). For instance, the share of calls related to ‘fear’ (including fear of infection) increased by 2.2 percentage points in Germany and by 2.7 percentage points in France after the outbreak of the COVID-19 pandemic (Brühlhart et al., 2021). As reported by some helpline psychological counselors, the most of the callers knew how to regulate their emotions, maintain an organized life, and receive support from their family and partner during the pandemic (Hervalejo et al., 2020). However, the pandemic-related acute stress responses wouldn’t last long. With psychological adaption and resilience, people would gradually recover from the crisis’s hit (Kimhi et al., 2020; Kaye-Kauderer et al., 2021). Additionally, the government’s success in managing pandemics could alleviate people’s stress (Lim et al., 2021; Malèsza and Kaczmarek, 2021).

Surprisingly, anger, sadness, and obsession increased over time. One possible reason is that when the country enters a stable stage of regular prevention and control, online mental health help-seekers may seek help for more common problems like love relationships and learning issues instead of pandemic-related problems (Wu et al., 2021). The emotions of anger and sadness are common reactions to these topics (Guerrero et al., 2008; Hughes, 1998). For obsession, a systematic review concluded that obsessive-compulsive symptoms worsened during the early stages of the pandemic (Guzick et al., 2021). In contrast to the current study, a longitudinal survey conducted in China with three measurement time points (February 7, March 25 and April 28, 2020) reported decreasing obsessive-compulsive symptoms over time (Jia et al., 2021). Another one-year follow-up study showed that the pandemic-related obsession symptoms, anxiety, and depression of obsessive-compulsive disorder patients persisted after one year (Liao et al., 2021). One explanation is that though the overall prevalence and obsession decreased with the easing pandemic, some people may maintain the symptoms. Obsession symptoms in a stable stage may lead to more distress, so these people may be more likely to seek help in the late phase of the pandemic.

Several emotional responses and psychiatric symptoms didn’t show significant changes across stages of the pandemic, including symptoms of depression, hypochondria, insomnia, and emotions of hopelessness, fatigue, worry and guilt. Acute stress may be relieved rapidly over time. Still, some chronic stress of COVID-19 would last longer because of the deterioration in the living environment with the economic crisis and unemployment caused by the pandemic (Borio, 2020; Polizzi et al., 2020). Robinson et al. (2022) also found that depression didn’t change significantly over time. China adopted the dynamic zero COVID-19 strategies, with sporadic cases rising and subsiding there (Liu et al., 2022). Thus, Chinese people may maintain higher sensitivity and stronger emotional reactions to the pandemic. Other common topics may cause these emotions and symptoms in the late stage of the pandemic except for pandemic-related problems. Therefore, though the negative pandemic-related impacts on mental health were relieved in the late stage, some mental health concerns were still pronounced because the callers were always biased toward the people with “problems.”

![Fig. 4. Bootstrapped CIs of edge weights.](image-url)
4.2. The psychological network structures of callers and stage differences

The psychological networks of the callers in stage I and stage II displayed similarities and differences. Anxiety had the highest centrality, strongly linked to other emotional responses and psychiatric symptoms in stage I or II. Taylor et al. (2020) conducted a network analysis of COVID-19-related worry, avoidance, and coping and found that concerns about the dangerousness of COVID-19 formed the core of the previously identified COVID Stress Syndrome. Another study also revealed that anxiety was the most central problem among anxiety, depression, subjective well-being, and academic performance among students with COVID-19-infected relatives (Ventura-León et al., 2022). Considerable research has reported that anxiety was the most prevalent mental problem during the COVID-19 pandemic (Saeed et al., 2022). And anxiety showed high comorbidity with a lot of mental disorders such as depression (Galyamina et al., 2017; Pollack, 2005), obsessive-compulsive disorder (Renna et al., 2018), and somatization disorder (Meuret et al., 2020), so it’s easy to understand its high centrality among psychological networks. Furthermore, our study indicated that the strength centrality of anxiety in callers didn’t change significantly over time. Despite the mitigation of the pandemic, people with anxiety may tend to seek help than people with depression due to the clinical features (Rones et al., 2005).

However, the stage I and II networks were somewhat different. The relationship between anxiety and hypochondria became weaker over time. As the first hit of the COVID-19 pandemic, China was confronted with more stress and uncertainty in the initial stage. High-level health anxiety triggered hypochondria before the disease was well-known and controlled effectively (Sauer et al., 2020). In the regular prevention and control stage, the risk of infection has been dramatically reduced, thus weakening the association between anxiety and hypochondria. In addition, it’s seen that the fear had lower strength centrality among emotional responses and psychiatric symptoms in stage II, indicating that the people may have recovered from the initial fear of the pandemic over time, which can be supported by a previous study (Mertens et al., 2020). The previous survey collected data from 34 countries and found that fear steadily decreased after a peak in April 2020 (Mertens et al., 2020). Fear is an evolutionary adaptive emotion that protects people from harm. Once a threat diminishes, fear dissipates as well.

4.3. Strengths and limitations

The present study has several strengths that are worth noting. Firstly, the psychological helpline data is a vital and valuable source to reflect the public’s mental health concerns in a natural setting (Brühlhart et al., 2021). Despite numerous research on mental health during the COVID-19 pandemic, few work insights the helpline callers. Compared with previous studies on helplines (Brühlhart et al., 2021; Brühlhart and Lalive, 2020), we captured more emotional responses and psychiatric symptoms of the callers and explored the changes in mental health concerns between the pandemic stage and following sound stage of the COVID-19 pandemic, which can help better understand the COVID-19 impacts. Besides, we focused on the individual mental health concerns of the participants. This study didn’t track the same participants’ changes in mental health concerns. It should acknowledge that network analyses do not define the causal relationship between emotions and symptoms. Moreover, we didn’t measure to what extent the emotional responses or psychiatric symptoms were caused by the pandemic, so inferences drawn from this study should be cautious. Nevertheless, the helpline data could reflect the natural psychological needs of the public during the COVID-19 pandemic. Finally, although multiple psychiatric symptoms and emotional responses were investigated in the present study, other essential constructs like pandemic-related burn out, should be further researched in future work (Lau et al., 2022).

5. Conclusions

The present study investigated the changes in callers’ mental health concerns during the COVID-19 pandemic from the perspective of the helpline, providing valuable insights into how callers’ emotional responses and psychiatric symptoms change over time. The results suggested that callers’ acute stress responses, such as anxiety, fear, stress and somatization decreased while emotions of anger, sadness, and obsession symptoms increased over time. Other chronic reactions, including symptoms of depression, hypochondria, insomnia, and emotions of hopelessness, fatigue, worry, guilt, lasted in the late stage of the pandemic. The high strength centrality and high connectedness of anxiety in stages I and II demonstrated that anxiety-related interventions are vital in helpline services. The decreased connections among anxiety and hypochondria and decreased strength centrality of fear suggested that pandemic-related health anxiety and fear are relieved over time.

CRediT authorship contribution statement

Liuza Lai and Zhihong Ren contributed to the manuscript’s concept, design, analysis, and writing. Jingqiang Tong contributed to the data collection and management process. Yu-Tao Xiang and Lin Zhang contributed to the revision of the manuscript.

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Conflict of Interest

All authors declare that they have no conflicts of interest.

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