Exploring the psychological impact of the 2022 SARS-CoV-2 Omicron variant outbreak in China

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INTRODUCTION

The impact of the coronavirus disease 2019 (COVID-19) pandemic in 2020 on mental health was substantial in China12 and various other countries.3 4 Beyond the direct consequences of COVID-19, the pandemic created an environment in which many determinants of mental health were affected. Issues associated with the pandemic, such as loss of livelihood, limited access to medical services, reduced social interactions, and economic downturn, could potentially have adverse effects on the population’s mental well-being.5 In November 2021, the World Health Organization (WHO) designated the new variant of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), variant B.1.1.529, as a variant of concern and named it Omicron; its rapid mutation and spread raised a new global health concern.6 The first wave of the Omicron outbreak in mainland China started in Shanghai in late February 2022.5 Subsequently, it led to a few small eruptions in several cities in China,7 despite multifaceted public health interventions. After evaluating the pathogenicity, immunity evasion, transmission of the virus, and possible consequences of the Omicron wave, the State Council of China lifted the strict virus control measures on December 7, 2022.8 The official release from attempting to control the epidemic rapidly ushered in the first widespread wave of Omicron, peaking within a month. The number of infected people across the country increased explosively.9 10 The pandemic’s evident impact on netizens’ health emphasised the need for up-to-date information on the prevalence of infectious symptoms and mental health effects. Unfortunately, the threat of future pandemics exists.11 Investigating the impact of epidemics, such as Omicron, and incorporating the findings in ways that inform health system responses has never been more urgent. However, there are few large-scale studies containing significant evidence to explain the effects of recent pandemics in large, widespread regions such as China. In January 2023, this study investigated the prevalence of the infectious illness and mental health-related symptoms among the general Chinese population during the nationwide Omicron outbreak using a self-reported, anonymous online survey. It calculated population-attributable fractions (PAF) of the Omicron wave of the COVID-19 pandemic for common mental health-related adverse effects. We hypothesised that the prevalence rates of infection, anxiety, depression, acute stress and insomnia symptoms in China would increase dramatically. However, we also contended that the potential for preventing mental disorders during pandemics in China was considerable.

METHODS

Study design and participants

Figure 1 shows the flowchart of study participants. We used market research sampling to conduct a cross-sectional anonymous
online survey. An invitation sought online adult volunteers from throughout China to participate in the study to evaluate the effects of the recent nationwide Omicron variant spread on respondents’ daily lives and mental health status. A quick response code linking the online questionnaire was released to the public accounts of WeChat and QQ—two of China’s largest online social platforms—during January 2–9, 2023. Necessary explanations and guidance about the form completion and survey process (ie, information about confidentiality) were provided before the survey began. The inclusion criteria were (1) age >16 years, (2) Chinese resident living in mainland China and (3) willingness to complete the survey. The exclusion criterion was a history of psychotic disorders diagnosed at a medical institution. Written informed consent was obtained online before the respondents completed the questionnaire.

Self-measurement and procedures
Participants were asked to complete a structured questionnaire with six sections: (1) sociodemographic characteristics; (2) self-reported signs and symptoms of the COVID-19 infection and current clinical status; (3) worries about the infection, re-infection and the sequelae of the illness; (4) the impact of the pandemic on quality of life, accessibility to medical services and social interactions; (5) an evaluation of common mental health-related symptoms—namely anxiety, depression and stress—in the past 2 weeks as measured by the Chinese versions of Generalised Anxiety Disorder-7 Scale (GAD-7), Patient Health Questionnaire-9 (PHQ-9) and Perceived Stress Scale-10 (PSS-10), respectively and (6) an assessment of sleep problems as evaluated by the Pittsburgh Sleep Quality Index (PSQI). Notably, the instruments used in this survey offer clinicians self-administered screening and diagnostic tools for mental health disorders and have been tested in clinical settings with many comparable prepandemic estimates. Detailed information about these scales is provided in the online supplemental material.

Statistical analysis
Statistical analyses were performed using SPSS statistical software V.26 (SPSS, IBM, Armonk, New York, USA). The distribution of participant characteristics was described. Chi-square tests were used to assess the prevalence of anxiety, depression, acute stress and insomnia in the total sample, along with demographic characteristics and pandemic-related factors. Furthermore, logistic regression models were used to examine the possible correlates of the four types of mental health-related symptoms. The odds ratio (OR) and 95% confidence interval (CI) were determined. Additionally, we used OR estimates from this survey data to calculate PAF for six Omicron wave-related factors. PAF calculates the proportion of psychological symptoms that would not occur in a population if each risk factor was to be eliminated. The weighted PAF indicates the contribution of each pandemic factor to the overall PAF after adjusting for communality (ie, overlap between risk factors). We used these values to calculate the overall weighted PAF for the four types of mental health-related symptoms. The significance level was set at p<0.05. We used the Bonferroni method to correct the p values for analyses of more than one primary outcome.

RESULTS
Characteristics of participants
Overall, 95009 individuals visited the survey webpage by WeChat and QQ platforms during January 2–9 2023, and 69926 individuals provided informed consent and proceeded with the survey, with a response rate of 73.6%. We excluded 38670 individuals in the analysis phase, among whom 28868 had missing data; 3175 were from...
Hong Kong, Taiwan, Macao or overseas; 4992 spent less than 2 minutes or more than 15 minutes answering the questionnaire and 1635 duplicated answers or used the same IP addresses (figure 1). The study finally included 31256 eligible participants from all over China, including the 4 municipalities, 22 provinces, and 5 autonomous regions of mainland China: 28940 (92.6%) were aged 19–50 years, 16885 (53.9%) were female, and 25384 (81.2%) had college education or above. Of the total, 8192 (26.2%) were worried about a viral infection or re-infection, and 9732 (31.1%) were worried about the COVID-19 sequelae. Additionally, 9562 (30.6%), 9622 (30.8%) and 9979 (31.9%) perceived the pandemic had greatly impacted their quality of life, medical accessibility and social interactions, respectively. Moreover, 24893 (79.6%) participants self-reported having been infected by the virus, while 6363 (20.4%) reported having had no infection (online supplemental table 1). We categorised the 16 typical self-reported infection symptoms into five types according to organs and systems, and supplementary table 2 shows the rates of them (online supplemental file 2). The prevalence of moderate-to-severe symptoms for the four mental health conditions in the sample was 25.9% for anxiety, 36.9% for depression, 13.6% for acute stress and 56.6% for insomnia (online supplemental table 3).

Impact of the related factors of the Omicron wave of COVID-19 on anxiety, depression, acute stress and insomnia symptoms

We estimated the PAF of six factors—actively infected with the Omicron variant of the SARS-CoV-2 virus, worried about becoming infected, re-infection and the sequelae of the infection, the impact on quality of life, medical accessibility and social interactions—related to the Omicron wave of the COVID-19 pandemic for the four mental health-related symptoms based on the ORs listed in online supplemental table 4. The proportion of anxiety, depression, acute stress, and insomnia symptoms that were theoretically attributed to the six pandemic factors—overall weighted PAF—was 21.9% (95% CI: 21.4% to 22.4%), 19.2% (95% CI: 18.8% to 19.6%), 18.1% (95% CI: 17.7% to 18.5%) and 10.7% (95% CI: 10.4% to 11.0%), respectively (figure 2A–D, table 1 and online supplemental table 5). Surprisingly and in contrast to other factors, having an active infection was not a risk factor with a weighted PAF of −10.8% (95% CI: −11.2% to −10.4%) for anxiety; −4.1% (95% CI: −4.3% to −3.9%) for depression; −2.8% (95% CI: −3.0% to −2.6%) for acute stress, and −0.5% (95% CI: −0.6% to −0.4%) for insomnia (table 1 and online supplemental table 5). Therefore, we did a sub-analysis to assess the ORs by clinical stage and frequency of infection (online supplemental table 6), showing that the participants who had recovered from the illness were less likely to have continuous anxiety (OR: 0.92, 95% CI: 0.85 to 0.98, p=0.01) or insomnia (OR: 0.94, 95% CI: 0.89 to 1.00, p=0.04) than those who were actively infected. Furthermore, people with a second infection were less likely to have symptoms of anxiety (OR: 0.88, 95% CI: 0.79 to 0.98, p=0.02), depression (OR: 0.79, 95% CI: 0.72 to 0.88, p=0.001) or insomnia (OR: 0.66, 95% CI: 0.60 to 0.73, p<0.001) than those with a first infection. Lastly, the correlation between the frequency and prevalence of acute stress was not statistically significant.

DISCUSSION

Main findings

In this nationwide survey, the prevalence of moderate-to-severe symptoms of anxiety, depression, acute stress and insomnia was 25.9%, 36.9%, 13.6%, and 56.6%, respectively. Notably, the prevalence of symptoms of anxiety and depression during the Omicron wave was twofold higher than during the first wave of the COVID-19 pandemic and eightfold higher than before the COVID-19 pandemic in China. Additionally, the prevalence of moderate-to-severe insomnia was ninefold higher than in the first wave of the COVID-19 pandemic. However, the prevalence of acute stress related to COVID-19 was lower than in a previous online survey in China; however,

Figure 2 The PAF for the impact of Omicron wave of the COVID-19-related factors on mental health in China. PAF calculates the proportion of psychological symptoms that would not occur in a population if each risk factor was to be eliminated. The weighted PAF indicates the contribution of each pandemic factor to the overall PAF after adjusting for communality (i.e., overlap between risk factors). PAF, population-attributable fractions.
the screening tools used in the two surveys differed. In our study, 21.9% of anxiety, 19.2% of depression, 18.1% of acute stress and 10.7% of insomnia were theoretically attributed to epidemic-related factors. Among individual epidemic-related factors, the PAF order from greatest to smallest was as follows: perceived impact on social interactions > impact on accessibility to medical services > impact on quality of life > worries about the sequelae > worries about active COVID-19-related infection or re-infection. Notably, being actively infected contributed to a reduced risk of adverse mental health-related outcomes, differing from previous survey findings in China but consistent with other studies. Recovery from an infection of the virus and possibly a re-infection may have contributed to the reduced risk. Together, these findings suggest a profile of the population’s response to the wide-ranging upheavals experienced during the Omicron outbreak and provide evidence for the increased prevalence of adverse mental health-related outcomes. These results, along with other studies, can inform population-level mental health management and intervention strategies when responding to epidemic outbreaks.

Before the COVID-19 outbreak, depressive and anxiety disorders were the leading contributors to the global mental health burden. In China, the 12-month prevalence rates of depressive and anxiety disorders in the general population were 3.6% and 5.0%, respectively. The COVID-19 pandemic in 2020 substantially increased the prevalence and burden of major mood disorders. The prevalence of anxiety, depression, acute stress and insomnia in China increased dramatically during the first wave of the COVID-19 pandemic. However, China’s first wave of the COVID-19 pandemic was mainly limited to Hubei Province, as aggressive non-pharmaceutical public health interventions abated it quickly in early 2020. Unlike that outbreak, the Omicron wave at the end of 2022 rapidly spread to the entire country, disrupting many aspects of life for the entire population within a short period of one month. This was unlike other countries and regions where peaks of the SARS-CoV-2 Omicron wave ranged from several months to years.

Therefore, the conditions in which the Chinese population was exposed to the Omicron variant differed from those in other countries and from the early pandemic conditions in China in early 2020. Our timely study during this wave suggests that the impact of the epidemic on the prevalence of major mental disorder symptoms was more substantial during the 2022–2023 outbreak than in 2020. We systematically demonstrated the risk of mental health consequences associated with pandemic factors and estimated the proportion of mental health outcomes attributable to six pandemic-related factors.

### Table 1 PAF for the Omicron wave of COVID-19-related factors for symptoms of anxiety, depression, acute stress and insomnia (n=31256)*

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Communalitv (%)</th>
<th>Anxiety† WPAF (%) (95% CI)</th>
<th>Depression‡ WPAF (%) (95% CI)</th>
<th>Acute stress§ WPAF (%) (95% CI)</th>
<th>Insomnia¶ WPAF (%) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actively infected with the Omicron variant of the SARS-CoV-2 virus</td>
<td>99.9</td>
<td>-10.8 (-11.2 to -10.4)</td>
<td>-4.1 (-4.3 to -3.9)</td>
<td>-2.8 (-3.0 to -2.6)</td>
<td>-0.5 (-0.6 to -0.4)</td>
</tr>
<tr>
<td>Worried about becoming infected or re-infection</td>
<td>78.2</td>
<td>3.3 (3.1 to 3.5)</td>
<td>2.1 (1.9 to 2.3)</td>
<td>2.2 (2.0 to 2.4)</td>
<td>1.3 (1.2 to 1.4)</td>
</tr>
<tr>
<td>Worried about the sequelae of the infection</td>
<td>74.1</td>
<td>5.4 (5.1 to 5.7)</td>
<td>4.3 (4.1 to 4.5)</td>
<td>4.2 (4.0 to 4.4)</td>
<td>2.0 (1.8 to 2.2)</td>
</tr>
<tr>
<td>Impacted life quality</td>
<td>99.5</td>
<td>6.8 (6.5 to 7.1)</td>
<td>4.6 (4.4 to 4.8)</td>
<td>4.3 (4.1 to 4.5)</td>
<td>2.2 (2.0 to 2.4)</td>
</tr>
<tr>
<td>Impacted accessibility to medical services</td>
<td>68.8</td>
<td>8.2 (7.9 to 8.5)</td>
<td>6.0 (5.7 to 6.3)</td>
<td>4.6 (4.4 to 4.8)</td>
<td>3.1 (2.9 to 3.3)</td>
</tr>
<tr>
<td>Impacted social interactions</td>
<td>75.3</td>
<td>9.0 (8.7 to 9.3)</td>
<td>6.1 (5.8 to 6.4)</td>
<td>5.6 (5.3 to 5.9)</td>
<td>2.6 (2.4 to 2.8)</td>
</tr>
<tr>
<td>Overall weighted PAF</td>
<td>21.9 (21.4 to 22.4)</td>
<td>19.2 (18.8 to 19.6)</td>
<td>18.1 (17.7 to 18.5)</td>
<td>10.7 (10.4 to 11.0)</td>
<td></td>
</tr>
</tbody>
</table>

*The PAF value for each risk factor was calculated based on the prevalence and the strength of its association (OR) with the four mental disorders. WPAF is the contribution of each pandemic factor to the overall PAF when adjusted for communalitv (see online supplemental material for specific calculation methods).
†Scores of 10–21 for the Generalised Anxiety Disorder-7 were defined as anxiety.
‡Scores of 10–27 for the Patient Health Questionnaire-9 were defined as depression.
§Scores of 21–40 for the Perceived Stress Scale-10 were defined as acute stress.
¶Scores of 9–21 on the Pittsburgh Sleep Quality Index were defined as insomnia.
CI, confidence interval; COVID-19, coronavirus disease 2019; OR, odds ratio; PAF, population-attributable fractions; WPAF, weighted population-attributable fractions.
in China. The impact people perceived on their social life, accessibility to medical services, quality of daily life, and worries about the sequelae, infection or re-infection were the top factors that contributed to mental health-related symptoms. Partially consistent with a previous report, these factors highlight the potential priorities for preventing mental disorders in pandemics. To date, no published research has estimated the PAF for mental health-related symptoms using epidemic factors. However, using different measures, the COVID-19 Mental Disorders Collaborators, estimated that the global prevalence of depression and anxiety increased by 27.6% and 25.6%, respectively, in the general population during the COVID-19 pandemic.

Unlike previous studies that reported an association between self-reporting of COVID-19 and mental health deterioration and sleep quality, our study found that self-reported infection did not contribute to adverse mental health-related symptoms. We further found that participants who recovered from the illness were less likely to have symptoms of anxiety and insomnia than those who were actively ill. Additionally, participants who had re-infections were less likely to suffer from anxiety, depression and insomnia than those with a first-time infection. This finding provides new evidence that, for most people, adverse life events result in initial short-term increases in symptoms of mental distress, followed by recovery. Moreover, this pattern is consistent with the results of large-scale studies on COVID-19. Furthermore, the outbreak of the Omicron variant in China in December 2022 differed from that in other countries and regions. Most people in China were infected over a short period of time; however, in our study, their symptoms were mild to moderate, as 13.2% were asymptomatic, 81.6% had systemic symptoms, 62.6% had respiratory symptoms and 16.5% had gastrointestinal symptoms; only 7.2% of the participants experienced life-threatening shortness of breath. At the time of writing this article, the COVID-19 pandemic in China has declined drastically, according to a report from the National Health Commission of the People’s Republic of China.

Limitations
First, given the nature of the online survey, most participants were young and highly educated, limiting the sample’s representativeness, especially that of older adults. Second, we relied on self-rating scales rather than clinical diagnoses to estimate the prevalence of common mental health-related symptoms. The prevalence estimates of common mental health-related outcomes assessed using screening tools are considerably higher than those from diagnostic interviews. Third, given the nature of this cross-sectional study, causal relationships between mental health-related symptoms and risk factors cannot be established.

Implications
In conclusion, self-reported mental health-related symptoms increased dramatically during the late 2022 to early 2023 Omicron wave in China. Worries and perceived impact, rather than the actual infection, contributed greatly to this increase. To inform ongoing work in the field, timely, high-quality surveys during epidemic outbreaks in China are required.

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