



ORIGINAL ARTICLE

Worse psychological traits associated with higher probability of emotional problems during the Omicron pandemic in Tianjin, China

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Abstract

Background and Objectives: Individuals with specific psychological weaknesses are prone to mental problems during the coronavirus pandemic. This self-rating study assessed the combined effects of infection-related stress, resilience, worry, and loneliness on the likelihood of depression and anxiety among infected and non-infected individuals during the Tianjin Pandemic in 2022.

Methods: Individuals infected with Omicron ($n = 249$) and health residents ($n = 415$) were recruited from two hospitals and communities in Tianjin. Each respondent completed the following on-site assessment: Self-developed Scale of Demographics, Zung Self-Rating Depression Scale (SDS), Zung Self-Rating Anxiety Scale (SAS), the Connor-Davidson Resilience Scale (CD-RISC), De Jong Gierveld Scale (DJGLS), and the Penn State Worry Questionnaire (PSWQ). The respondents were categorized into depression or non-depression group by SDS scores, and anxiety or non-anxiety group by SAS scores.

Results: The overall scores of CD-RISC, DJGLS, and PSWQ were significantly different both between the depression group and non-depression groups and between the anxiety group and non-anxiety groups. The greater likelihood of depression was associated with lower overall scores of CD-RISC and higher scores of PSWQ; the greater likelihood of anxiety was associated with higher scores of PSWQ. The likelihood of depression was also positively associated with having infection-related stress and three demographics.

Conclusions: This on-site study demonstrates the importance of specific traits in a small-scale pandemic: the worse resilience and the greater worry propensity related to the higher probability of depression, and the greater propensity of worry related to the higher probability of anxiety. Moreover, those experiencing infection-related stress, being male, living alone, and being unemployed are more likely to have depressive problems.

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Introduction

As a global public health event, the coronavirus disease (COVID-19) pandemic has been affecting people's daily lives and well-being for the last three years.^{1,2} After most persons have been vaccinated or infected with COVID-19, the physiological problems related to the virus have steadily been reduced, mainly including death, acute syndromes, and sequelae symptoms.³ In contrast to the initial stage, the stress related to this public event has gradually become prominent because of the increased infectivity, the lockdown, the isolation, et al.⁴ During the stressful period, some individuals, especially those with fragile psychological traits, might develop a series of mental distress.⁵⁻⁹ A systematic review demonstrated that the rates of anxiety and depression in the general population reached 6.33% to 50.9% and 14.6% to 48.3%, respectively, across the globe during this period.¹⁰

Different psychological traits might contribute to the individuals' emotional problems, like depression and anxiety in stressful situations.^{11,12} Good psychological resilience might protect individuals from emotional problems by mitigating the effect induced by a stress event.¹³⁻¹⁵ Previous studies demonstrated that loneliness and worry were associated with an increased risk of depression and anxiety.¹⁶⁻²⁰

There were about 606 individuals infected with Omicron in Tianjin from January to March 2022 (tj.gov.cn). They all received a period of free rehabilitation in two hospitals designated by the government. Since acute symptoms have hardly harassed them, their mental health has become the primary intervention target during hospitalization. Separation from family, inconvenience of living, isolated environment, and other factors might make them feel stressed.

The association between emotional status and the effect of infection-related stress, resilience, loneliness, or worry has been individually investigated in much online research among non-infected residents during the COVID-19 pandemic. However, no on-site research has reported the relationships between emotional status, infection-related stress, and the three traits mentioned above using a cohort with infected and non-infected individuals.²¹⁻²⁶ In the current study, we assumed that the worse resilience, the greater loneliness, and the greater worry propensity would relate to the higher probabilities of depression and anxiety in a cohort including infected and non-infected persons during the Tianjin Omicron pandemic in early 2022.

Materials and methods

Participants

The inclusion criteria were listed as follows: 1) the candidate must be older than the age of 18; 2) she/he did not have a history of severe brain injury, significant brain disease, or major cognitive impairment; and 3) she/he did not

have a history of severe somatic illnesses. If not, she/he would be excluded from the study. From 28th January to 28th February in 2022, 165 infected candidates from Tianjin First Center Hospital were interviewed, 22 incorrectly completed the assessment, 10 met the excluding criteria, and 133 were included in the analysis. From 30th January to 28th March in 2022, 141 infected candidates from Tianjin Haihe Hospital were interviewed, 6 refused to participate, 11 incorrectly completed the assessment, 8 met the exclusion criteria, and 116 were included in the analysis. Because the residents in Xiqing County have similar social-economic backgrounds and demographics to those infected participants from Jinnan County and Xiqing County, they were invited to the local community health agencies by phone and were recruited as non-infected candidates. From 22nd February to 6th March in 2022, 1012 non-infected candidates from 4 none-lockdown communities in Xiqing County were contacted, 556 were not available for the investigation, 39 incorrectly completed the assessment, and 2 met the excluding criteria, 415 were included in the analysis. In total, there were 249 infected respondents and 415 non-infected respondents. All respondents have completed the written informed consent by a handwritten or electronic signature.

Conduct of the assessment

This is the first on-site self-rating study related to COVID-19. The interviewers included psychiatrists, psychiatric nurses, and students pursuing a master's or doctoral degree in psychiatry or psychology. The study coordinator (CHH) trained them all in a two-hour course. Two interviewers and 10 were involved in the on-site investigations using hard-copy questionnaires in Tianjin First Center Hospital and communities. Three interviewers were involved in the on-site investigations using e-copy questionnaires in Tianjin Haihe Hospital.

After the interviewers introduce the study, the candidates should complete informed consent by a handwritten or electronic signature if she or he agrees to participate in the study. Each responder needs complete the scales by herself or himself. If she or he has questions, the interviewer provides a standardized answer but not an excessive explanation. Upon completion, the subjects would be given a gift worth 50 Renminbi for their time.

Demographic characteristics scale

A self-developed questionnaire was used to collect the infection status of Omicron and demographics, including gender, age, education level, marriage status, ethnicity, living status, work status, economic level and physiological illness history, and mental disorders history. The subjects in the hospital were defined as suffering from infection-related stress, and those in the communities were defined as not.

Zung Self-rating Depression Scale

The Zung Self-rating Depression Scale (SDS) ²⁷ was used to assess the severity of depressive symptoms during the last 7 days. In the current study, the scale had good reliability and validity, which has been demonstrated in its prior Chinese version. ²⁸ It includes 20 items rating along a 4-point Likert scale: “1–4” represents none or a little of the time, small of the time, a good part of the time, and most or all of the time respectively. The total score of SDS was computed by first reversing the 10 items and then converting the sum of all 20 items into a score ranging from 0 to 100 (total score = $100 \times 1.25 \times [\text{sum of 20 item scores} - (20 - \text{number of missing items})]$ / $[60 - 3 \times \text{number of missing items}]$), with higher total scores indicating more severe depression. Subjects were categorized into depression and non-depression groups by a cutoff value of 53 for SDS.

Zung Self-rating Anxiety Scale

The Zung Self-rating Anxiety Scale (SAS) ²⁹ was used to assess the severity of anxiety symptoms during the last 7 days. In the current study, the scale had good reliability and validity, which has been demonstrated in its prior Chinese version. ³⁰ It includes 20 items rating along a 4-point Likert scale: “1–4” represents none or a little of the time, small of the time, a good part of the time, and most or all of the time respectively. The total score of SAS was computed by first reversing the 5 items and then converting the sum of all 20 items into a score ranging from 0 to 100 (total score = $100 \times 1.25 \times [\text{sum of 20 item scores} - (20 - \text{number of missing items})]$ / $[60 - 3 \times \text{number of missing items}]$), with higher total scores indicating more severe anxiety. Subjects were categorized into anxiety group and non-anxiety group by a cutoff value of 50 for SAS.

Connor-Davidson Resilience Scale

The Connor-Davidson Resilience Scale (CD-RISC) ³¹ measured a person's psychological resilience. As its previous Chinese edition, ³² it also demonstrated good reliability and validity in the current study. It includes 25 items rating along a 5-point Likert scale: 0 = not at all, 1 = rarely, 2 = sometimes, 3 = often, and 4 = always. The total score of CD-RISC was computed by converting the sum of all 25 items into a score ranging from 0 to 100 (total score = $100 \times [\text{sum of 25 item scores} - (25 - \text{number of missing items})]$ / $[100 - 4 \times \text{number of missing items}]$), with higher total scores representing better resilience.

De Jong Gierveld Scale

The De Jong Gierveld Scale (DJGLS) ³³ measured a person's loneliness. As its previous Chinese edition, ³⁴ it also demonstrated good reliability and validity in the current study. It includes 11 items rating along a 5-point Likert scale: 0 = never, 1 = seldom, 2 = sometimes, 3 = often, and 4 = always. On the 5 negatively worded items (items 1, 4, 7, 8, 11), the answers of “sometimes”, “often”, and “always” are scored as “1”; On the remaining 6 positively worded

items, the answers of “never” and “seldom” are scored as “1”. The total score of DJGLS was computed by adding two subscale's scores and ranged from 0 to 11, with higher total scores representing greater loneliness.

Penn State Worry Questionnaire

The Penn State Worry Questionnaire (PSWQ) ³⁵ was used to measure a person's worry. As its previous Chinese edition, ³⁶ it also demonstrated good reliability and validity in the current study. It includes 16 items rating along a 5-point Likert scale: 1 = not at all typical of me, 2 = not really typical of me, 3 = a little of typical of me, 4 = really typical of me, and 5 = very really typical of me. The total score of PSWQ was computed by first reversing the 5 items and then converting the sum of all 16 items into a score ranging from 0 to 100 (total score = $100 \times [\text{sum of 16 item scores} - (16 - \text{number of missing items})]$ / $[64 - 4 \times \text{number of missing items}]$), with higher total scores representing greater propensity of worry.

Statistical analysis

The data were prepared using double entry verification in EpiData 3.1. SPSS version 25.0 (SPSS Inc., Chicago, IL, USA) was used for data analysis. The Chi-square test was used for the qualitative variables in the univariate analysis between every two groups. In contrast, Wilcoxon's test was used for the quantitative variables after the Kolmogorov-Smirnov test. The multivariate logistic regression model was used to analyze the associations between the variables with significant differences and depression or anxiety, adjusting age, gender, and education level. Both the Step-forward method and Step-backward were tried. The odd ratio (OR) and 95% confidence interval (CI) were calculated. The statistical significance was set at $p < 0.05$ for all tests.

Results

Univariate comparisons between depression group vs. non-depression group and between anxiety group vs. non-anxiety group

As shown in Table 1, the median (quantile) of total SDS scores for the depression group was significantly higher than that of the non-depression group. Among the 8 respondent demographics considered, there were significant difference on 4 characteristics between the depression group and the non-depression group including gender ($\chi^2 = 6.48$, $p = 0.01$), education level ($\chi^2 = 10.40$, $p < 0.01$), living status ($\chi^2 = 5.91$, $p = 0.02$), and work status ($\chi^2 = 7.71$, $p < 0.01$). Compared to the respondents in the non-depression group, those in the depression group were more likely to experience infection-related stress ($\chi^2 = 36.03$, $p < 0.01$). There was significant difference between the depression group and the non-depression group for the overall scores of all three psychological traits scales: CD-RISC ($Z = -6.51$, $p < 0.01$), DJGLS ($Z = -4.05$, $p < 0.01$), and PSWQ ($Z = -7.41$, $p < 0.01$).

Table 1 Demographics and total scores of three psychological traits scales for depression vs. non-depression group during Omicron pandemic in Tianjin.

Variables	Depression group (n = 129)	Non-depression group (n = 535)	χ^2/Z	p-value
Median of Total SDS scores (Quantile) ^a	60.0 (56.3, 62.5)	38.8 (33.8, 45.0)	−17.66	<0.01
Median of Age (Quantile) [Years]	42.0 (33.0, 52.0)	44.0 (34.0, 54.0)	−1.07	0.28
Gender [n(%)]			6.48	0.01
Female	58 (45.0)	307 (57.4)		
Male	71 (55.0)	228 (42.6)		
Education [n(%)]			10.40	<0.01
Middle school & below	63 (48.8)	180 (33.6)		
High school	30 (23.3)	155 (29.0)		
Bachelor's degree & above	36 (27.9)	200 (37.4)		
Marriage Status [n(%)]			5.00	0.08
Single	9 (7.0)	59 (11.0)		
Married	111 (86.0)	458 (85.6)		
Divorced	9 (7.0)	18 (3.4)		
Living Status [n(%)]			5.91	0.02
Not alone	120 (93.0)	521 (97.4)		
Alone	9 (7.0)	14 (2.6)		
Work Status [n(%)]			7.71	<0.01
Employed	104 (80.6)	479 (89.5)		
Unemployed	25 (19.4)	56 (10.5)		
Ethnicity [n(%)]			1.11	0.29
Han	124 (96.1)	523 (97.8)		
Other ethnicities	5 (3.9)	12 (2.2)		
Economic level			5.82	0.05
Good	27 (20.9)	79 (14.8)		
General	87 (67.4)	415 (77.6)		
Poor	15 (11.6)	41 (7.7)		
Infection-related Stress			36.03	<0.01
None	51 (39.5)	364 (68.0)		
Yes	78 (60.5)	171 (32.0)		
Median of Total CD-RISC scores (Quantile) ^a	53.0 (37.0, 71.0)	68.0 (56.0, 80.0)	−6.51	<0.01
Median of Total DJGLS scores (Quantile) ^a	5.0 (4.0, 6.0)	4.0 (3.0, 6.0)	−4.05	<0.01
Median of Total PSWQ scores (Quantile) ^a	44.0 (36.0, 52.0)	36.0 (28.0, 42.0)	−7.41	<0.01

^a Abbreviations for: SDS, Zung Self-rating Depression Scale; CDRISC, Connor–Davidson Resilience Scale; DJGLS, DeJong Gierveld Loneliness Scale; PSWQ, Penn State Worry Questionnaire.

As shown in Table 2, the median (quantile) of total SAS scores for the anxiety group was significantly higher than that of the non-anxiety group. No difference was found between the anxiety and non-anxiety groups for all 8 respondent demographics considered and for the infection-related stress. There also was significant difference between the anxiety group and in the non-anxiety group for the overall scores of all three psychological traits scales: CD-RISC ($Z = -4.62$, $p < 0.01$), DJGLS ($Z = -4.67$, $p < 0.01$), and PSWQ ($Z = -9.27$, $p < 0.01$).

Multivariate assessment of factors associated with depression and anxiety

Table 3 shows the results of 2 separate logistic regression models, which explored the associated factors with depression or anxiety. In each regression function, age, gender, and education level are forced into the model to identify the factors with statistical significance (including all three psychological traits variables in both the functions; and

infection-related stress, living status, and work status in the function of depression).

Compared to the respondents without depression, those with depression were more likely to be with lower overall scores of CD-RISC (OR = 0.98, 95%CI (0.97–0.99), $p < 0.01$), to be with higher overall scores of PSWQ [OR = 1.08, 95%CI (1.05–1.11), $p < 0.01$], to experience the infection-related stress [OR = 3.17, 95%CI (1.95–5.16), $p < 0.01$], to be a male [OR = 1.96, 95% CI (1.25–3.06), $p < 0.01$], to live alone [OR = 2.82, 95%CI (1.09–7.29), $p = 0.03$], and to be unemployed [OR = 2.02, 95%CI (1.12–3.66), $p = 0.02$]. Compared to the respondents without anxiety, those with anxiety only were more likely to be with higher overall scores of PSWQ [OR = 1.14, 95%CI (1.10–1.17), $p < 0.01$].

Discussion

The first on-site study explores the associated factors for emotional problems and included infected and uninfected

Table 2 Demographics and total scores of three psychological traits scales for anxiety vs. non-anxiety group during omicron pandemic in Tianjin.

Variables	Anxiety group (n = 58)	Non-anxietygroup (n = 606)	χ^2/Z	p-value
Median of Total SAS scores (Quantile) ^a	55.0 (51.3, 58.8)	33.8 (28.8, 40.0)	-12.61	<0.01
Median of Age (Quantile) [Years]	46.0 (33.8, 56.0)	43.0 (34.0, 53.0)	-0.70	0.48
Gender [n(%)]			0.74	0.39
Female	35 (60.3)	330 (54.5)		
Male	23 (39.7)	276 (45.5)		
Education [n(%)]			1.19	0.55
Middle school & below	25 (43.1)	218 (36.0)		
High school	15 (25.9)	170 (28.1)		
Bachelor's degree & above	18 (31.0)	218 (36.0)		
Marriage Status [n(%)]			0.06	0.97
Single	6 (10.3)	62 (10.2)		
Married	50 (86.2)	519 (85.6)		
Divorced	2 (3.4)	25 (4.1)		
Living Status [n(%)]			0.56	0.46
Not alone	55 (94.8)	586 (96.7)		
Alone	3 (5.2)	20 (3.3)		
Work Status [n(%)]			0.65	0.42
Employed	49 (84.5)	534 (88.1)		
Unemployed	9 (15.5)	72 (11.9)		
Ethnicity [n(%)]			0.20	0.65
Han	56 (96.6)	591 (97.5)		
Other ethnicities	2 (3.4)	15 (2.5)		
Economic level			1.26	0.53
Good	10 (17.2)	96 (15.8)		
General	41 (70.7)	461 (76.1)		
Poor	7 (12.1)	49 (8.1)		
Infection-related Stress			0.41	0.52
None	34 (58.6)	381 (62.9)		
Yes	24 (41.4)	225 (37.1)		
Median of Total CD-RISC scores (Quantile) ^a	52.0 (38.0, 66.0)	67.0 (54.0, 79.0)	-4.62	<0.01
Median of Total DJGLS scores (Quantile) ^a	6.0 (4.0, 7.3)	4.0 (3.0, 6.0)	-4.67	<0.01
Median of Total PSWQ scores (Quantile) ^a	50.0 (45.0, 58.0)	36.0 (29.0, 42.0)	-9.27	<0.01

^a Abbreviations for: SAS, Zung Self-rating Anxiety Scale; CDRISC, Connor–Davidson Resilience Scale; DJGLS, DeJong Gierveld Loneliness Scale; PSWQ, Penn State Worry Questionnaire.

individuals during a small-scale Omicron pandemic in Tianjin, China.

The current study repeated the findings in prior research that individuals with worse resilience might more easily develop depression problems.^{37,38} They seem more vulnerable to stress and are less likely to use external resources. The relationship between the lower overall PSWQ score and the higher probability of depression is quite comprehensible because individuals with worrying qualities would accumulate more pressure in daily life and thus be more prone to depression.^{39,40} Although the infected individuals did not develop obvious physical symptoms and all the consumption was covered by public finance, they still were quarantined in the hospital and separated from their family members. They experienced more stress than those in the community neighborhood. Thus, the infected would be more likely to become depressed than the uninfected.⁴¹⁻⁴³ It is also intuitive that individuals are more susceptible to depression when living

alone or unemployed and thus might not have enough external resources and support, especially when facing a stressful public event like the Omicron pandemic.⁴³⁻⁴⁵ Some previous studies supported our findings that males were more likely to develop depression problems than females.^{46,47} However, other studies reported that females were at greater risk for depression than males.³

It is intuitive that individuals with worrying qualities are more sensitive to stress and, thus, are more likely to develop anxiety problems.⁴⁸ However, it is counterintuitive that resilience and infection-related stress are not associated with anxiety in the study. There might be two reasons. First, the financial support from the government significantly reduced the stress intensity and thus reduced the anxiety in the infected individuals.⁴⁹ Second, the number of 606 infected individuals during the Tianjin pandemic indicated it was only a small-scale epidemic and thus brought up a reasonable response, which was proven by the overall scores of SDS and SAS (tj.gov.cn). Therefore, the individuals did

Table 3 Multivariate logistic analysis for depression problem and anxiety problem during omicron pandemic in Tianjin.

Variables	Depression (n / N = 129/664)			Anxiety (n / N = 58/664)		
	OR	95% CI	p-value	OR	95% CI	p-value
Age (Years)	1.01	0.99–1.03	0.43	1.02	0.99–1.05	0.23
Gender						
Female	1.00	—	—	1.00	—	—
Male	1.96	1.25–3.06	<0.01	0.82	0.43–1.53	0.52
Education						
Middle school & below	1.00	—	—	1.00	—	—
High school	0.76	0.44–1.32	0.33	0.86	0.41–1.84	0.70
Bachelor's degree & above	0.70	0.38–1.26	0.23	0.68	0.30–1.58	0.37
Living Status						
Not alone	1.00	—	—			
Alone	2.82	1.09–7.29	0.03			
Work Status						
Employed	1.00	—	—			
Unemployed	2.02	1.12–3.66	0.02			
Infection-related Stress						
None	1.00	—	—			
Yes	3.17	1.95–5.16	<0.01			
Total score of CD-RISC ^a	0.98	0.97–0.99	<0.01	1.00	0.98–1.01	0.57
Total score of DJGLS ^a	0.97	0.87–1.09	0.64	1.06	0.90–1.25	0.47
Total score of PSWQ ^a	1.08	1.05–1.11	<0.01	1.14	1.10–1.17	<0.01

^a Abbreviations for: CDRISC, Connor–Davidson Resilience Scale; DJGLS, DeJong Gierveld Loneliness Scale; PSWQ, Penn State Worry Questionnaire.

not need to utilize too much inner strength or become too anxious.

Compared to the two groups without emotional problems, both groups with emotional problems have significantly higher DJGLS scores, as shown in the univariate analysis. However, none of the final logistic models included the variable. Because most of the respondents are married (85.7%), the married status might neutralize the effect of loneliness.⁵⁰

Limitations

There are several limitations in the current study. First, depression and anxiety were assessed by a self-rating scale, and no corresponding diagnoses were made using ICD or DSM systems. It means the results should be limited to the general population and could not be generalized to those with emotional disorders. Second, the data of the age variable was skewed and non-uniform distributed. The main reason is the repeated occurrence of COVID-19 epidemics and the dynamic zero-Covid policy impeded recruiting more subjects in the neighborhood. However, the adjustment by entering the age variable in the multivariate analysis and a large-enough sample size attenuated the distribution effects. Finally, as mentioned above, the number of infected persons and the areas in this epidemic were limited, so the results could not be generalized to a massive pandemic. Even with the above shortcoming, this might be the first on-site psychological research during the COVID-19 pandemic.

Conclusion

As shown in the current study about the Omicron pandemic in Tianjin, weaker resilience and greater propensity to worry are associated with a greater likelihood of having a depression problem; the greater propensity to worry is the only factor associated with a greater likelihood of having an anxiety problem. In addition, the individuals experiencing infection-related stress, being male, living alone, and being unemployed are more likely to have depression problems. Using an on-site assessment, the current study provides a reliable reference for the mental health professionals and the stakeholders in the government to identify the vulnerable individuals for depression or anxiety facing a public health event like the Omicron pandemic and to develop an appropriate intervention plan.

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Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of Tianjin Anding

Hospital, Tianjin Medical University. All the participants provided their written informed consent to participate in this study.

Author contributions

DZ and HHC wrote the first draft of the manuscript. DZ, HC, and JL conceived and designed the study, analyzed the data, interpreted the results, and approved the final version. DZ, HHC, PL, and XW performed the study. All authors contributed to the article and approved the submission.

Conflict of interest

The authors declare no conflict of interest related to this study.

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