ORIGINAL RESEARCH

Depression and Anxiety Symptoms and Their Associated Factors Among Chinese Residents After the Lifting of the Dynamic Zero-COVID Policy: A Cross-Sectional Study

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Purpose: China lifted its strict zero-Covid approach on December 7, 2022. This study aimed to investigate depression and anxiety symptoms and their associations among Chinese residents after the change in public policy.

Methods: A cross-sectional sample of 925 Chinese residents (726 females and 199 males) was recruited using convenience and snowball sampling approach between 16 and 25 December 2022. Participants completed online questionnaires on basic information, depression, anxiety, COVID-19 related perceptions, and protective behaviors change.

Results: Mild and moderate-to-severe depression symptoms were reported by 35.6% and 19.1% of participants, respectively. Nearly 40% of participants reported mild anxiety and 18.7% reported moderate-to-severe anxiety. Results from multinomial logistic regression analysis indicated that male gender, younger age, the presence of chronic disease, poorer self-rated mental health status, perceived impact, and worry were risk factors for both depression and anxiety, while higher education and protective behaviors change were protective factors. Besides, living with or caring for children (4–6 years), family members or other housemates currently with influenza-like symptoms, and perceived severity were also risk factors for depression.

Conclusion: Our findings provided initial evidence that Chinese residents may face heightened depression and anxiety during the early stage after the policy was released. Furthermore, we identified some vulnerable populations in need of prioritizing mental health assistance and some potentially modifiable factors associated with depression and anxiety, which provides an important guide for developing timely and effective psychological interventions and preparing for future pandemics.

Keywords: COVID-19, public policy, depression, anxiety, COVID-19 related perceptions, protective behaviors change

Introduction

During the last 3 years, the COVID-19 epidemic has caused tremendous disruption in almost all aspects of daily life[1–4] and has overwhelmed the healthcare systems in countries.[5–7] Due to the higher transmissibility and there were no effective antiviral therapeutics to treat or prevent COVID-19, China adopted a dynamic zero-Covid strategy by controlling infectious sources, blocking transmission routes, and protecting susceptible individuals.[8] According to new characteristics of COVID variants and the new situation of the epidemic, combined with the recent practical experience in dealing with the epidemic situation, China issued the "Notice on Further Optimizing the Implementation of COVID-19 Prevention and Control Measures" on December 7, 2022, which is known as "the 10-point measures".[9] The release of "the 10-point measures" declared that the country was moving

away from its strict zero-Covid approach, most notably, any form of temporary lockdown in communities, streets or towns, and schools is prohibited; mass and regular nucleic acid testing will no longer be arranged by administrative regions; proof of negative nucleic acid test results and digital health codes will no longer be required for entry into public spaces except for special places such as nursing homes or childcare facilities; and for the first time, home quarantine is allowed for asymptomatic and mild cases.[9] Thus, the country's epidemic control had entered a "new stage and mission" on a national level, and the public had to face the sudden change and take more active roles in managing their own and their family's health when coexisting with the Covid virus, instead of being passive receivers of prevention measures imposed by the government in the past three years.

Since the outbreak, the negative impact of the COVID-19 pandemic and related public health measures on the mental health of the general public have garnered global attention.[10–12] The overall prevalence of depression and anxiety in the general population during the COVID-19 early pandemic was 29.0% and 26.0%, respectively, according to a large-scale meta-analytic atlas.[13] One online survey of 56,679 individuals from all 34 province-level regions in China found that 27.9% of respondents reported symptoms of depression and 31.6% reported symptoms of anxiety during the COVID-19 pandemic.[14] Studies have also found a high prevalence of mental health symptoms in the general population during COVID-19 related lockdown.[15–18] While the 12-month prevalence of depressive disorders and anxiety disorders was 3.6% and 5.0%, respectively, in a large population-based survey of Chinese adults prior to the pandemic, much lower than those during the pandemic.[19] Undoubtedly, the end of the stringent measures could bring further tremendous changes to the daily life of Chinese people and has the potential to affect their mental health. The need for appropriate and up-to-date information on mental health symptoms among Chinese residents after the release of "the 10-point measures" in a way that informs health system response has never been more urgent.

During the COVID-19 pandemic, common risk factors for psychological distress among adults include female gender, younger age group (≤40 years), noninfectious chronic disease patients, centralized or home-quarantined persons, participants with confirmed or suspected COVID-19, having a high risk of contracting COVID-19, having more infected relatives, having lower socioeconomic status, and social isolation.[14,20–22] The literature has also highlighted the importance of perceived severity of COVID-19, perceived impact of COVID-19, and negative emotions such as fear and worry in mental health.[23–25] Protective factors include higher education, having grown-up children, perception of good health status, up-to-date and accurate information, and taking precautionary measures.[24,26,27] The release of "the 10-point measures" has created an environment where many determinants of poor mental health are exacerbated. Therefore, it is imperative to further evaluate the determinants of mental health symptoms of Chinese residents during this period, which may provide a scientific reference for optimizing the pandemic management decision-making and preparing for future pandemics.

Thus, this study aimed to investigate depression and anxiety symptoms and their associations among Chinese residents after the lifting of the dynamic zero-COVID policy.

Materials and Methods

Study Design and Participants

The study was a cross-sectional online survey. Convenience sampling and snowball sampling methods were used to recruit participants between 16 December and 25 December 2022. Eligible participants had to be 18 years older, understand Mandarin Chinese and have internet access.

The general rule of thumb for sample size calculation to use multinomial logistic regression is a minimum ratio of 10 respondents to each independent variable.[28] A total of 25 independent variables were included, thus the minimum sample size was 250.

A total of 995 Chinese visited the online survey and 11 were not willing to participate in the survey, leaving 984 participants to complete the survey. Then, 59 were removed because of duplicated data and logistic mistakes. Finally, 925 surveys (726 females and 199 males) provided complete data and were enrolled for data analysis (effective response rate: 94.0%).

Of 925 residents enrolled, 78.5% (n = 726) were female. The mean age of the participants was 34.91 (SD 10.56) years, of which 42.9% (n = 397) were aged 31–45 years old. The majority (77.8%, n = 720) of the participants had an undergraduate or associate degree. 76.3% (n = 706) were married and 80.3% (n = 743) lived with others. More information about sample characteristics is reported in Table 1.

Table 1 Comparison of Depression and Anxiety Among Different Sample Groups (N = 925)

Variable	n (%)/ Mean (SD)	Depression n/Mean (SD)			P	Anxiety n/Mean (SD)			P
		Minimal (n=419)	Mild (n=329)	Moderate-to-Severe (n=177)		Minimal (n=379)	Mild (n=373)	Moderate-to-Severe (n=173)	
Gender									
Male	199 (21.5)	85	71	43	0.553	78	75	46	0.195
Female	726 (78.5)	334	258	134		301	298	127	
Age									
≤30	371 (40.1)	156	143	72	0.026*	148	157	66	0.870
31–45	397 (42.9)	172	146	79		160	164	73	
≥46	157 (17.0)	91	40	26		71	52	34	
Educational level									
High school and below	137 (14.8)	59	46	32	0.135	54	52	31	0.052
Undergraduate or associate degree	720 (77.8)	325	260	135		290	295	135	
Graduate	68 (7.4)	35	23	10		35	26	7	
Relationship status									
Married or in a relationship	706 (76.3)	325	245	136	0.603	282	284	140	0.246
Single	219 (23.7)	94	84	41		97	89	33	
Living arrangement									
Living alone	182 (19.7)	81	70	31	0.580	79	69	34	0.721
Living with others	743 (80.3)	338	259	146		300	304	139	
Living with or caring for infants or juveniles (0–3 years)									
Yes	127 (13.7)	60	38	29	0.287	49	54	24	0.825
No	798 (86.3)	359	291	148		330	319	149	
Living with or caring for children (4–6 years)									
Yes	195 (21.1)	75	82	38	0.064	67	89	39	0.101
No	730 (78.9)	344	247	139		312	284	134	
Living with or caring for the elderly (>65 years)									
Yes	277 (29.9)	129	92	56	0.607	108	115	54	0.722
No	648 (70.1)	290	237	121		271	258	119	

(*Continued*)

Table 1 (Continued).

Variable	n (%)/ Mean (SD)	Depression n/Mean (SD)			P	Anxiety n/Mean (SD)			P
		Minimal (n=419)	Mild (n=329)	Moderate-to-Severe (n=177)		Minimal (n=379)	Mild (n=373)	Moderate-to-Severe (n=173)	
Living with or caring for people with chronic conditions									
Yes	154 (16.6)	70	45	39	0.055	56	58	40	0.039*
No	771 (83.4)	349	284	138		323	315	133	
Place of residence									
Urban	787 (85.1)	358	279	150	0.961	316	321	150	0.471
Rural	138 (14.9)	61	50	27		63	52	23	
High employment-related risk of contracting COVID-19									
Yes	653 (70.6)	297	227	129	0.648	264	265	124	0.863
No	272 (29.4)	122	102	48		115	108	49	
Perceived family economic level									
Very poor or poor	152 (16.5)	52	61	39	<0.001***	49	62	41	0.001**
Fair	608 (65.6)	275	216	117		251	251	106	
Good or very good	165 (17.9)	92	52	21		79	60	26	
With chronic disease or not									
Yes	253 (27.4)	99	84	70	<0.001***	87	94	72	<0.001***
No	672 (72.6)	320	245	107		292	279	101	
History of COVID-19 infection									
Yes	291 (31.5)	114	113	64	0.058	102	123	66	0.043*
Have no idea	99 (10.7)	41	36	22		40	37	22	
No	535 (57.8)	264	180	91		237	213	85	
History of COVID-19 infection among family members or friends									
Yes	372 (40.2)	160	130	82	0.057	140	149	83	0.040*
Have no idea	90 (9.7)	32	40	18		33	36	21	
No	463 (50.1)	227	159	77		206	188	69	
Currently having influenza-like symptoms									
Yes	606 (65.5)	261	219	126	0.100	241	247	118	0.533
No	319 (34.5)	158	110	51		138	126	55	

Currently having influenza-like symptoms in families or others living together								
Yes	593 (64.1)	247	213	133	0.001**	234	239	120	0.223
No	332 (35.9)	172	116	44		145	134	53	
Perceived current physical health status								
Very poor or poor or fair	475 (51.4)	165	192	118	<0.001***	158	204	113	<0.001***
Good or very good	450 (48.6)	254	137	59		221	169	60	
Perceived current mental health status								
Very poor or poor or fair	344 (37.2)	90	148	106	<0.001***	88	146	110	<0.001***
Good or very good	581 (62.8)	329	181	71		291	227	63	
COVID-19 related perceptions								
Perceived susceptibility	8.21 (1.86)	8.12 (1.94)	8.17 (1.85)	8.51 (1.66)	0.057	8.10 (1.99)	8.25 (1.75)	8.36 (1.80)	0.277
Perceived severity	3.61 (0.87)	3.44 (0.85)	3.67 (0.86)	3.88 (0.86)	<0.001***	3.44 (0.83)	3.65 (0.88)	3.88 (0.87)	<0.001***
Perceived impact	13.69 (3.37)	12.84 (3.26)	13.91 (3.18)	15.27 (3.32)	<0.001***	12.70 (3.22)	13.84 (3.18)	15.49 (3.30)	<0.001***
Fear	3.36 (0.96)	3.20 (0.95)	3.44 (0.96)	3.62 (0.92)	<0.001***	3.11 (0.91)	3.46 (0.93)	3.71 (1.00)	<0.001***
Worry	29.54 (6.82)	27.88 (0.89)	30.10 (6.52)	32.42 (6.06)	<0.001***	27.39 (6.73)	30.23 (6.39)	32.77 (6.35)	<0.001***
Protective behaviors change	61.53 (10.07)	62.49 (9.76)	60.13 (10.22)	61.86 (10.28)	0.006**	61.57 (10.00)	61.10 (9.80)	62.37 (10.78)	0.387

Note: *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.
Abbreviation: SD, standard deviation.

Measures

Basic Information

Basic information included gender, age, educational level, relationship status, living arrangement, place of residence, employment-related risk of contracting COVID-19, perceived family economic level, with chronic disease or not, perceived current physical health status, perceived current mental health status, living with or caring for infants or juveniles (0–3 years), children (4–6 years), the elderly (>65 years), or people with chronic conditions, history of COVID-19 infection, history of COVID-19 infection among family members or friends, and currently having influenza-like symptoms in self or families or other housemates.

COVID-19 Related Perceptions

COVID-19 related perceptions included perceived susceptibility to COVID-19, perceived severity of COVID-19, perceived impact of COVID-19, fear, and worry, which were designed based on previous research.[25]

Perceived susceptibility to COVID-19 consisted of 2 items on the likelihood of oneself and one's family members contracting COVID-19. A five-point Likert scale was used (1 = very little to 5 = very much). Higher scores suggest higher levels of perceived susceptibility, with scores ranging from 2 to 10. In the present study, the Cronbach's alpha coefficient was 0.88 for perceived susceptibility.

Perceived severity of COVID-19 was measured by a single item. An individual's perception of the seriousness of contracting COVID-19 was asked, and a five-point Likert scale was used (1 = not serious to 5 = very serious). Higher scores suggest higher levels of perceived severity.

Perceived impact of COVID-19 included 4 items. Participants were asked to rate whether COVID-19 had affected any part of their daily lives (impact on work/studies, finances, family relationships, and social contacts). A five-point Likert scale was used (1 = very little to 5 = very much). Higher scores suggest higher levels of perceived impact. In the present study, the Cronbach's alpha coefficient was 0.77 for perceived impact.

Fear was assessed by a single item. Participants were asked to rate their level of fear of COVID-19 on a five-point Likert scale (1 = very little to 5 = very much). Scores range from 1 to 5, where higher scores suggest higher levels of fear.

Worry was assessed by 8 items. Participants were asked to rate their level of worry on various aspects related to COVID-19 (worried about contracting COVID-19, family members or friends contracting COVID-19, transmitting COVID-19 to others, physical symptoms, sequela, financial burden, stigmatization due to the infection, and reinfection). A five-point Likert scale (1 = very little to 5 = very much). Scores can range from 8 to 40 with higher scores suggesting higher levels of worry. In the present study, the Cronbach's alpha coefficient was 0.93 for worry.

Protective Behaviors Change

Protective behaviors change involves 17 items on the changes in protective behaviors after the release of "the 10-point measures", designed based on previous studies:[29–31] avoiding going to public places with large crowds, maintaining a social distance of more than one meter, avoiding dining out or gathering with friends, wearing a surgical/an N95 mask when accessing public places, opening a window for natural ventilation for at least 30 minutes per day, washing hands with either an alcohol-based hand rub or soap and water, using disinfectants, choosing a balanced diet and ensuring adequate nutrition, ensuring sufficient sleep and rest, using serving spoons or chopsticks, as well as eating from individual plates, engaging in regular physical activities, taking herbal medicines or supplements, keeping a good mood, understanding COVID-19 related knowledge, symptoms, and medication use, vaccination-related behaviors of oneself and convincing families and friends to be vaccinated. Except for two vaccination-related items rated on a three-point scale (1 = no need to vaccinate, 2 = have been vaccinated, and 3 = plan to vaccinate/convince them), other items were scored on a five-point scale (1 = much less than before, 2 = a bit less than before, 3 = as often as before, 4 = a bit more than before, and 5 = much more than before). We summed scores across the 17 items and higher scores indicated an increase in self-report protective behaviors, with scores ranging from 17 to 81. In the present study, the Cronbach's alpha coefficient was 0.89 for protective behaviors change.

Depression

Depression was assessed by the 9-item Patient Health Questionnaire (PHQ-9).[32] A four-point Likert scale (0 = not at all to 3 = nearly every day) was used. Total scores range from 0 to 27, with higher scores indicating greater severity of

depression symptoms. Total PHQ-9 scores can be classified as minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27) depression symptoms. PHQ-9 has been validated and widely used in the Chinese population.[33,34] Internal reliability was excellent, with a Cronbach's alpha of 0.94.

Anxiety

Anxiety was measured by the 7-item General Anxiety Disorder scale (GAD-7).[35] A four-point Likert scale (0 = not at all to 3 = nearly every day) was used. Total scores range from 0 to 21, with higher scores indicating greater severity of anxiety symptoms. Total GAD-7 scores can be classified as minimal (0–4), mild (5–9), moderate (10–14), and severe (15–21) anxiety symptoms. GAD-7 has been validated and widely used in the Chinese population.[33,34] Internal reliability was excellent, with a Cronbach's alpha of 0.95.

Data Collection

The study has been approved by the ethics committee of the first author's affiliation (Issued No: 2022.1943). The questionnaire was delivered through Wenjuanxing (http://www.wjx.cn/), a widely used online survey platform in China. The research team shared the questionnaire link through WeChat to invite people to fill in the survey. IP address restriction technology was adopted to ensure users with the same IP address could only complete the questionnaire once. Information about the purpose, the procedure of the survey, and the voluntary, anonymous, and confidential nature of participation were provided on the first page of the online survey. Participants who agreed to take part in the survey were asked to provide informed consent by clicking the "agree to participate" option before starting the survey. The survey took about 10–15 minutes to complete.

Data Analysis

SPSS (Version 22.0, IBM SPSS Statistics, New York, United States) was adopted for data analysis. Continuous variables were presented as means and standard deviations (SDs), while frequencies and percentages were used to describe categorical variables. Differences were evaluated using the chi-square test for categorical variables and using independent sample t-test and one-way ANOVA tests for continuous variables. Variables exhibiting a P value <0.20 in the univariate analysis along with those professionally considered important were included in subsequent multinomial logistic regression analysis, and the resulting odds ratios (ORs) and 95% CI were calculated.

Results

Depression and Anxiety Symptoms

Mild and moderate-to-severe depression symptoms were reported by 35.6% (n = 329) and 19.1% (n = 177) of participants, respectively. Approximately 40% (n = 373) of participants reported mild anxiety and 18.7% (n = 173) reported moderate-to-severe anxiety (Table 1).

COVID-19 Related Perceptions and Protective Behaviors Change

Table 1 shows the results of COVID-19 related perceptions and protective behaviors change. Besides, item mean scores of perceived susceptibility, perceived severity, perceived impact, fear, and worry were 4.11 (SD 0.93), 3.61 (SD 0.87), 3.42 (0.84), 3.36 (SD 0.96), and 3.69 (SD 0.85), respectively.

Univariate and Multivariate Analysis of Factors Related to Depression

The results of the univariate analysis revealed that age, perceived family economic level, with chronic disease or not, currently having influenza-like symptoms in families or other housemates, perceived current physical health status, perceived current mental health status, perceived severity, perceived impact, fear, worry, and protective behaviors change were significantly associated with depression (Table 1). The results from the multivariate multinomial regression analysis showed that age, perceived fair-very poor mental health status, perceived impact, and worry were risk factors, while protective behaviors change was a protective factor for all levels of depression. Besides, living with or caring for children (4–6 years) was a risk factor for mild depression. Male gender, with chronic disease, currently having influenza-like

symptoms in families or other housemates, and perceived severity were risk factors for moderate-to-severe depression, while higher education was a protective factor for moderate-to-severe depression (Table 2).

Univariate and Multivariate Analysis of Factors Related to Anxiety

The results of the univariate analysis revealed that living with or caring for people with chronic conditions, perceived family economic level, with or without chronic disease, history of COVID-19 infection, history of COVID-19 infection among family members or friends, perceived current physical health status, perceived current mental health status, perceived severity, perceived impact, fear, and worry were significantly associated with anxiety (Table 1). The results from the multivariate multinomial regression analysis showed that perceived fair-very poor mental health status and worry were risk factors for all levels of anxiety. Furthermore, age (≤30 years) was a risk factor, while protective behaviors change was a protective factor for mild anxiety. Male gender, with chronic disease, and perceived impact were risk factors for moderate-to-severe anxiety, while higher education was a protective factor for moderate-to-severe anxiety (Table 3).

Discussion

The COVID-19 pandemic continues to evolve rapidly and has created a challenging environment riddled with uncertainty about how it will progress in the future. The current study was an early attempt in assessing symptoms of depression and

Table 2 Multinomial Logistic Regression of Depression Among Participants (N = 925)

Variable	OR (95% CI)	P	OR (95% CI)	P
	Mild		**Moderate to Severe**	
Gender				
Male	1.157 (0.767,1.745)	0.488	1.747 (1.052,2.900)	0.031*
Female	1		1	
Age				
≤30	2.658 (1.450,4.873)	0.002**	4.026 (1.841,8.808)	<0.001***
31–45	2.336 (1.330,4.102)	0.003**	3.006 (1.452,6.222)	0.003**
≥46	1		1	
Educational level				
High school and below	1		1	
Undergraduate or associate degree	0.797 (0.446,1.422)	0.442	0.402 (0.195,0.831)	0.014*
Graduate	0.635 (0.283,1.425)	0.271	0.309 (0.108,0.885)	0.029*
Living with or caring for children (4–6 years)				
Yes	1.625 (1.069,2.471)	0.023*	1.332 (0.778,2.282)	0.296
No	1		1	
With chronic disease or not				
Yes	1.027 (0.697,1.514)	0.891	1.774 (1.118,2.813)	0.015*
No	1		1	
Currently having influenza-like symptoms in families or others living together				
Yes	1.320 (0.892,1.954)	0.165	2.243 (1.327,3.792)	0.003**
No	1		1	
Perceived current mental health status				
Very poor or poor or fair	2.354 (1.565,3.541)	<0.001***	4.028 (2.405,6.748)	<0.001***
Very good or good	1		1	
Perceived severity	1.283 (0.982,1.676)	0.067	1.609 (1.143,2.266)	0.006**
Perceived impact	1.073 (1.009,1.140)	0.024*	1.175 (1.086,1.272)	<0.001***
Worry	1.035 (1.001,1.071)	0.045*	1.072 (1.025,1.120)	0.002**
Protective behaviors change	0.963 (0.946,0.980)	<0.001***	0.970 (0.949,0.992)	0.008**

Note: *P < 0.05, **P < 0.01, ***P < 0.001.
Abbreviations: OR, odds ratio; 95% CI, 95% confidence interval.

Table 3 Multinomial Logistic Regression of Anxiety Among Participants (N = 925)

Variable	OR (95% CI)	P	OR (95% CI)	P
	Mild		**Moderate to Severe**	
Gender				
Male	1.233 (0.826,1.841)	0.306	2.134 (1.274,3.576)	0.004**
Female	1		1	
Age, years				
≤30	1.853 (1.049,3.272)	0.034*	1.979 (0.926,4.227)	0.078
31–45	1.480 (0.874,2.505)	0.145	1.214 (0.595,2.477)	0.594
≥46	1		1	
Educational level				
High school and below	1		1	
Undergraduate or associate degree	0.833 (0.479,1.451)	0.520	0.734 (0.350,1.536)	0.411
Graduate	0.576 (0.267,1.243)	0.160	0.277 (0.088,0.875)	0.029*
With chronic disease or not				
Yes	1.036 (0.713,1.505)	0.852	1.944 (1.208,3.129)	0.006**
No	1		1	
Perceived current mental health status				
Very poor or poor or fair	1.765 (1.184,2.631)	0.005**	6.287 (3.570,11.073)	<0.001***
Very good or good	1		1	
Perceived impact	1.053 (0.994,1.116)	0.080	1.218 (1.121,1.324)	<0.001***
Worry	1.042 (1.008,1.076)	0.014*	1.062 (1.014,1.113)	0.010*
Protective behaviors change	0.981 (0.964,0.997)	0.024*	0.987 (0.965,1.010)	0.268

Note: *P < 0.05, **P < 0.01, ***P < 0.001.
Abbreviations: OR, odds ratio; 95% CI, 95% confidence interval; SDs, standard deviations; ORs, odds ratios; CI, confidence interval.

anxiety and the associated factors of these symptoms among Chinese residents after the lifting of the dynamic zero-COVID policy, capturing a temporary impact of the new policy on Chinese adults' mental health and providing vital guidance for the development of a psychological support strategy.

It is worth noting that more than half of the sample (506/925, 54.7%) experienced probable depression, and 59.0% (546/925) reported probable anxiety, which were higher than that observed in a systematic review among the general population across international settings (14.6% to 48.3% for depression and 6.33% to 50.9% for anxiety).[22] Our findings indicate that Chinese residents face worsened mental health problems after the lifting of the dynamic zero-COVID policy. We suggest three possible explanations for this phenomenon. First, it may be the psychological impact of facing possible new waves of COVID-19. Second, the changing COVID-19 prevention and control measures could strengthen the public's uncertain attitude toward the future macro environment. Third, the previous long-term zero-Covid policy has made the Chinese accustomed to kinds of passive protections from the government, while the new measures put not only more responsibilities but also more pressure on the public to take protective measures against COVID-19. Of concern, we observed higher rates of both mild depression (35.6% VS 21%) and mild anxiety (40.3% VS 29%) compared to Southeast Asia,[36] and the rate of mild anxiety was higher than the global level (15.45%),[37] which highlighted the importance of population screening and early interventions to reduce these symptoms and the risk of progression. Current guidelines for depression and anxiety in adults do not positively recommend the use of medication for mild depression and mild anxiety[38,39] while guided self-help intervention, individual or group psychological therapies, and exercise[38,40,41] should be considered to reduce depressive and anxious symptoms and prevent progression from mild symptoms to persisting psychological complications.

This study also identified possible factors associated with depression and anxiety. Among demographic factors, male gender, younger age, lower educational level, and presence of chronic disease were found to be significantly associated with depression and anxiety in multinomial logistic analysis. Previous research findings concerning the association between gender and psychological health during the COVID-19 pandemic have been inconsistent, with most studies reporting higher levels of psychological symptoms in females,[10,42,43] some in males,[44,45] and others no gender

differences.[46] The findings of our research revealed that males had more severe depression and anxiety compared to females. Considering the Chinese traditional gendered division of labor where males are likely to bear more financial responsibilities of the whole family,[47,48] the unfavorable condition of the economic downturn superimposed with the impact of the COVID-19 epidemic might place more psychological pressure on men.[49] Regarding age, our findings showed individuals with younger age had significantly higher depression and anxiety. Previous studies illustrated that depression and anxiety were persisting in the young generation during the whole pandemic period.[10,27,50] This can be explained as social restrictions affecting peer interaction[10] and working status, who are also more likely to be unemployed during and following economic crises compared to older participants.[51] Additionally, after three long years of social and economic depressions, the younger generation is less likely to be financially prepared for future uncertainties than the middle-aged groups. Although China is moving away from the very strict zero-Covid policy, the problems caused by social isolation and economic crises may not be solved immediately due to people's active protective behaviors such as home quarantine and social distancing. Lower education and previous chronic disease significantly increased the odds of moderate-to-severe depression and anxiety, which parallels the findings of a systematic review,[27] calling for more attention to these vulnerable people when providing mental health assistance.

It is no doubt that self-perceived level of mental health was associated with depression and anxiety after the release of "the 10-point measures". Similar results were obtained by previous studies reporting that a single-item measure of self-rated mental health was strongly correlated with multi-item measures of mental health.[52,53] Hence, the findings suggest that single-item self-rated mental health could be used as a population screening tool for mental health to reduce the respondent burden of long questionnaires.

It is not difficult to understand the associations between perceived impact and worry related to COVID-19 and symptoms of depression and anxiety. Our findings echo those of previous work,[25] suggesting that people who conceived the pandemic as more severe and extensively negative and worried more about the pandemic may tend to generate greater depression and anxiety symptoms.

We also found that protective behaviors change was a protective factor for depression and anxiety during the early phase after the shift in China's Covid policy. The benefits of adopting precautionary measures against COVID-19 on mental health were discussed in previous work.[30,54,55] Generally, increased preventive behaviors may offer confidence and a sense of security and help to reduce the fear of and worry about serious infections, which may minimize potential adverse psychological consequences during the pandemic. Furthermore, evidence showed that it could be helpful to stay in healthy lifestyle such as maintaining or increasing physical activity and healthy eating behaviors for improving mental health during the pandemic.[56–61] Accordingly, better change of protective behaviors may play a significant protective role in maintaining mental health in the face of formidable uncertainty of the future COVID-19 spread tendency. Conversely, previous research demonstrated that self-reported anxiety over the epidemic is a facilitator in decision making concerning positive behaviors,[62] but too much may reduce compliance with recommended protective behaviors.[63] Besides, there is evidence that moderate anxiety related to COVID-19 drives protective behaviors that in turn further reduce anxiety.[64] The relationship between protective behaviors and anxiety may be complex and future longitudinal studies could further examine this relationship.[65] As suggested by previous studies, health literacy and eHealth literacy could promote protective behaviors against COVID-19.[66,67] Taken together, timely health education strategies or other interventions based on health and eHealth literacy should be promoted to increase COVID-19-related protective behaviors and mental health, not only during the COVID-19 pandemic but in future public health emergencies.

Besides factors that were associated with both depression and anxiety mentioned above, it should be noticed that individuals living with or caring for children at the age of 4–6 years old were more likely to experience mild depression. Evidence has shown that the preschool years (aged 4–6 years) have been identified as a critical period in shaping lifelong healthy lifestyle habits.[68] During the past three years, these children along with their parents went through a new pattern of preschool education where online education become mainstream. Hence, parents may endorse higher levels of depressive symptoms due to the negative impact of decreased physical activities, increased sedentary screen time, and disrupted sleep patterns on the overall health and development of children.[69–71] The release of "the 10-point measures" may become an additional source of depression for these parents worrying about their children's high risks of being infected by COVID-19 both at home and school. Additionally, these children are not old enough to take care of

themselves if they get sick. In China, where dual-career couples are prevalent, this means that at least one parent has to be off work to provide care for the children, bringing extra caring and economic burden to the family. We also found that individuals with families or others housemates having influenza-like symptoms currently tend to report moderate-to-severe depression. One possible explanation may be that these people bore a heavy burden in terms of taking care of sick family members or housemates while protecting oneself and/or the other family members from getting infected. The findings of our study also suggested that individuals with higher perceived severity of COVID-19 tend to report moderate-to-severe depression, which aligns with the results of previous studies.[25,72] In particular, Han et al proposed that the association between perceived severity of the pandemic and depression was mediated by cyberchondria,[72] indicating the importance of curbing the spread of false information related to the pandemic and internet-based cognitive behavioral therapy to treat the symptoms of cyberchondria and depression.[73,74]

Limitations

Several important limitations need to be considered when interpreting our findings. First, given the cross-sectional nature of the study, causality among study variables and underlying mechanisms remain to be established. Furthermore, this study was carried out several days after China's Covid policy shift, which might only reflect the respondents' feelings and perceptions during the survey collection period, but to some extent, it was the typical peak time for the public's stress reactions. Future longitudinal studies to explore the continued development throughout the pandemic over time are needed. Second, this study used convenience sampling and snowball sampling, and only included respondents who were willing to participate, which might influence the sample representation and lead to selection bias. Most of our participants were females, urban residents, and those with higher educational levels, and may have limited generalizability. Third, as no validated scale for measuring COVID-19 related perceptions and protective behavior changes is available, variables were measured by self-designed questionnaires with references to previous studies. Although the Cronbach's alpha coefficients are acceptable, the reliability and validity of the questionnaires should be tested in future research. And self-report nature and retrospective recall should be treated with caution.

Conclusion

This study provided initial evidence of the psychological responses of Chinese residents during the early stage after the lifting of the dynamic zero-COVID policy and found that they experienced elevated levels of depression and anxiety symptoms, particularly, with higher rates of mild depression and anxiety. Furthermore, we identified some vulnerable populations that need prioritized mental health assistance and some potentially modifiable factors (COVID-19 related perceptions and protective behaviors change) associated with depression and anxiety, providing an important guide for the development of timely and effective psychological interventions, such as interventions based on health and eHealth literacy and internet-based cognitive-behavioral therapy.

Data Sharing Statement

The data that support the findings of this study are available on request from the correspondence.

Ethics Approval

The study complies with the Declaration of Helsinki and was approved by the Ethics Committee on Biomedical Research, West China Hospital of Sichuan University (Issued No: 2022.1943).

Acknowledgments

Disclosure

The authors report no conflicts of interest in this work.

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