# Sociodemographic Correlates of Perceived Psychosocial Health in Times of the COVID-19 Pandemic: A Community-Based Online Study in China

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# Abstract

The coronavirus (COVID-19) pandemic and the ensuing sociopolitical measures to control and curb its spread have been affecting people's psychosocial health and well-being through various complex pathways and in unprecedented ways. The present study aims to assess the sociodemographic correlates of psychosocial health situation of Chinese community-dwelling residents.

**Methods:** This was a cross-sectional survey that was carried out online and using a structured questionnaire during April 2020. In total, 4788 men and women with the age range of 11-98 years were included in the analysis. Outcome variables were the change in the experience of hopelessness, loneliness and depression before and during the pandemic, and the explanatory variables included demographic and social capital related variables.

**Results**: Respectively 34.80%, 32.50% and 44.84% of the participants expressed feeling more hopeless, lonely, and depressed during the pandemic. The percentage of all three indicators was comparatively higher among women than among men: hopelessness (50.67% vs 49.33%), loneliness (52.44% vs 47.56%), and depression (56.22% vs 43.78%). Being married was associated lower odds of loneliness among men [Odds ratio= 0.63, 95% CI=0.45,0.90]. Loneliness was negatively associated with smoking [Odds ratio= 0.67, 95% CI=0.45,0.99] and positively with drinking [Odds ratio= 1.45, 95% CI=1.04,2.02]. Compared with those in the lowest income bracket (<10K), men [Odds ratio= 0.34, 95% CI=0.21,0.55] and women [Odds ratio= 0.36, 95% CI=0.23,0.56] in the highest (>40K) had the lowest odds of reporting perceived hopelessness [Odds ratio= 0.35, 95% CI=0.25,0.48]. Smoking also showed negative association with depression only among men [Odds ratio=0.63, 95% CI=0.43,0.91].

**Conclusion:** More about one-third of the participants reported worsening in the experience of hopelessness and loneliness, with more than two-fifth of worsening depression during the pandemic compared with the time before. Several socioeconomic and lifestyle factors were found to be associated with the outcome variables, most notably participants marital status, household income, smoking, alcohol drinking, existing chronic conditions, and urbanicity.

# Background

On January 30, 2020, World Health Organization declared the novel coronavirus (COVID-19) outbreak as a Public Health Emergency of International Concern (PHEIC).[1] Countries around the world have soon responded to the emergency through the adoption of various strategies to contain the outbreak such as cessation of local and international travels, foreclosure of non-essential businesses, home quarantine for at-risk population and strict physical distancing.[2] The drastic changes in social and personal aspects of daily living are resulting in considerable degrees of psychosocial distress for people of all ages.[3–5] What makes the COVID-19 situation unique is the inherent difficulties in providing the necessary psychological care even for the most advanced healthcare systems in the world.

Being the epicenter of the pandemic, the situation is particularly concerning in China. There are several explanations for that. Firstly, the country has been struggling to meet the mental healthcare needs of the population. Although the country has been able to achieve considerable progress in terms of promoting its mental healthcare infrastructure and service delivery system, evidence suggests that the prevalence of population with psychological conditions have been increasing. Unhealthy lifestyle behavior, sociocultural environment, and demographic structure are the commonly cited factors that are fueling the mental health crisis. In the context of COVID-19 pandemic, the situation is to a great degree attributable to the widespread fear and panic stemming the health and socioeconomic consequences of the pandemic. Notably, the necessity for maintaining constant physical distancing have most certainly have deepened social isolation and inadequate community adhesion in the society where loneliness is already a grave concern among mental healthcare providers. Even among people who are otherwise capable of maintaining adequate networking and having a healthy social life are being forced to self-isolate themselves from their beloved ones driven by the fear of cross-transmission of the virus. This is especially the case for frontline workers such as those involved in the healthcare and retail industry. China is among the most highly urbanized countries in Asia, with nearly two-thirds of the population are residing in the ever-expanding cities. The country has shown strong resolution to fight urban poverty so far; however, pockets of poverty-ridden communities are still common who are now being the hardest-hit by the economic repercussions of the pandemic.[6–8] A great majority of the urban population are directly employed in the labor-intensive industries (e.g. manufacturing) are at risk of falling into poverty.

The compounding effect of loss of income and the adverse health outcomes can be identified as a key contributor to the worsening psychosocial situation of the population. For low-income earning individuals and families, loss of income can translate to catastrophic expenditures even when it comes to affording basic commodities. Several research papers have been published so far illustrating the psychosocial health consequences of economic poverty among children and general population in China. [9, 10] Apart from the direct impacts of people's financial situation, the prolonged pandemic is affecting psychosocial well-being through various other pathways such as disruption in routine lifestyle, alterations in the environmental factors that are driving unhealthy behaviors such as less physical activity, higher scopes for smoking and drinking, inadequate supply of fresh and nutritious food, and longer screen-time and more addictive social media use among the younger population- all of which have been shown to be associated with negative mental health outcomes among adolescent and adult population.[11–17] For the elderly population on the other, the need for higher dependency and physical and emotional care, especially among those with chronic health conditions, lack of psychologically supportive environment and caregiving can lead to feelings of hopelessness and loneliness, which themselves can wreak mental health havocs.[18–21] China's growing segment of the elderly population and the capacity of the healthcare system to meet their special physical and mental healthcare needs are rising concern among health policy makers and researchers. Since the outbreak of the pandemic, several research studies have been published regarding the mental health issues among Chinese population.[19, 22–24] However, the findings are still mixed, and the use of different domains of mental health and their measurement techniques make their generalization and contextual interpretation challenging for scholars and the general reader. In this study, we adopted a tactical approach to capture three core domains of mental health that are more likely to occur during a pandemic and relate them to several proximal and distal factors to understand the relative their contrasting contribution to each of the three constructs.

## Methods

## Study settings and sampling methods

In this study, residents in eastern, central, and western China were selected through directional stratification and convenience sampling. According to the epidemic prevalence of COVID-19 on April 1 2020, top two provinces and lower one provinces in terms of the number of cases were selected from each region. Therefore, we selected Hubei, Hunan and Shanxi provinces from Central China, and selected Guangdong, Zhejiang and Fujian provinces from eastern China. Due to the similarities in local conditions and customs between Sichuan and Chongqing, we chose only one of those two provinces with a comparatively higher prevalence in western China. According to the comprehensive influence of the city in each province, the provincial capital and another city are selected in each province. Sixty households from both rural and urban households in one city and all households aged over ten years were invited to participant in the survey. A total of 7,118 residents from 1,920 households in 8 provinces (16 cities) were surveyed. Due to the low response of residents in Guangdong and Zhejiang provinces, only half of the households attend in the survey, so we combined them together in the analysis.

Data collection was conducted from April 4 to April 15 of 2020, a project manager in each province recruited and coordinated provincial survey training, and six local investigators are recruiting base from each city household income to send online questionnaires and control quality. Half of them are from urban areas and most are college students. After receiving training in online data collection, each investigator was asked to send online questionnaires to 20 local families on their social network, including friends, relatives, native classmates and so on. Each eligible family member was invited to fill out an online questionnaire on an average of 15 minutes. A secret gift will be sent to encourage the participants completing the submission through the WeChat. Due to the limitations of objective factors such as age, education level, and space distance, residents may lose the ability to participate in the online survey. It is suggested to invite the young offspring living together to answer the questions according to their choice. If there is difficulty in investigating the surrounding 20 families, a supplementary survey is carried out by other investigators to complete the remaining household survey.

Meanwhile, the follow-up investigation of quality control measures were took during the data collection process. (1) Conducted a preliminary survey, group and trained the investigators. (2) Each researcher was independent, allowing the relationship between students at different learning stages. (3) Before distributed the online questionnaire, the names and eligible family Numbers of 20 family members were required to generate a unique questionnaire number. 4) Questionnaires for each family were sent out one by one and asked to convey a message: "Those who carefully complete the questionnaire will receive a secret gift."Many trap questions were set in the questionnaire to identify people who did not answer the questions carefully. (5) The project manager will be required to check the quality of each questionnaire according to the threshold value of survey time exceeding 450 seconds and the consistency of the two groups of questions set in the questionnaire.

## Outcome and explanatory measurements

In this study, we adopted a tactical approach to capture three key domains of psychosocial health that are more likely to occur during a pandemic including hopelessness, loneliness and depression.

The second outcome variable is perceived hopelessness, which is a commonly used construct used in population-based studies as an indicator of psychosocial well-being such as depression and suicide[25, 26] and has been studied in the context of predicts general health and social functioning among population with mood disorders, showing the wider applicability of this construct in the context of psychological well-being. For this study, it was measured by the question: would you say since the beginning of the pandemic you have been feeling hopeless: same as before, little worse than before, far worse than before. Hopelessness is associated with increases the risk of emotional maladjustment and a range of negative mood states, both in the general population and clinical settings.[27]

The second outcome variable is perceived loneliness, which was measured by the question: would you say since the beginning of the pandemic you have been feeling lonely: same as before, little worse than before, far worse than before. Loneliness is widely a prevalent phenomenon globally and have been a popular topic of research across various domains including chronic health conditions, psychological stress, and anxiety.[28] Loneliness is a common human emotion that is linked to feeling of insecurity, vulnerability and isolation and is associated with overall morbidity and mortality in adult populations. Although there is no universally agreed definition of loneliness, it is generally understood as not just being alone, but perceived feeling of lack of an attachment figure, social network, and absence of a circle of people that allows an individual to develop a sense of belonging, of company, of being part of a community.[28][29]

The third outcome variable is perceived depression which was measured by the question: would you say since the beginning of the pandemic you have been feeling depressed: same as before, little worse than before, far worse than before.

A single-item measure of self-rated depression (SRD) is being used increasingly population-based health surveys for its ease of application and high sensitivity to objectively measured health outcomes including all-cause mortality among cognitively intact community-dwelling older adults.[31] One-item questions for measuring general health conditions are increasingly used in epidemiologic surveys [1] and measure by questions like: "In general, would you say your mental health is: Excellent, Very Good, Good, Fair or Poor?" [30]

Explanatory variables included: Age (11−20/20−29/30−39/40−49/50−59/60−69/70−79/79+); Sex (Male/Female); Marital status (Not married/Married); Household income (< 10 k/10−20 k/20−30 k/30−40 k/>40 k yuan); Occupation (White-collar/Blue-collar/Student and Unemployed); Smoker (No/Yes);

Alcohol consumer (No/Yes); has any chronic conditions (No/Yes); Residency (Urban/Rural); Provinces (Hubei, Hunan, Shanxi, Chongqing, Gansu, Fujian, Zhejiang, Guangdong).

## Data analysis:

Data analyses were performed using Stata version 14. The prevalence of sample population reporting hopelessness, loneliness, and depression was presented as percentages. Following that, the relationship between the three outcome and explanatory variables were measured by multivariable regression methods. Given the dichotomous nature of the outcome variables, a binary logistic regression model was used to generate the odds ratios and their 95% confidence intervals. The variance inflation factor (VIF) was used as a measure of collinearity to ensure that none of the predictor variables in the final model was highly associated with each other. All statistical tests were two-tailed and p values below 0.05 were considered statistically significant.

## Ethics statement

The protocol was reviewed, the ethical approval was obtained from the Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology (2020S107). The oral informed consent was obtained from each participant before taking the online survey. Finally, a total of 6,253 residents over the age of 10 completed the survey, of which 4,788 were eligible. The participation ratio was 87.85%(6253/7118), and the valid participation ratio was 67.13% (4778/7118).

## Results

Basic demographic characteristics and the prevalence of reporting hopelessness, loneliness, and depression were presented in Table 1. Respectively 34.80%, 32.50% and 44.84% of the participants expressed feeling more hopeless, lonely, and depressed during the pandemic. The percentage of all three indicators was comparatively higher among women than among men: hopelessness (50.67% vs 49.33%), loneliness (52.44% vs 47.56%), and depression (56.22% vs 43.78%).

Table 1
Sample characteristics.

| | n | Hopelessness | | Loneliness | | Depression | |
|---|---|---|---|---|---|---|---|
| | | No | Yes | No | Yes | No | Yes |
| | | 65.20% | 34.80% | 67.50% | 32.50% | 55.16% | 44.84% |
| **Age** | | | | | | | |
| < 20 | 359 | 8.55 | 5.52 | 7.24 | 8.03 | 7.91 | 6.99 |
| 20–29 | 1,464 | 28.44 | 34.57 | 27.51 | 36.95 | 27.15 | 34.79 |
| 30–39 | 504 | 9.03 | 13.33 | 9.93 | 11.76 | 8.22 | 13.37 |
| 40–49 | 910 | 19.70 | 17.71 | 21.19 | 14.46 | 20.52 | 17.14 |
| 50–59 | 699 | 15.63 | 12.67 | 15.56 | 12.60 | 16.36 | 12.44 |
| 60–69 | 388 | 8.20 | 7.92 | 8.14 | 8.03 | 8.14 | 8.06 |
| 70–79 | 351 | 7.94 | 6.18 | 8.08 | 5.78 | 8.67 | 5.68 |
| 80+ | 113 | 2.50 | 2.10 | 2.35 | 2.38 | 3.03 | 1.54 |
| **Sex** | | | | | | | |
| Male | 2,248 | 49.33 | 42.50 | 46.66 | 47.56 | 49.53 | 43.78 |
| Female | 2,540 | 50.67 | 57.50 | 53.34 | 52.44 | 50.47 | 56.22 |
| **Marital status** | | | | | | | |
| Not married | 1,937 | 39.81 | 41.66 | 36.79 | 48.07 | 38.13 | 43.32 |
| Married | 2,851 | 60.19 | 58.34 | 63.21 | 51.93 | 61.87 | 56.68 |
| **Living arrangement** | | | | | | | |
| Alone | 418 | 7.88 | 10.32 | 7.83 | 10.60 | 8.37 | 9.18 |
| With family | 4,37 | 92.12 | 89.68 | 92.17 | 89.40 | 91.63 | 90.82 |
| **Household income** | | | | | | | |
| < 10 k | 2,074 | 41.45 | 46.82 | 41.99 | 46.08 | 43.05 | 43.64 |
| 10–20 k | 1,735 | 37.03 | 34.75 | 36.29 | 36.12 | 36.01 | 36.52 |
| 20–30 k | 579 | 12.43 | 11.46 | 12.78 | 10.67 | 12.57 | 11.50 |
| 30–40 k | 193 | 4.00 | 4.08 | 3.96 | 4.18 | 3.71 | 4.42 |
| > 40 k | 207 | 5.09 | 2.88 | 4.98 | 2.96 | 4.66 | 3.91 |
| **Occupation** | | | | | | | |
| White-collar | 1,317 | 28.12 | 26.35 | 28.16 | 26.16 | 28.28 | 26.55 |
| Blue-collar | 890 | 18.35 | 19.03 | 19.28 | 17.16 | 19.27 | 17.75 |
| Student/Unemployed | 2,581 | 53.52 | 54.62 | 52.57 | 56.68 | 52.44 | 55.71 |
| **Smoke** | | | | | | | |
| No | 3,867 | 80.62 | 81.03 | 81.50 | 79.24 | 80.54 | 81.04 |
| Yes | 921 | 19.38 | 18.97 | 18.50 | 20.76 | 19.46 | 18.96 |
| **Alcohol** | | | | | | | |
| No | 3,39 | 70.85 | 70.71 | 71.19 | 69.99 | 70.62 | 71.03 |
| Yes | 1,398 | 29.15 | 29.29 | 28.81 | 30.01 | 29.38 | 28.97 |
| **NCDs** | | | | | | | |
| No | 3,71 | 78.25 | 76.05 | 77.54 | 77.38 | 77.66 | 77.27 |
| Yes | 1,078 | 21.75 | 23.95 | 22.46 | 22.62 | 22.34 | 22.73 |
| **Residency** | | | | | | | |

|  |  | Hopelessness | | Loneliness | | Depression | |
|---|---|---|---|---|---|---|---|
| Urban | 1,723 | 36.13 | 35.71 | 35.15 | 37.72 | 36.58 | 35.26 |
| Rural | 3,065 | 63.87 | 64.29 | 64.85 | 62.28 | 63.42 | 64.74 |
| Province |  |  |  |  |  |  |  |
| 1 | 791 | 17.52 | 14.65 | 17.88 | 13.69 | 18.25 | 14.39 |
| 2 | 672 | 10.95 | 19.81 | 12.62 | 16.97 | 9.81 | 19.24 |
| 3 | 728 | 15.53 | 14.59 | 14.88 | 15.87 | 15.41 | 14.95 |
| 4 | 703 | 16.88 | 10.56 | 16.58 | 10.73 | 17.34 | 11.41 |
| 5 | 334 | 7.88 | 5.28 | 7.43 | 6.04 | 7.95 | 5.78 |
| 6 | 280 | 6.05 | 5.46 | 6.50 | 4.50 | 5.76 | 5.96 |
| 7 | 587 | 12.91 | 11.04 | 12.41 | 11.95 | 12.84 | 11.55 |
| 8 | 693 | 12.27 | 18.61 | 11.70 | 20.24 | 12.65 | 16.72 |

As shown in Fig. 1, men were less likely to report same level of hopelessness (49.3% vs 57.7%), loneliness (46.7% vs 53.3%) and depression (49.5% vs 50.5%) during the pandemic than before compared with women. More than half of the women reported having higher level of hopelessness (55.4%), loneliness (50.5%) and depression (58.0%) during the pandemic than before.

## Results of regression analysis

Factors associated with hopelessness, loneliness, and depression were presented in Table 2. In general, compared with those in the youngest age group (11–19 years), those in the higher age groups had relatively higher odds of reporting hopelessness, loneliness and depression. However, these associations reversed for those in the higher age groups of 70–79 and 79 + years. For instance, participants aged 70–79 years had lower odds of reporting hopelessness [Odds ratio = 0.55, 95% CI = 0.37,0.82], loneliness [Odds ratio = 0.59, 95% CI = 0.39,0.87] and depression [Odds ratio = 0.39, 95% CI = 0.24,0.64]. women had higher odds of reporting all three outcomes, however the odds were significant for depression only [Odds ratio = 1.38, 95% CI = 1.20,1.58].

Those who were currently married had lower odds of loneliness [Odds ratio = 0.74, 95% CI = 0.59,0.92], with the association being significant among men only [Odds ratio = 0.63, 95% CI = 0.45,0.90]. household income showed consistently significant and inverse association with reporting hopelessness, but not with loneliness and depression. Compared with those in the lowest income bracket (< 10K), those in the highest (> 40K) had the lowest odds of reporting hopeless [Odds ratio = 0.35, 95% CI = 0.25,0.48], with the association being significant both among men [Odds ratio = 0.34, 95% CI = 0.21,0.55] and women [Odds ratio = 0.36, 95% CI = 0.23,0.56].

Participants who were employed in blue-collar jobs, as well as those with no job or studying, had higher odds of reporting hopeless and depression. For hopelessness, the association was significant among men [Odds ratio = 1.36, 95% CI = 1.04,1.78], and for depression among women [Odds ratio = 1.49, 95% CI = 1.19,1.86]. Smoking was negatively associated with loneliness [Odds ratio = 0.67, 95% CI = 0.45,0.99], with which drinking showed a positive association [Odds ratio = 1.45, 95% CI = 1.04,2.02]. Smoking also showed negative association with depression only among men [Odds ratio = 0.63, 95% CI = 0.43,0.91].

Having NCDs was associated with higher odds of reporting loneliness among men [Odds ratio = 1.43, 95% CI = 1.11,1.84] and women, and depression both among men [Odds ratio = 1.53, 95% CI = 1.21,1.95] and women [Odds ratio = 1.49, 95% CI = 1.16,1.92]. participants in the urban areas had higher odds of reporting hopelessness [Odds ratio = 1.57, 95% CI = 1.18,2.08], loneliness [Odds ratio = 2.15, 95% CI = 1.17,3.96] and depression [Odds ratio = 6.55, 95% CI = 1.24,34.74]. compared with province 1, province 2 had higher odds of reporting all three outcomes both among men and women. While province 8 had higher odds of reporting loneliness and depression among men and women.

Table 2
Factors associated with hopelessness, loneliness, and depression

| | Hopelessness | | | Lonely | | | Depression | | |
|---|---|---|---|---|---|---|---|---|---|
| | Pooled | Men | Women | Pooled | Men | Women | Pooled | Men | Women |
| **Age (11–19)** | | | | | | | | | |
| 20–29 | 2.09*** [1.63,2.69] | 1.90** [1.29,2.80] | 2.26*** [1.62,3.15] | 1.10 [0.86,1.42] | 1.06 [0.72,1.56] | 1.14 [0.81,1.60] | 1.35* [1.06,1.72] | 1.55* [1.05,2.27] | 1.28 [0.93,1.77] |
| 30–39 | 3.24*** [2.26,4.65] | 3.95*** [2.27,6.87] | 2.84*** [1.75,4.62] | 1.25 [0.87,1.78] | 1.16 [0.68,1.98] | 1.39 [0.86,2.26] | 1.87*** [1.33,2.65] | 2.17** [1.28,3.68] | 1.80* [1.13,2.88] |
| 40–49 | 2.23*** [1.57,3.16] | 2.73*** [1.57,4.75] | 2.00** [1.26,3.15] | 0.75 0.53,1.07] | 0.86 [0.50,1.48] | 0.70 [0.44,1.13] | 0.94 [0.67,1.32] | 1.10 [0.65,1.89] | 0.90 [0.58,1.39] |
| 50–59 | 1.63** [1.14,2.33] | 2.03* [1.17,3.55] | 1.39 [0.86,2.24] | 0.78 [0.54,1.13] | 0.79 [0.45,1.38] | 0.83 [0.51,1.37] | 0.75 [0.53,1.06] | 0.99 [0.58,1.71] | 0.63 [0.39,1.00] |
| 60–69 | 0.94 [0.64,1.37] | 1.06 [0.59,1.90] | 0.87 [0.52,1.46] | 0.83 [0.56,1.22] | 0.84 [0.47,1.51] | 0.88 [0.52,1.48] | 0.81 [0.56,1.18] | 1.08 [0.61,1.90] | 0.70 [0.43,1.16] |
| 70–79 | 0.55** [0.37,0.82] | 0.64 [0.36,1.16] | 0.51* [0.30,0.86] | 0.59** [0.39,0.87] | 0.67 [0.37,1.21] | 0.54* [0.31,0.94] | 0.53*** [0.36,0.77] | 0.62 [0.34,1.11] | 0.50** [0.30,0.84] |
| 79+ | 0.51** [0.31,0.84] | 0.44* [0.20,0.99] | 0.59 [0.31,1.16] | 0.78 [0.48,1.27] | 0.88 [0.42,1.84] | 0.76 [0.39,1.49] | 0.39*** [0.24,0.64] | 0.42* [0.19,0.93] | 0.40** [0.21,0.76] |
| **Sex (Male)** | | | | | | | | | |
| Female | 1.15 [1.0 ,1.33] | | | 1.06 [0.91,1.22] | | | 1.38*** [1.20,1.58] | | |
| **Currently married (No)** | | | | | | | | | |
| Yes | 1.18 [0.94,1.47] | 1.07 [0.74,1.53] | 1.26 [0.94,1.67] | 0.74** [0.59,0.92] | 0.63* [0.45,0.90] | 0.78 [0.59,1.05] | 0.98 [0.79,1.21] | 0.91 [0.65,1.29] | 1.00 [0.76,1.32] |
| **Income (< 10)** | | | | | | | | | |
| 10–20 k | 0.74*** [0.64,0.85] | 0.76* [0.61,0.95] | 0.72** [0.59,0.88] | 1.07 [0.92,1.24] | 1.20 [0.97,1.49] | 0.98 [0.80,1.20] | 1.09 [0.95,1.26] | 1.09 [0.88,1.34] | 1.09 [0.90,1.32] |
| 20–30 k | 0.45*** [0.37,0.56] | 0.46*** [0.34,0.63] | 0.45*** [0.34,0.60] | 0.95 [0.76,1.18] | 1.15 [0.84,1.58] | 0.79 [0.58,1.08] | 1.00 [0.81,1.23] | 0.85 [0.63,1.16] | 1.14 [0.86,1.51] |
| 30–40 k | 0.48*** [0.35,0.67] | 0.50** [0.32,0.80] | 0.46** [0.29,0.73] | 1.17 [0.84,1.63] | 1.20 [0.75,1.92] | 1.09 [0.68,1.77] | 1.27 [0.93,1.74] | 1.39 [0.89,2.18] | 1.11 [0.71,1.76] |
| > 40 k | 0.35*** [0.25,0.48] | 0.34*** [0.21,0.55] | 0.36*** [0.23,0.56] | 0.70 [0.49,1.01] | 0.72 [0.43,1.21] | 0.72 [0.44,1.18] | 0.99 [0.72,1.35] | 1.05 [0.67,1.66] | 0.96 [0.62,1.48] |
| **Occupation (White-collar)** | | | | | | | | | |
| Blue-collar | 2.52*** [2.05,3.09] | 2.83*** [2.13,3.76] | 2.28*** [1.70,3.07] | 1.12 [0.91,1.38] | 1.12 [0.85,1.49] | 1.09 [0.80,1.49] | 1.34** [1.11,1.63] | 1.36* [1.04,1.78] | 1.31 [0.98,1.74] |
| Student/Unemployed | 1.38*** [1.17,1.64] | 1.44** [1.11,1.87] | 1.38** [1.10,1.74] | 1.09 [0.92,1.30] | 1.03 [0.79,1.34] | 1.09 [0.86,1.39] | 1.38*** [1.17,1.63] | 1.28 [ 1.00,1.65] | 1.49*** [1.19,1.86] |

N.B: Number are odds ratios, those in brackets are 95% confidence intervals. Level of significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

|  | Hopelessness | | | Lonely | | | Depression | | |
|---|---|---|---|---|---|---|---|---|---|
|  | Pooled | Men | Women | Pooled | Men | Women | Pooled | Men | Women |
| **Smoking (No)** | | | | | | | | | |
| Yes | 0.90 | 0.84 | 0.98 | 0.73 | 0.67* | 0.90 | 0.71* | 0.63* | 1.40 |
|  | [0.64,1.26] | [0.58,1.22] | [0.38,2.53] | [0.51,1.04] | [0.45,0.99] | [0.34,2.37] | [0.51, 0.99] | [0.43,0.91] | [0.56,3.46] |
| **Drinking (No)** | | | | | | | | | |
| Yes | 1.18 | 1.29 | 0.90 | 1.45* | 1.54* | 1.22 | 1.47* | 1.40 | 1.58 |
|  | [0.85,1.66] | [0.87,1.91] | [0.45,1.78] | [1.04,2.02] | [1.05,2.28] | [0.62,2.43] | [1.06,2.03] | [0.96,2.06] | [0.82,3.05] |
| **Has NCDs (No)** | | | | | | | | | |
| Yes | 1.07 | 1.04 | 1.09 | 1.33** | 1.43** | 1.24 | 1.52*** | 1.53*** | 1.49** |
|  | [0.89,1.27] | [0.81,1.33] | [0.84,1.42] | [1.11,1.59] | [1.11,1.84] | [0.95,1.62] | [1.28,1.80] | [1.21,1.95] | [1.16,1.92] |
| **Residency (rural)** | | | | | | | | | |
| Urban | 1.57** | 1.43* | 2.29* | 2.15* | 1.80** | 1.51 | 6.55* | 1.16 | 1.39 |
|  | [1.18,2.08] | [1.05,1.97] | [1.03,5.07] | [1.17,3.96] | [1.16,2.78] | [0.94,2.41] | [1.24,34.74] | [0.87,1.55] | [0.69,2.80] |
| **Province (1)** | | | | | | | | | |
| Province 2 | 1.66*** | 1.87*** | 1.51** | 1.75*** | 1.63** | 1.84*** | 2.55*** | 2.55*** | 2.60*** |
|  | [1.33,2.08] | [1.34,2.60] | [1.11,2.05] | [1.40,2.20] | [1.17,2.28] | [1.34,2.52] | [2.04,3.17] | [1.85,3.52] | [1.92,3.53] |
| Province 3 | 1.31* | 1.44* | 1.22 | 1.35** | 1.35 | 1.33 | 1.28* | 1.43* | 1.17 |
|  | [1.05,1.63] | [1.04,2.01] | [0.90,1.65] | [1.08,1.70] | [0.96,1.88] | [0.97,1.83] | [1.03,1.58] | [1.04,1.97] | [0.87,1.57] |
| Province 4 | 0.85 | 0.89 | 0.81 | 0.86 | 0.89 | 0.84 | 0.86 | 0.93 | 0.80 |
|  | [0.68,1.06] | [0.64,1.23] | [0.60,1.10] | [0.68,1.10] | [0.62,1.26] | [0.60,1.17] | [0.69,1.08] | [0.67,1.29] | [0.60,1.08] |
| Province 5 | 0.76 | 0.70 | 0.83 | 1.12 | 1.16 | 1.04 | 0.96 | 1.26 | 0.79 |
|  | [0.58,1.00] | [0.46,1.07] | [0.57,1.20] | [0.83,1.50] | [0.75,1.79] | [0.69,1.56] | [0.73,1.27] | [0.84,1.90] | [0.54,1.15] |
| Province 6 | 1.03 | 1.22 | 0.92 | 0.89 | 1.09 | 0.74 | 1.33 | 1.49 | 1.25 |
|  | [0.77,1.39] | [0.77,1.92] | [0.63,1.35] | [0.65,1.23] | [0.67,1.76] | [0.48,1.15] | [,1.77] | [0.96,2.33] | [0.86,1.81] |
| Province 7 | 0.93 | 0.84 | 1.03 | 1.28* | 1.23 | 1.31 | 1.18 | 1.02 | 1.32 |
|  | [0.74,1.17] | [0.60,1.19] | [0.75,1.40] | [,1.62] | [0.86,1.77] | [0.94,1.82] | [0.94,1.48] | [0.72,1.44] | [0.98,1.79] |
| Province 8 | 1.14 | 1.30 | 1.04 | 1.97*** | 1.99*** | 1.92*** | 1.60*** | 1.65** | 1.53** |
|  | [0.91,1.42] | [0.93,1.83] | [0.76,1.42] | [1.57,2.48] | [1.42,2.79] | [1.40,2.63] | [1.28,1.98] | [1.19,2.28] | [1.14,2.06] |
| Observations | 4788 | 2248 | 2540 | 4788 | 2248 | 2540 | 4788 | 2248 | 2540 |

N.B: Number are odds ratios, those in brackets are 95% confidence intervals. Level of significance: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

## Discussion

The COVID-19 pandemic, through its various socio-cultural and environmental factors, is exerting adverse effects on people's psychosocial health around the world. The present study aimed to understand the state and the associated factors of three contextual mental health indicators, namely hopelessness, loneliness and depression among Chinese community-dwelling residents. Initial descriptive analysis showed that more about one-third of the participants reported worsening in the experience of hopelessness and loneliness, with more than two-fifth of worsening depression during the pandemic compared with the time before. Notably, the percentage of all three indicators was comparatively higher among women than among men, implying that gender-gradient in the vulnerability to mental health implications of the pandemic. There is a growing volume of literature on mental health repercussions of the pandemic, but the sex-differences in the mental health related outcomes are not very clear. However, the prevalence of psychological disorders, especially

that of major depressive disorders has been found to be higher among women in previous studies.[32, 33]. In the context of COVID-19, women might be at higher risk for poor mental health outcomes due to issues related to increased incidence of intimate partner violence (IPV) and loss of livelihood. In addition, women who are pregnant and experiencing difficulties in receiving routine antenatal care might experience psychological challenges that are being ignored by themselves and their caregivers. While this study didn't include these potential factors such as pregnancy, quality of marriage, it is recommended that future research underscored these issues to better understand the sex-disparity in mental health outcomes from COVID-19.

Results further revealed that the worsening experience of hopelessness, loneliness and depression are correlated with a range of sociodemographic and economic factors. We found that participants in the higher age groups had relatively higher odds of reporting hopelessness, loneliness and depression, except for those in the oldest age groups (70 + years), in whom the association was reversed. In general, being currently married, living in the higher income households, being employed in white collar occupation had protective effects on the three outcomes, however inconsistently across the outcomes and the sex groups. For instance, being employed in blue-collar jobs showed higher odds for hopeless and depression, but not for loneliness. For hopelessness, the associations were significant only among men, and depression only among women. Expectedly, the we found a strong positive association between reporting hopelessness and household income. The current body of literature provides evidence of the physical and psychological morbidities resulting from financial constraints,[34−36] with a handful of studies briefly focusing on the construct of hopelessness.[37−40] The intersection between financial and mental well-being is a complex one and is mediated with the underlying benefits of material advantage. Nonetheless, this result should be interpreted with caution since we had data only on raw income which may not be indicative of the actual financial situation of the participants. It is also worthy of noting that household income didn't show any significant association with loneliness and depression. While the link between socioeconomic status and mental health is relatively clear, our findings enrich the literature by showing contrastingly that income brackets are more likely to be corelated with sense of hopelessness, compared with the more commonly studied construct of depression.

Regarding health and health related behavior, we found that tobacco smoking was negatively associated with loneliness and depression, while drinking was positively associated with loneliness and only among men. Several studies have so far discussed that the use of both smoking and drinking are being triggered by the psychosocial stress resulting from the pandemic.[16, 17, 41, 42] As the world's largest consumer of tobacco and alcoholic products, China is already having a serious mental health burdens resulting from tobacco and alcohol induced diseases. Special effort should therefore be made to control the use of these products in order to minimize their psychological consequences during the pandemic. Having NCDs was also found to be associated with higher odds of reporting loneliness and depression both among men and women. In China, NCDs represent a major contributor to mental health related morbidities and mortalities especially among elderly population,[43−45] and the current situation is likely be further aggravating given the higher susceptibility of elderly population to COVID-19 infection. While the healthcare system is being overstrained with the COVID-19 patients, the mental healthcare needs of people with chronic diseases should be given special priority at the same time. Lastly, we found that participants in the urban areas had higher odds of reporting hopelessness, loneliness and depression, indicating that urban population share a higher susceptibility to psychological stressors compared with their rural counterparts. The underlying reasons behind this urban-rural difference might be rooted to the factors such as population density and relative risk of cross-transmission, differences in the type of employment, and availability of essential goods and services. Urbanization or urban residency is a well-documented contributor to psychological stress,[46−48] and the effect of the stressor can get intensified by the unique aspects brought by the pandemic. Besides urbanicity, results also showed important differences in the outcome variables across provinces, denoting the potential role of geographic factors in the mental health implications of the pandemic.

### Strengths and limitations

To our knowledge, ours is the first cross-sectional study to assess the situation of mental health status in terms of hopelessness, loneliness, and depression in the context of COVID-19 among Chinese population. sample size was relatively large and included participants with broad age range. One important aspect of the study is the contrasting measurement of the outcome factors before and during the pandemic. This method of subjective measurement of mental health status is relatively simpler and yet captures important information regarding the change in the situation specific to the pandemic. It should be kept in mind that this method doesn't reflect whether or not people were in sound mental health status prior to the pandemic, but rather the shift which can be used effectively in other crisis settings such as natural disasters. Our results should be interpreted with caution because of several limitations. First, the data are cross-sectional and the associations cannot indicate causality. Second, the conclusions cannot be generalized to the entire population of China due to inadequate sample size. Third, data were self-reported, and therefore the chance of reporting bias cannot be ignored. We were also unable to include these potential factors such as pregnancy and spousal relationships which are likely to be associated with the outcome variables among women. Also, financial situation was measured in terms of raw income and not as subjective assessment of solvency, which could have given a better reflection of the association between material wealth and psychological health.

## Conclusions

The present study aimed to explore the state of selected mental health indicators and their associated factors among community-dwelling residents in China. Findings showed that more about one-third of the participants reported worsening in the experience of hopelessness and loneliness, with more than two-fifth of worsening depression during the pandemic compared with the time before, with the percentage of all three indicators being comparatively higher among women than among men. Several socioeconomic and lifestyle factors were found to be associated with the outcome variables, most notably participants marital status, household income, smoking, alcohol drinking, existing chronic conditions, and urbanicity. Although the data are cross-sectional and hence no causal inference can be made of the associations, out study makes an important contribution to the current literature regarding the mental health situation among population who are not directly affected by the pandemic, but among the healthy and community dwelling population.

These findings will hope understand the sociodemographic groups sharing a higher susceptibility to psychosocial stress arising from the pandemic and design proper intervention strategies.

## Declarations

### - Ethical Approval and Consent to participate

The ethical approval was obtained from the Ethics Committee of Tongji Medical College, Huazhong University of Science and Technology (2020S107). The oral informed consent was obtained from each participant before taking the online survey.

### - Consent for publication

Not applicable

### - Availability of supporting data

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### - Competing interests

The authors declare that they have no competing interests

### - Funding

### - Authors' contributions

ST was responsible for collecting the data, drafted the outline of this study, performed data management, and revised the manuscript. GW performed the data analysis and drafted the first manuscript. All authors read and approved the final manuscript.

### - Acknowledgements

Not applicable

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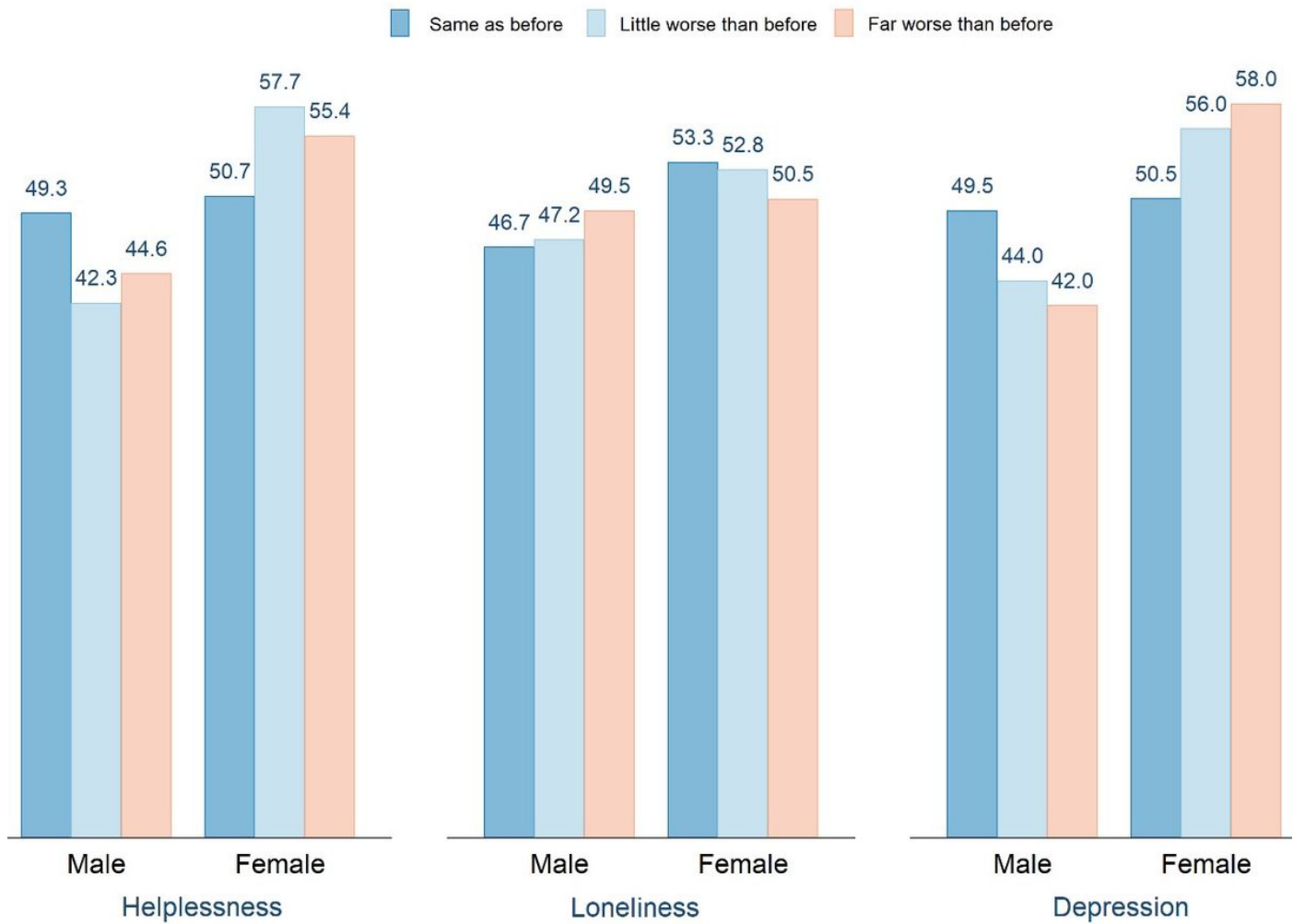
# Figures



Figure 1

Prevalence of hopelessness, loneliness, and depression before and since the outbreak.