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## Gender differences in depression and anxiety among migrant workers in Shenzhen: A cross-sectional study

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4 **Gender differences in depression and anxiety among migrant workers in Shenzhen: A**  
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6 **cross-sectional study**  
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## Abstract

### Objectives

To investigate the gender differences and associated factors of depression and anxiety among migrant workers in Shenzhen.

### Design

Cross-sectional study.

### Setting

Labor intensive factories in Shenzhen, Guangdong, China.

### Participants

We recruited 3200 migrant workers who aged over 18 years old and above and did not register in Shenzhen's Hukou system. In total, there were 3095 participants eligible for this study.

### Methods

Participants completed sociodemographic questionnaire, the Patient Health Questionnaire-9, the Generalized Anxiety Disorder-7, the UCLA Loneliness Scale, the Barratt Impulsiveness Scale, the Social Support Rating Scale, the Simplified Coping Style Questionnaire and Meaning in Life Questionnaire. We applied Chi-square test, analysis of variance, Wilcoxon rank test, Fisher's exact test, and univariate and multivariate linear regression analysis.

### Results

The overall prevalence of depression and anxiety was 27.85% and 19.26% among migrant workers. We reported gender disparities of mental health among migrant workers in Shenzhen that the prevalence of depression and anxiety was higher in females (30.57% vs. 26.43% and 22.67% vs. 17.47%), and the symptoms were more severe among females. Female migrant workers were more likely to be singled, have lower prevalence of smoking and drinking, receive less education and monthly income, have higher level of impulsiveness and social support and lower level of meaning in life. Further, we found the severity of anxiety symptoms

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3 among female migrant workers would be 0.43 unit higher than male migrant workers.  
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5 Additionally, we found age, marriage, income, adaption to living in Shenzhen, being  
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7 discriminated, drinking, loneliness, impulsiveness, social support, coping strategies and  
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9 meaning of life were associated with the severity of mental health among migrant workers.  
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## 12 **Conclusion**

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14 Gender inequity may be the institutional factor leading to disparities in the mental health among  
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16 migrant workers. Prevention and intervention strategies that improve the migrant workers'  
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18 mental health should focus on factors associated with gender inequities.  
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24 **Keywords** : Depression, Anxiety, Gender disparity, Migrant workers, China  
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## 29 **Strength and limitations**

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1. This is a large cross-sectional study with a sample of 3095 Chinese migrant workers exploring the gender disparities of depression and anxiety in Shenzhen.
  2. The overall prevalence of depression and anxiety was 27.85% and 19.26% among migrant workers in Shenzhen; the prevalence of depression and anxiety was 30.57% and 22.67% among females, and it was 26.43% and 17.47 among males.
  3. This study recruited participants from labor intensive factories and the generalizability was limited.
  4. The parent study did not collect more detailed information related to gender disparities, and we could not conceptualize frameworks to explain the mechanism from gender disparities to mental health problems.

## Introduction

Internal migrant workers contribute to China's accomplishments in economics, industrialization and urbanization in recent decades. In 2018, the internal migrant population is up to 244 million, accounting for 17.4% of China's total population<sup>1</sup>. Based on China's household registration system, the "Hukou" policy, migrant workers or the "floating population" are defined as people who leave registered residence areas (cities, towns and villages) for engaging in various jobs in non-residence areas. The coastal urban cities including Shenzhen in the Pearl River Delta area are the major destination of the internal migration.

Migrant workers are vulnerable to both physical and psychological problems because of the "Hukou" policy that migrants don't share the same social benefits as the local residents, including education, employment, health care and social services in urban cities<sup>2 3</sup>. After a series of Foxconn migrant worker suicides in Shenzhen, 2010, the mental health of migrant workers in China, especially depression, anxiety and suicide, has gained tremendous attention; and a growing number of studies have examined the relationship between migration and mental health through different perspectives, such as help-seeking, income-related inequality and social integration<sup>4-9</sup>. The prevalence of mental health problems of migrant workers varies among inland and coastal urban cities. For example, the prevalence of depressive symptoms varied from 16.5% in Beijing, 23.7% in Chengdu, 34.2% in Wuxi to 37.3% in Shenzhen<sup>10-13</sup>.

It has been well established that women are in greater risk for mental health problems than men<sup>14 15</sup>. The increased risk cannot be attributed to biological differences, it results from the interactions between biological factors and social determinants including gender stereotypes and roles, social stigma and inequity, and social autonomy<sup>16 17</sup>. Internal migration and related changes naturally serves as their primary source of stressors for accumulative stress that leads to mental health problems<sup>18</sup>. In He and Wong's study, involving 959 female migrant workers from 12 factories in Shanghai, Kunshan, Dongguan and Shenzhen, about 24% of participants



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3 were in poor mental health, measured by Brief Symptom Inventory, and the rate was the highest  
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5 in Shenzhen of 35%<sup>19</sup>. Other studies, applying the Symptom Check List 90 (SCL-90), reported  
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7 female migrant workers gained higher scores in most of the sub-scales of SCL-90 than the  
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9 Chinese norms, and the prevalence of any mental health symptoms was also higher than  
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11 males<sup>20 21</sup>. Few studies reported the prevalence of a specific mental health problem among  
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13 female migrant workers. For example, in Beijing, a study reported the prevalence of depression  
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15 22.6% among female migrant workers, which was close to another study in Shenzhen reporting  
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17 the prevalence was 22.4%<sup>22 23</sup>; and another study in Chengdu reported the prevalence of anxiety  
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19 was 22.72% in female migrants workers, and there was no gender differences<sup>24</sup>.

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24 Shenzhen is one of the pilot cities in China to develop the Psychosocial Service System  
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26 (PSS). As a meta-city with about 8.48 million migrants accounting for 65.1% of total  
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28 population in 2018, a large portion of the migrants work in labor-intensive industries and have  
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30 gained great attention during the PSS development<sup>25</sup>. This study is part of a larger observational  
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32 epidemiological study aiming to investigate the mental health problems of migrant workers in  
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34 Shenzhen, including depression, anxiety, suicide ideation, suicide plan and suicide attempt.  
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36 This study aims to 1) investigate the gender differences of mental health problems, especially  
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38 depression and anxiety, among migrant workers in Shenzhen; 2) to explore the relationships  
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40 between mental health problems and factors that help understand the gender differences.  
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## 47 **Methods**

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49 As mentioned, this study is a part of a larger observational epidemiological study conducted  
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51 among migrant workers in Shenzhen.  
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## 54 **Sample and sampling**

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56 During 2018 to 2019, with a multistage sampling strategy, the parent study first randomly  
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58 selected 4 out of 10 districts in Shenzhen, then randomly selected 8 labor intensive factories to  
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3 recruit participants. For each factory, the parent study randomly selected 400 participants. The  
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5 study recruited migrant workers who: 1) aged 18 years old and above, 2) were born elsewhere  
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7 or did not register in Shenzhen's Hukou (local registry record) system, 3) provided written  
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9 consent. We excluded migrant workers, who had a history of severe mental disorders that might  
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11 impede them finishing the survey, from this study.  
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### 14 **Procedure**

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16 Before the field survey, the study team contacted with liaisons in selected factories and  
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18 provided sampling frame; then the liaisons delivered written consents to selected migrant  
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20 workers. Once all participants provided consents, the team and the liaisons would select a date,  
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22 on which liaisons would gather participants to finish the field survey. Considering mental  
23  
24 health problems were sensitive information, we required all participants to complete the survey  
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26 while keeping personal space with others.  
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31 During the field survey, experienced and well-trained investigators would help participants  
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33 complete questionnaires. After participants finished the survey, investigators would check if  
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35 all required fields had been completed and remind participants to complete missing items  
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37 before they left.  
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### 40 **Measurements**

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42 The study team developed the sociodemographic questionnaire to collect participants'  
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44 characteristics including age, gender, education, marriage, monthly personal income, length of  
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46 staying in Shenzhen, adaption, self-perceived discrimination, drinking, smoking and number  
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48 of mental health source.  
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51 As mentioned earlier, we mainly focused on migrant workers' depression and anxiety, and  
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53 we also collected information on other psychological factors that might associate with  
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55 depression and anxiety including hopelessness, loneliness, impulsiveness, social support,  
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57 coping strategies and perceived meaning of life.  
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3 We applied the Chinese version of Patient Health Questionnaire-9 (PHQ-9), which has  
4 shown great reliability and validity, to measure the severity of depressive symptoms among  
5 participants<sup>26 27</sup>. The items capture 9 symptom criteria for clinical depression diagnosis from  
6 Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). Each item  
7 can be scored from 0 (“Not at all”) to 3 (“Nearly every day”), and the total score ranges from  
8 0 to 27 with a higher score indicating more severity of depressive symptoms; and a total score  
9 of 5, 10, 15 and 20 indicates mild, moderate, moderately severe and severe depression<sup>26</sup>. We  
10 set the cut-off point at 5 to screen for distress/depression. The Cronbach’s alpha was 0.880 in  
11 this study.  
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23 We applied the Chinese version of the Generalized Anxiety Disorder-7 (GAD-7), which has  
24 shown great reliability and validity, measure the severity of anxiety among participants<sup>28 29</sup>.  
25 The items reflect all symptom criteria for GAD from DSM-IV. Each item can be scored from  
26 0 (“Not at all”) to 3 (“Nearly every day”), and the total score ranges from 0 to 21 with a higher  
27 score indicating a more severity of GAD symptoms; and a total score of 5, 10, and 15 indicates  
28 mild, moderate and severe anxiety<sup>28</sup>. We set the cut-off point at 5 to screen for anxiety. The  
29 Cronbach’s alpha was 0.906 in this study.  
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40 We applied the Chinese version of 6-item UCLA Loneliness Scale (ULS-6), which was  
41 developed and validated by Li in China based on the short-form of the UCLA Loneliness Scale  
42 (ULS-8), to measure loneliness among participants<sup>30 31</sup>. The ULS-6 removed item “I am an  
43 outgoing person” and “I can find companionship when I want it” from the ULS-8. Each item  
44 can be scored from 1 to 4, and the total score ranges from 6 to 24 with a higher score indicating  
45 a more severity of of loneliness. The Cronbach’s alpha was 0.859 in this study.  
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54 We applied the Chinese version of the Barratt Impulsiveness Scale (BIS-11), which has  
55 been translated and validated in Chinese population by Li and Phillips et al., to measure  
56 impulsiveness among participants<sup>32</sup>. Different from the English version, the 30-item Chinese  
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3 version is a 5-point scale by separating “Never” and “Rarely”, and has 3 sub scales to evaluate  
4 attentional, motor and non-planning impulsiveness. Each item can be scored from 1 (“Never”)  
5 to 5 (“Always”), and, after transforming, the total score ranges from 0 to 100 with a higher  
6 score indicating a higher level of impulsiveness. The Cronbach’s alpha was 0.794 in this study.  
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12 We applied the Social Support Rating Scale (SSRS), developed by Xiao in China, to  
13 measure social support among participants. The SSRS is a 10-item scale and measures social  
14 support from objective social support, subjective social support and utilization, and it has been  
15 widely used in China with great reliability and validity<sup>33-36</sup>. Each item inquires participant  
16 either the types and numbers of source, the supportive circumstances and relationships, how to  
17 utilize help. Each item has been assigned a score, and the total ranges from 12 to 66 with a  
18 higher score indicating a higher level of social support. The Cronbach’s alpha was 0.804 in this  
19 study.  
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30 We applied the Simplified Coping Style Questionnaire (SCSQ), developed by Xie in China,  
31 to explore how participants cope with daily stress or events. The SCSQ is a 20-item scale and  
32 measures both positive and negative coping<sup>37</sup>. There are 12 items for positive coping and 8  
33 items for negative coping. Each item can be scored from 1 (“Never”) to 4 (“Very often”). For  
34 each type of coping, the score is the mean of the domain with a higher score indicating being  
35 more inclined to adopt the coping strategy. The Cronbach’s alpha was 0.863 in this study.  
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44 We applied the Chinese version of Meaning in Life Questionnaire (C-MLQ), which has  
45 been translated and validated in China, to measure how participants assessed the presence of  
46 and searched for meaning in life<sup>38 39</sup>. The C-MLQ scale is a 10-item scale. Each item can be  
47 scored from 1 (“Strongly disagree”) to 7 (“Strongly agree”), and the total score ranges from 10  
48 to 70 with a higher score indicating more satisfied in life. The Cronbach’s alpha was 0.844 in  
49 this study.  
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## Statistical analysis

In this study, we analyzed data with R (version 3.5.1 ) and set the statistical significance at 0.05<sup>40</sup>.

## Data preparation

Before analysis, we recoded participants' marital status into two categories: singled and married/coupled. We divided education into four groups: primary school and below, junior high school, high school, and college and above. We divided personal monthly income into four groups:  $\leq$ ¥2999, ¥3000 ~ 4999, ¥5000 ~ 9999, and  $\geq$ ¥10000.

## Analytic plan

We compared the characteristics between male and female participants by one-way analysis of variance (ANOVA) or Wilcoxon rank test (if the data were of skewed distribution) for continuous variables, Chi-square test for categorical variables, and Fisher's exact test if necessary. Descriptive analysis were conducted by R package "psych"<sup>41</sup>.

We created dummy variables for categorical variables first, then conducted univariate linear regression analysis between depression/anxiety and potential associated variables, and then to conduct multivariate linear regression analysis with variables of significance in the univariate analysis. In multivariate analysis, we adopted a stepwise backward strategy. We chose the Akaike information criterion (AIC), adjusted R-squared and F-value to assess the fitness of models, and lower values indicated better model fitness. Analysis were conducted by R package "car" and "lme4" and "MASS"<sup>42-44</sup>.

## Patient and Public Involvement

Participants who we recruited did not involve in the design, or conduct, or reporting, or dissemination plans of our study.

## Results

From July 1<sup>st</sup> 2018 to June 30<sup>th</sup> 2019, we have recruited 3200 migrant workers in Shenzhen, and 3095 of them were eligible for this study. Of 3095 participants, there were 2032 males and 1063 females.

Overall, the age of participants ranged from 18 to 62 years old with a mean of  $34.38 \pm 9.03$ . There were 1959 (63.30%) participants married or coupled. Among all participants, and 227 of them (7.33%) have finished college and above, 1461 of them (47.21%) finished junior high school, 1346 of them finished high school (43.49%), and 61 of them (1.97%) finished primary school. A majority of participants (1995, 64.46%) received monthly personal income between ¥3000 ~ 4999, followed by 17.42% (539/3095) and 17.16% (531/3095) of them received monthly personal income of  $\leq$  ¥2999 and ¥5000 ~ 9999, and only 0.97% (30/3095) of them received monthly personal income of 10000 and above. The length of stay in Shenzhen ranged from one month to 34 years with a mean of  $7.53 \pm 6.17$  years. There were 89.63% of participants (2774/3095) adapted to living in Shenzhen, and there were 75.12% of participants (2325/3095) reported not being discriminated. The prevalence of smoking and drinking was 31.21% (966/3095) and 42.58% (1318/3095) respectively. The total number of mental health resource ranged from 0 to 9 with a mean of  $1.35 \pm 0.95$ . The score of ULS-6 ranged from 6 to 24 with a mean of  $9.89 \pm 3.86$ . The score of BIS-11 ranged from 25 to 88 with a mean of  $51.43 \pm 8.78$ . The score of SSRS ranged from 14 to 63 with a mean of  $38.85 \pm 8.63$ . The score of positive coping ranged from 0 to 36 with a mean of  $21.39 \pm 7.47$ . The score of negative coping ranged from 0 to 24 with a mean of  $8.14 \pm 4.72$ . The score of CMLQ ranged from 10 to 70 with a mean of  $49.94 \pm 10.95$ . The score of PHQ-9 ranged from 0 to 27 with a mean of  $3.31 \pm 4.34$ ; and the prevalence of depression was 27.85% (862/3095). The score of GAD-7 ranged from 0 to 21 with a mean of  $2.30 \pm 3.53$  and the prevalence of anxiety was 19.26% (596/3095).

We observed gender disparities in several aspects. Among sociodemographic

characteristics, we found the proportion of being singled was higher in males (43.90% vs. 22.95%), the proportion of receiving high school education and above was higher in males (55.56% vs. 42.17%), the proportion of monthly personal income over ¥5000 was higher in males (21.8% vs. 11.1%), the prevalence of smoking (46.31% vs. 2.35%) and drinking (53.48% vs. 21.07%) was also higher in males than in females. Among psychological scales, the scores of BIS-11 (53.18 vs. 50.51) and SSRS (39.70 vs. 38.40) were higher in females than males; and the score of CMLQ (58.50 vs. 48.85) was higher in males than in females. These results indicated that female migrant workers had a higher level of impulsiveness, social support, while male migrant workers were more satisfied in life. The mean scores of PHQ-9 (3.66 vs. 3.14) and GAD-7 (2.69 vs. 2.09) were higher in females than in male, and the prevalence of depression and anxiety were also higher among females (30.57% vs. 26.43% and 22.67% vs. 17.47%). More details were shown in Table 1.

Table 1 Demographic information of participants

	Overall N=3095 (mean/%)	Gender		<i>p</i>
		Male n=2032 (mean/%)	Female n=1063(mean/%)	
Age	34.38 (9.03)	34.75 (9.59)	33.69 (7.78)	<0.01
Marriage				<0.01
Singled	1136 (36.70%)	892 (43.90%)	244 (22.95%)	
Married/coupled	1959 (63.30%)	1140 (56.10%)	819 (77.05%)	
Education				<0.01
Primary school	61 (1.97%)	32 (1.57%)	29 (2.73%)	
Junior high school	1461 (47.21%)	871 (42.86%)	590 (55.50%)	
High school	1346 (43.49%)	1003 (49.36%)	343 (32.67%)	
College and above	227 (7.33%)	126 (6.20 %)	101 (9.5%)	
Monthly personal income				<0.01
≤¥2999	539 (17.42%)	372 (18.31%)	167 (15.71%)	
¥3000 ~ 4999	1995 (64.46%)	1217 (59.89%)	778 (73.19%)	
¥5000 ~ 9999	531 (17.16%)	419 (20.62%)	112 (10.54%)	
≥¥10000	30 (0.97%)	24 (1.18%)	6 (0.56%)	
Years in Shenzhen	7.53 (6.17)	7.28 (6.18)	8.03 (6.11)	<0.01
Adaption				0.88
Yes	2774 (89.63%)	1823 (89.71%)	951 (89.46%)	
No	321 (10.37%)	209 (10.29%)	112 (10.54%)	
Discrimination				0.02
Yes	770 (24.88%)	532 (26.18%)	238 (22.39%)	
No	2325 (75.12%)	1500 (73.82%)	825 (77.61%)	
Smoking				<0.01
Yes	966 (31.21%)	941 (46.31%)	25 (2.35%)	
No	2129 (68.79%)	1091 (53.69%)	1038 (97.65%)	
Drinking				<0.01
Yes	1318 (42.58%)	1094 (53.84%)	224 (21.07%)	



No	1777 (57.42%)	938 (46.16%)	839 (78.93%)	
Number of mental health source	1.35 (0.95)	1.34 (0.96)	1.35 (0.92)	0.85
Loneliness (ULS-6)	9.89 (3.86)	2.09 (3.36)	2.69 (3.79)	0.42
Impulsiveness (BIS-11)	51.43 (8.78)	50.51 (8.97)	53.18 (8.11)	<0.01
Social support (SSRS)	38.85(8.63)	38.40 (8.75)	39.70 (8.32)	<0.01
Coping				
Positive coping	21.39 (7.47)	21.45 (7.53)	21.26 (7.37)	0.51
Negative coping	8.14 (4.72)	8.16 (4.74)	8.10 (4.68)	0.71
Meaning of life (C-MLQ)	49.94 (10.95)	50.50 (11.13)	48.85 (10.53)	<0.01
Depression (PHQ-9)	3.32 (4.43)	3.14 (4.26)	3.66 (4.47)	<0.01
Anxiety (GAD-7)	2.30 (3.53)	2.09 (3.36)	2.69 (3.79)	<0.01

### Linear regression analysis of depressive symptoms

As showed in Table 2, after univariate linear regression analysis, age, gender, marriage status, monthly personal income, years in Shenzhen, adaption, discrimination, drinking, number of mental health source, loneliness, impulsiveness, social support, coping strategies and meaning of life were associated with depressive symptoms. Then, we included these variables into multivariate linear regression analysis (Model 1).

Table 2 Univariate linear regression analysis

	PHQ 9 score			GAD-7 score		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Age	-0.048	-0.65	-0.031	-0.022	-0.35	-0.0079
Gender						
Male	--	--	--	--	--	--
Female	0.52	0.20	0.84	0.60	0.34	0.86
Marriage						
Single	--	--	--	--	--	--
Married/coupled	-0.32	-0.77	0.13	-0.010	-0.27	0.24
Education						
Primary school	--	--	--	--	--	--
Junior high school	0.73	-0.094	1.56	0.59	-0.082	1.26
High school	0.069	-0.57	0.70	0.46	-0.058	0.97
College and above	0.13	-0.22	0.48	0.15	-0.13	0.43
Monthly personal income						
≤¥2999	--	--	--	--	--	--
¥3000 ~ 4999	2.41	1.35	3.48	1.74	0.87	2.61
¥5000 ~ 9999	2.08	1.26	2.89	1.62	0.96	2.29
≥¥10000	1.59	1.14	2.04	1.17	0.80	1.53
Years in Shenzhen	-0.030	-0.055	-0.0055	-0.0043	-0.024	0.016
Adaption						
Yes	--	--	--	--	--	--
No	2.66	2.17	3.16	1.61	1.21	2.01
Discrimination						
Yes	--	--	--	--	--	--
No	-1.08	-1.43	-0.73	-0.85	-1.13	-0.56
Smoking						



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2						
3						
4	Yes	--	--	--	--	--
5	No	-0.16	-0.49	0.17	0.10	-0.16
6	Drinking					
7	Yes	--	--	--	--	--
8	No	-1.03	-1.34	-0.72	-0.65	-0.90
9	Number of mental health source	-0.31	-0.47	-0.15	-0.24	-0.37
10	Loneliness (ULS-6)	0.62	0.59	0.66	0.52	0.49
11	Impulsiveness (BIS-11)	0.20	0.19	0.22	0.15	0.14
12	Social support (SSRS)	-0.14	-0.15	-0.12	-0.092	-0.11
13	Coping					
14	Positive coping	-0.065	-0.085	-0.044	-0.048	-0.064
15	Negative coping	0.25	0.21	0.28	0.19	0.16
16	Meaning of life (CMLQ)	-0.059	-0.072	-0.045	-0.042	-0.053
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20 We found Model 1 was a significant regression equation with an adjusted R-squared of

21 0.3887, an F-value of 116.7 ( $p < 0.05$ ) and an AIC of 7582.69. We applied a backward step-

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wisely removed number of mental health source, years in Shenzhen and positive coping strategy from the analysis, and finally we got the final model (Model 2). Comparing with Model 1, Model 2 improved in model fitness with an adjusted R-squared of 0.3889, an F-value of 141.7 ( $p < 0.05$ ) and an AIC of 7579.018.

In this study, the severity of depressive symptoms would increase 0.46, 0.088 and 0.11 unit for each unit of loneliness, impulsiveness and negative coping increased, respectively. Comparing with singled migrant workers, the severity of depressive symptoms among married/coupled migrant workers would be 0.31 unit higher; comparing with migrant workers with monthly personal income of 2999 and below, the severity of depressive symptoms among those with income between ¥ 3000 ~ 4999, ¥ 5000 ~ 9999, and over 10000 would 3000 would be 1.39, 0.96 and 0.69 units higher; and the severity of depressive symptoms would be 0.90 unit higher among migrant workers did not adapt to living in Shenzhen. The severity of depressive symptoms would decrease 0.038, 0.022 and 0.013 unit for each unit of age, social support and meaning of life increased. Comparing with migrant workers who reported discrimination and who reported drinking, the severity of depressive symptoms among migrant workers who did not report discrimination, and did not drink would be 0.31 and 0.29 unit lower.

More details were showed in Table 3.

Table 3 Stepwise Linear Model analysis of depression

	Model 1			Model 2		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Age	-0.037	-0.055	-0.018	-0.038	-0.054	-0.021
Gender						
Male	--	--	--	--	--	--
Female	0.25	-0.032	0.54	0.24	-0.050	0.52
Marriage						
Singled	--			--		
Married/coupled	0.30	0.073	0.54	0.31	0.075	0.53
Monthly personal income						
≤¥2999	--	--	--	--	--	--
¥3000 ~ 4999	1.43	0.58	2.28	1.39	0.55	2.24
¥5000 ~ 9999	0.95	0.30	1.61	0.96	0.30	1.61
≥¥10000	0.69	0.33	1.05	0.69	0.34	1.05
Years in Shenzhen	-0.0059	-0.029	0.018	--	--	--
Adaption						
Yes	--	--	--	--	--	--
No	0.89	0.61	1.18	0.90	0.62	1.19
Discrimination						
Yes	--	--	--	--	--	--
No	-0.31	-0.54	-0.11	-0.31	-0.51	-0.11
Drinking						
Yes	--	--	--	--	--	--
No	-0.30	-0.48	-0.11	-0.29	-0.48	-0.11
Number of mental health source	-0.020	-0.15	0.11	--	--	--
Loneliness (ULS-6)	0.46	0.43	0.50	0.46	0.43	0.50
Impulsiveness (BIS-11)	0.086	0.069	0.10	0.088	0.072	0.10
Social support (SSRS)	-0.030	-0.037	-0.0029	-0.022	-0.039	-0.0057
Coping						
Positive coping	-0.010	-0.031	0.010	--	--	--
Negative coping	0.12	0.089	0.15	0.11	0.085	0.14
Meaning of life (CMLQ)	-0.012	-0.024	0.00016	-0.013	-0.025	-0.0016
AIC		7582.690			7578.018	
Adjusted R-squared		0.3887			0.3889	
F value		116.7			141.7	
<i>p</i>		<0.05			<0.05	

### Linear regression analysis of anxiety symptoms

As showed in Table 2, after univariate linear regression analysis, we found age, gender, monthly personal income, adaption, discrimination, drinking, number of mental health source, loneliness, impulsiveness, social support, coping strategies and meaning of life were associated with anxiety symptoms. Then, we included these variables into multivariate linear regression analysis (Model 3).

We found Model 3 was a significant regression equation with an adjusted R-squared of 0.3746, an F-value of 124.50 ( $p < 0.05$ ) and an AIC of 6364.065. We applied a backward stepwisely removed age, social support and positive coping from the analysis, and finally we got the final model (Model 4). Comparing with Model 3, Model 4 improved in model fitness with an adjusted R-squared of 0.03747, an F-value of 169.60 ( $p < 0.05$ ) and an AIC of 6359.401.

In this study, the severity of anxiety symptoms would increase 0.42, 0.064 and 0.081 unit for each unit of loneliness, impulsiveness and negative coping increased, respectively. Comparing with male migrant workers, the severity of anxiety symptoms among female migrant workers would be 0.43 unit higher; comparing with migrant workers with monthly personal income of 2999 and below, the severity of anxiety symptoms among those with income between ¥3000 ~ 4999, ¥5000 ~ 9999, and over 10000 would be 1.03, 0.67 and 0.42 units higher; and the severity of anxiety symptoms would be 0.40 unit higher among migrant workers did not adapt to living in Shenzhen. The severity of anxiety symptoms would decrease 0.0091 unit for each unit of meaning of life increased. Comparing with migrant workers who reported discrimination and who reported drinking, the severity of anxiety symptoms among migrant workers who did not report discrimination, and did not drink would be 0.20 and 0.14 unit lower. More details were showed in Table 4.

Table 4 Stepwise Linear Model analysis of anxiety

	Model 3			Model 4		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Age	-0.0088	-0.021	0.0030	--	--	--
Gender						
Male	--	--	--	--	--	--
Female	0.42	0.19	0.64	0.43	0.21	0.66
Monthly personal income						
≤ ¥2999	--	--	--	--	--	--
¥3000 ~ 4999	1.03	0.33	1.73	1.03	0.34	1.73
¥5000 ~ 9999	0.70	0.16	1.23	0.67	0.14	1.21
≥ ¥10000	0.43	0.15	0.72	0.42	0.13	0.72
Adaption						
Yes	--	--	--	--	--	--
No	0.38	0.15	0.61	0.40	0.16	0.63
Discrimination						
Yes	--	--	--	--	--	--

No	-0.21	-0.38	-0.049	-0.20	-0.37	-0.038
Drinking						
Yes	--	--	--	--	--	--
No	-0.13	-0.28	0.020	-0.14	-0.29	0.012
Number of mental health source	-0.019	-0.13	-0.0890	--	--	--
Loneliness (ULS-6)	0.42	0.39	0.45	0.42	0.39	0.45
Impulsiveness (BIS-11)	0.062	0.048	0.076	0.064	0.051	0.077
Social support (SSRS)	0.0057	-0.0077	0.019	--	--	--
Coping						
Positive coping	-0.0097	-0.026	0.0070	--	--	--
Negative coping	0.088	0.063	0.11	0.081	0.048	0.10
Meaning of life (CMLQ)	-0.018	0.018	0.0086	-0.0091	-0.018	0.00038
AIC		6364.065			6359.401	
Adjusted R-squared		0.3746			0.3747	
F value		124.5			169.6	
<i>p</i>		<0.05			<0.05	

## Discussion

We identified several key findings based on a sample of 3095 migrant workers: a) the overall prevalence of depression and anxiety was 27.85% and 19.26% among migrant workers in Shenzhen, which was lower than the previous study in Shenzhen<sup>13</sup>; b) gender disparities were observed among migrant workers in Shenzhen that the prevalence of depression and anxiety was higher in females, and the symptoms were also more severe among females; c) age, gender, marriage, income, adaption to living in Shenzhen, being discriminated, drinking, loneliness, impulsiveness, social support, coping strategies and meaning of life were associated with the severity of mental health; d) we observed gender differences among these sociodemographic characteristics and psychological factors that male migrant workers were older, more likely to be married, to receive more education and income, to feel being discriminated, to drink, to be more satisfied with life, and to have a lower level of impulsiveness and social support.

Migrant workers in Shenzhen are faced with increased mental health problems than local community residents. A large epidemiology study among community residents from seven Chinese provinces reported the mean score of PHQ-9 and GAD-7 was 3.95 and 2.71, respectively, and it also reported the score of GAD-7 was higher in females than in males (2.75 vs. 2.66)<sup>45</sup>. Further, this study comprised a sample of 2002 residents in Guangdong province

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3 and the mean score of PHQ-9 and GAD-7 in the sub-sample was 2.46 and 1.91, respectively,  
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5 and gender differences were not reported in the subsample<sup>45</sup>. In comparison, we reported the  
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7 mean score of PHQ-9 and GAD-7 among migrant workers in Shenzhen was 3.31 and 2.30,  
8  
9 respectively. Not only the severity of depression and anxiety symptoms, we believe the  
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11 prevalence of depression and anxiety among migrant workers in Shenzhen is higher than local  
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13 residents, which is consistent with previous studies<sup>10-13 45 46</sup>. An epidemiology study in 2009,  
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15 applying the Composite International Diagnostic Interview (CIDI), reported the prevalence of  
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17 depression and anxiety in Shenzhen was 9.15% and 12.58% among registered residents, and it  
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19 was 9.74% and 14.92% among non-registered residents<sup>47</sup>. However, we could not estimate the  
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21 change of mental health problems among migrant workers after a decade because of the non-  
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23 diagnostic tool we applied.  
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28 The prevalence of mental health problems varies among studies cross China, and we  
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30 contribute the variation to explanations. First, the cross-sectional studies applied different tools  
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32 to screen depression and anxiety, such as the Center of Epidemiologic Studies Depression  
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34 (CES-D), the Symptom Checklist 90 (SCL-90), the Self-rating Depression Scale (SDS), the  
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36 Patient Health Questionnaire Depression Module (PHQ-9), the Beck's Depression Inventory  
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38 (BDI), the Generalized Anxiety Disorder Scale (GAD-7), the Self-rating Anxiety Scale (SAS)  
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40 and the Beck's Anxiety Inventory (BAI)<sup>10-13 45 48-50</sup>. And even applying the same scale, studies  
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42 may choose different cut-off points to report the prevalence, for example, we chose the cut-off  
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44 point at 5 for PHQ-9 and GAD-7 while Wang set the cut-off point at 7 for both scales<sup>45</sup>. Second,  
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46 studies recruited different sub-groups of migrant workers. In this study, participants came from  
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48 labor intensive factories living in factory campuses which were micro-societal systems; other  
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50 studies recruited migrant workers from different industries like catering, retail and service etc.  
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52 Third, the prevalence also varies cross different samples of migrant workers because of  
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54 sampling methods and sample size. Fourth, more developed cities, like first-tier cities (i.e.  
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3 Beijing, Shanghai, Guangzhou and Shenzhen), are selective based on migrants' skills, where  
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5 working and living are much more stressful than in the rest<sup>51</sup>.  
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8 We identified factors associated with depression and anxiety from the social ecological  
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10 framework, and our results were consistent with previous studies that lower sociodemographic  
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12 status is associated with migrant workers' mental health problems<sup>10 52 53</sup>. Though gender as a  
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14 biological factor is at the individual level, it also crosses all levels of the framework and results  
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16 in institutional effects that lead to the gender disparities in mental health among migrant  
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18 workers. Empirical studies among Chinese internal migrant workers reported that, comparing  
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20 with males, females were younger, less educated and paid 20% to 30% less<sup>7 54 55</sup>. Rural  
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22 households have lower educational expectations for girls, especially among poorer households,  
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24 that leads to a higher dropout rate for girls<sup>56</sup>. Consequently, shortened education indicates  
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26 females are younger and less skilled when they enter the labor market in urban cities resulting  
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28 in the inequity of wages<sup>57</sup>. We found female migrant workers have stayed longer in Shenzhen  
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30 that may enable them a longer time to build social networks which would increase their social  
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32 support and reduce perceived discrimination in return. We reported female migrant workers  
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34 perceived lower meaning in life which may result from the labor intensity and the inequity in  
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36 wages. Despite social support, which would buffer daily stress and improve mental  
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38 wellbeing<sup>58</sup>, was higher among female migrant workers, they were in increased risk of mental  
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40 health problems. We believe the institutional gender disparities or even inequities might play  
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42 a more important role, and we encourage future research to collect detailed information,  
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44 hypothesize the mechanism between mental health problems and gender disparities in  
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46 sociodemographic factors, and test these hypotheses.  
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54 We recognize a few study limitations worth noting. First, the parent study aimed to  
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56 investigate the prevalence of common mental health problems among migrant workers from  
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58 labor intensive factories in Shenzhen, and the sample did not recruit migrant workers from  
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3 other industries, hence it was difficult to estimate the representativeness of our findings  
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5 comparing with the whole migrant worker population in Shenzhen. Second, because the parent  
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7 study did not focus on gender disparities among migrant workers, we did not collect further  
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9 information such as disparities in labor intensity, living environment, economic pressure, hence  
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11 we could not conceptualize frameworks to explain the mechanism from gender disparities to  
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13 mental health problems. Third, as a cross-sectional study, we could not draw causal inferences  
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15 from the findings. We encourage future studies to use longitudinal design to investigate the  
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17 causal effects of gender disparities on migrant workers' mental health problems, to develop  
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19 prevention and intervention strategies and to improve migrant workers' mental health.  
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## 26 **Conclusion**

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28 The findings suggest the reported prevalence of depression and anxiety is 27.85% and  
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30 19.26% among migrant workers in Shenzhen, which was lower than previous results, and  
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32 gender inequity may be the institutional factor leading to disparities in mental health among  
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34 migrant workers. Future studies should explore factors associated with gender inequities and  
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36 migrant workers' mental health problems to develop prevention and intervention strategies.  
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## 52 **Conflict of interest**

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54 The authors declare that they have not conflict of interest.  
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## 59 **Ethical Statement**

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3 The Ethics Committee of Shenzhen Kangning Hospital reviewed and approved the protocol,  
4 including the on-line informed consent process, and approved analysis of de-identified data  
5  
6 (KN-2020-04).  
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### 10 11 12 **Contribution**

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14  
15 FH developed the plan for analysis, analyzed the data, drafted and revised the paper. HL  
16 designed the survey instruments, monitored data collection, developed the plan for analysis  
17 and revised the paper. XP, LY, ZZ and HX designed the survey instruments, sent out  
18 recruitment advertisement, assisted in data collection and revised the paper. TL initiated the  
19 project, designed the study, and revised the paper. All authors had full access to all the data in  
20 the study and take responsibility for the integrity of the data and the accuracy of the data  
21 analysis. All authors read and approved the final manuscript.  
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33  
34 We sincerely thank all participants who completed the survey. We sincerely acknowledge  
35 coordination work of liaisons from selected factories.  
36  
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### 42 **Data sharing statement**

43  
44 The data on which this manuscript is based are not available to public. The data from this  
45 study are under certain restrictions according to the Shenzhen Science and Technology  
46 Innovation Commission and always under the supervision of the principal investigator of the  
47 study. Thus, there are access restrictions to the data. However, at any time, researchers can  
48 contact the principal investigator (Tiebang Liu, liutbsz@126.com) for data sharing.  
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## References

1. National Health Commission of the People's Republic of China. China Migrant Population Development Report 2018. Beijing: National Health Commission of the People's Republic of China, 2018.
2. Wong DFK, Li C, He X. Rural migrant workers in urban China: living a marginalised life. *International Journal of Social Welfare* 2007;16(1):32-40.
3. Chan KW. Migration and development in China: Trends, geography and current issues. *Migration and Development* 2012;1(2):187-205.
4. Phillips MR. Foxconn and China's suicide puzzle. *The Wall Street Journal* 2010 Wednesday, June 2;13.
5. Lam KK, Johnston JM. Depression and health-seeking behaviour among migrant workers in Shenzhen. *International Journal of Social Psychiatry* 2015;61(4):350-57.
6. Lin Y, Zhang Q, Chen W, et al. Association between social integration and health among internal migrants in Zhongshan, China. *PloS One* 2016;11(2):e0148397.
7. Shao C, Meng X, Cui S, et al. Income-related health inequality of migrant workers in China and its decomposition: an analysis based on the 2012 China labor-force dynamics survey data. *Journal of the Chinese Medical Association* 2016;79(10):531-537.
8. Zhong B, Chan S, Liu T, et al. Mental health of the old-and new-generation migrant workers in China: who are at greater risk for psychological distress? *Oncotarget* 2017;8(35):59791.
9. Wen M, Zheng Z, Niu J. Psychological distress of rural-to-urban migrants in two Chinese cities: Shenzhen and Shanghai. *Asian Population Studies* 2017;13(1):5-24.
10. Qiu P, Yang Y, Chen Q, et al. Depression and its impact factors among migrant workers in Chengdu. *Modern Preventive Medicine* 2010;37(22):4263-66.
11. Chen Z, Zhang X, Chen X, et al. Relationship between depression and self-rated health among floating populations. *Chinese Journal of Health Education* 2006;22(10):747-49.
12. Xu Y, Ji Y, Yuan Y, et al. Depressive symptoms and related factors among floating population. *Chinese Mental Health Journal* 2012;26(2):112-17.
13. Ding J, Zhou Z, Liu T, et al. Depression, anxiety and suicide risk among migrant workers in Shenzhen. 2012 Annual Guangdong Preventive Medicine Academic Conference Compilation. Guangzhou: Guangdong Preventive Medicine Association, 2013.
14. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet* 2018;392(10159):1789-858.
15. Riecher-Rössler A. Prospects for the classification of mental disorders in women. *European Psychiatry* 2010;25(4):189-96.
16. Afifi M. Gender differences in mental health. *Singapore Medical Journal* 2007;48(5):385.
17. Riecher-Rössler A. Sex and gender differences in mental disorders. *The Lancet Psychiatry* 2017; 4(1): 8-9.
18. Zhong B, Liu T, Huang J, et al. Acculturative stress of Chinese rural-to-urban migrant workers: a qualitative study. *PloS One* 2016;11(6):e0157530.
19. He X, Wong DFK. A comparison of female migrant workers' mental health in four cities in China. *International Journal of Social Psychiatry* 2011;59(2):114-22.
20. You L, Jin D, Yang H, et al. Psychological health and relevant factors among enterprise employees in Shenzhen. *China Journal of Health Psychology* 2013;21(10):1495-97.
21. Zheng L, Tan Q, Xue X. Investigation on mental health and the influencing factors of 1716 migrant workers in Shenzhen City. *Strait Journal of Preventive Medicine* 2012;18(1):9-11.
22. Sun Z. Women's depressed condition and its influencing factors in a factory in Shenzhen. *Chinese Primary Health Care* 2011;25(10):32-33.
23. Lin D, Fang X, Lin X, et al. The relationship between mobility, depression and smoking, alcohol use among rural-to-urban female migrants in Beijing. *Chinese Journal of Clinical Psychology* 2006;14(6):614-16.
24. Wang Q, Fu X, Wei Y, et al. The study on anxiety and its influence factors of floating population in Chengdu. *Journal of Preventive Medicine Information* 2007;23(5):544-46.
25. Shenzhen Statistical Bureau. Bulletin on Statistics of Economic and Social Development of Shenzhen. Shenzhen: Statistical Bureau of Shenzhen, 2019.
26. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine* 2001;16(9):606-13.

27. Sun X, Li Y, Yu C, et al. Reliability and validity of depression scales of Chinese version: a systematic review. *Chinese Journal of Epidemiology* 2017;38(1):110-16.
28. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine* 2006;166(10):1092-97.
29. He X, Li C, Qian J, Cui H, and Wu W. Reliability and validity of a gneralized anxiety scale in general hospital outpatients. *Shanghai Archieves of Psychiatry* 2010;22(4):200-03.
30. Hays RD, DiMatteo MR. A short-form measure of loneliness. *Journal of Personality Assessment* 1987;51(1):69-81.
31. Li Z. The evaluation and application of the Chinese version of the Short-form UCLA Loneliness Scale (ULS-8). Central South University, 2012.
32. Li, Phillips MR, Xu D, et al. Reliability and validity of an adapted Chinese version of Barratt Impulsiveness Scale. *Chinese Mental Health Journal* 2011;25(08):610-15.
33. Xiao S. Social support rating scale. *Chinese Mental Health Journal* 1993;Suppl: 42-46.
34. Liu J, Li F, Lian Y. Investigation of reliability and validity of the social support scale. *Journal of Xinjiang Medical Univerity* 2008;31(1):1-3.
35. Su L, Wei B, Ling X, et al. Study on the reliability, validity and norm of scial support scale in Chuang peasants. *Modern Preventive Medicine* 2009;36(23):4411-13.
36. Xie R, He G, Koszycki D, et al. Prenatal social support, postnatal social support, and postpartum depression. *Annals of Epidemiology* 2009;19(9):637-43.
37. Xie Y. Reliability and validity of the simplified Coping Style Questionnaire. *Chinese Journal of Clinical Psychology* 1998;6(2):114-15.
38. Wang M, Dai X. Chinese Meaning in Life Questionnaire revised in college students and its reliabiity and validity test. *Chinese Journal of Clinical Psychology* 2008;16(5):459-61.
39. Steger MF, Frazier P, Oishi S, et al. The meaning in life questionnaire: Assessing the presence of and search for meaning in life. *Journal of Counseling Psychology* 2006;53(1):80.
40. R: A language and environment for statistical computing [program], 2013.
41. psych: procedures for personality and psychological research [program], 2017.
42. Fox J, Weisberg S, Adler D, et al. Package ‘car’. *Vienna: R Foundation for Statistical Computing* 2012
43. Bates D, Maechler M, Bolker B, et al. Package ‘lme4’. *Convergence* 2015;12(1)
44. Ripley B, Venables B, Bates DM, et al. Package ‘mass’. *Cran R* 2013;538
45. Wang W. Psychological Health Status in Seven Provinces in China and Brief Intervention for Alcohol Abuse. Shanghai Jiao Tong University, 2014.
46. Qi X. Emotional problems and service needs of community residents. Shanghai Jiao Tong University, 2014.
47. Hu J, Hu C, Duan W, et al. Survey on mental disorders among registered residents and non-registered residents in Shenzhen *Chinese Journal of Epidemiology* 2009;30(6):543-48.
48. Yan X, Wang X, Qin Y, et al. Prenatal anxiety and its influential factors among floating women from rural area. *Chinese Journal of Public Health* 2015;31(2):235-37.
49. Zhou Z, Xu Y, Jin D, et al. Influencing factors of suicide ideation among migrant service workers in Shenzhen city. *Chinese Journal of Public Health* 2016;32(7):948-52.
50. Liu X, Liu Y, Pan R, et al. Anxiety and depression survey analysis among migrant workers of leather industry in Shenzhen. *Journal of Medical Theory and Practice* 2012;25(16):1972-74.
51. Hu W, Wang R. Which Chinese cities are more inclusive and why? *Cities* 2019;86:51-61.
52. Zhong B, Liu T, Chiu HF, et al. Prevalence of psychological symptoms in contemporary Chinese rural-to-urban migrant workers: an exploratory meta-analysis of observational studies using the SCL-90-R. *Social Psychiatry and Psychiatric Epidemiology* 2013;48(10):1569-81.
53. Lin Y, Zhang Q, Chen W, et al. The social income inequality, social integration and health status of internal migrants in China. *International Journal for Equity in Health* 2017;16(1):139.
54. Magnani E, Zhu R. Gender wage differentials among rural-urban migrants in China. *Regional Science and Urban Economics* 2012;42(5):779-93.
55. Xu S, Tian L. An empirical study on gender differences in Income of migrant workers from Jiangsu, Zhejiang and Shanghai. *Guizhou Social Sciences* 2015;305(5):34-39.
56. Danke L, Tasang MC. Household decisions and gender inequality in education in rural China. *China: An International Journal* 2003;1(2):224-48.
57. Wei J, Luo Z, Weng Z. Impact of human capital factors on employment and income levels of nascent migrant workers. *Economic Research Guide* 2013;191(3):151-53.
58. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychological Bulletin*

1985;98(2):310-57.

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## STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page number
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3,4
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	6
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6,7
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	6,7
		(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	No applicable
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7,8,9
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7,8,9
Bias	9	Describe any efforts to address potential sources of bias	17
Study size	10	Explain how the study size was arrived at	7,8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	10
		(b) Describe any methods used to examine subgroups and interactions	No applicable
		(c) Explain how missing data were addressed	7
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	10
		(e) Describe any sensitivity analyses	No applicable

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<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	11
		(b) Give reasons for non-participation at each stage	6,7
		(c) Consider use of a flow diagram	No applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	11, 12
		(b) Indicate number of participants with missing data for each variable of interest	11
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	No applicable
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	No applicable
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	No applicable
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	11,12
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-14
		(b) Report category boundaries when continuous variables were categorized	11-12
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	No applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	No applicable
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	14-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-17
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17,18

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Gender disparities in depressive and anxiety symptoms among internal migrant workers in Shenzhen: A cross-sectional study

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Keywords:	PUBLIC HEALTH, Depression & mood disorders < PSYCHIATRY, Anxiety disorders < PSYCHIATRY, SOCIAL MEDICINE, EPIDEMIOLOGY

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1           **Gender disparities in depressive and anxiety symptoms among internal migrant**  
2 **workers in Shenzhen: A cross-sectional study**

3  
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## 1 **Abstract**

### 2 **Objectives**

3 To investigate the gender disparities in the prevalence and severity of depressive and anxiety  
4 symptoms and associated factors among internal migrant workers in Shenzhen.

### 5 **Design**

6 Cross-sectional study.

### 7 **Setting**

8 Labor intensive factories in Shenzhen, Guangdong, China.

### 9 **Participants**

10 We recruited 3200 internal migrant workers who aged over 18 years old and above and did not  
11 register in Shenzhen's household registration system. There were 3095 participants eligible for  
12 this study.

### 13 **Methods**

14 Participants completed sociodemographic questionnaire, the Patient Health Questionnaire-9,  
15 the Generalized Anxiety Disorder-7, the UCLA Loneliness Scale, the Barratt Impulsiveness  
16 Scale, the Social Support Rating Scale, the Simplified Coping Style Questionnaire and  
17 Meaning in Life Questionnaire. We applied Chi-square test, analysis of variance, Wilcoxon  
18 rank test, Fisher's exact test, and univariate and multivariate multilevel linear regression  
19 analysis.

### 20 **Results**

21 The overall prevalence of depressive and anxiety symptoms was 27.85% and 19.26% among  
22 internal migrant workers. We reported gender disparities of depressive and anxiety symptoms  
23 among participants that the prevalence of depressive and anxiety symptoms was higher in  
24 females (30.57% vs. 26.43% and 22.67% vs. 17.47%), and the symptoms were more severe  
25 among females. Female migrant workers were more likely to be singled, have lower

1 prevalence of smoking and drinking, receive less education and monthly income, have higher  
2 level of impulsiveness and social support and lower level of meaning in life. We found age,  
3 marriage, income, adaption to living in Shenzhen, being discriminated, drinking, loneliness,  
4 impulsiveness, social support, coping strategies and meaning of life were associated with the  
5 severity of depressive and anxiety symptoms among internal migrant workers in Shenzhen.

## 6 **Conclusion**

7 Gender inequality may be the institutional factor leading to disparities in depressive and  
8 anxiety symptoms among internal migrant workers. Interventions should be embedded with  
9 strategies improving gender equality.

11 **Keywords :** Depression, Anxiety, Gender disparity, Migrant workers, China

## 13 **Strengths and limitations of this study**

- 14 1. This is a cross-sectional study with a large sample of Chinese internal migrant workers in  
15 Shenzhen exploring the gender disparities in the prevalence and severity of depressive and  
16 anxiety symptoms.
- 17 2. We report factors associated with the severity of depressive and anxiety symptoms among  
18 Chinese internal migrant workers.
- 19 3. This study recruited participants from labor intensive factories that limited the  
20 generalizability to internal migrant workers in other industries.
- 21 4. We were limited to detailed information on gender disparities and could not conceptualize  
22 frameworks to explain the mechanism from gender disparities to mental health problems.

## 1 Introduction

2 Internal migrant workers contribute to China's accomplishments in economics,  
3 industrialization and urbanization in recent decades. In 2018, the internal migrant population  
4 is up to 244 million, accounting for 17.4% of China's total population<sup>1</sup>. Based on China's  
5 household registration system, the "Hukou" policy, migrant workers or the "floating  
6 population" are defined as people who leave registered residence areas (cities, towns and  
7 villages) for engaging in various jobs in non-residence areas. The coastal urban cities including  
8 Shenzhen in the Pearl River Delta area are the major destinations of the internal migration.

9 Migrant workers are vulnerable to both physical and psychological problems because of the  
10 "Hukou" policy that migrants don't share the same social benefits as the registered household  
11 residents, including education, employment, health care and social services in urban cities<sup>2-3</sup>.  
12 After a series of Foxconn migrant worker suicides in Shenzhen, 2010, the mental health of  
13 migrant workers in China, especially depression, anxiety and suicide, has gained tremendous  
14 attention; and a growing number of studies have examined the relationship between internal  
15 migration and mental health through different perspectives, such as help-seeking, income-  
16 related inequality and social integration<sup>4-9</sup>. The prevalence of mental health problems of  
17 migrant workers varies among inland and coastal urban cities. For example, the prevalence of  
18 depressive symptoms varied from 16.5% in Beijing, 23.7% in Chengdu, 34.2% in Wuxi to  
19 37.3% in Shenzhen<sup>10-13</sup>.

20 Women are in greater risk for mental health problems than men<sup>14-15</sup>. The increased risk  
21 cannot be attributed to biological differences, it results from the interactions between biological  
22 factors and social determinants including gender stereotypes and roles, social stigma and  
23 inequality, and social autonomy<sup>16-17</sup>. Internal migration and related changes naturally serve as  
24 their primary source of stressors for accumulative stress leading to mental health problems<sup>18</sup>.  
25 In He and Wong's study of 959 female migrant workers from 12 factories in Shanghai,

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2  
3 1 Kunshan, Dongguan and Shenzhen, about 24% of participants were in poor mental health,  
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5 2 measured by Brief Symptom Inventory, and the rate was the highest in Shenzhen of 35%<sup>19</sup>.  
6  
7 3 Other studies, applying the Symptom Check List 90 (SCL-90), reported female migrant  
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9 4 workers gained higher scores in most of the sub-scales than the Chinese norms, and the  
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11 5 prevalence of any mental health symptoms was also higher than males<sup>20 21</sup>. Few studies  
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13 6 reported the prevalence of a specific mental health problem among female migrant workers.  
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15 7 For example, in Beijing, a study reported the prevalence of depression 22.6% among female  
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17 8 migrant workers, which was close to another study in Shenzhen reporting the prevalence was  
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19 9 22.4%<sup>22 23</sup>; and another study in Chengdu reported the prevalence of anxiety was 22.72% in  
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21 10 female migrants workers, and there was no gender differences<sup>24</sup>.  
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26 11 Shenzhen is one of the pilot cities in China to develop the Psychosocial Service System  
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28 12 (PSS). There were about 8.48 million internal migrants in Shenzhen accounting for 65.1% of  
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30 13 its total population in 2018, and a large portion of the migrants work in labor-intensive  
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32 14 industries who have gained great attention during the PSS development<sup>25</sup>. This study is a part  
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34 15 of the Social Epidemiological and Biological Study of Suicide Behaviors Among Factory  
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36 16 Migrant Workers in Shenzhen, which aims to investigate the social, biological and mental  
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38 17 health factors associated with suicide, suicide ideation, suicide plan and suicide attempts  
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40 18 among internal migrant workers in Shenzhen. The current study aims to 1) investigate the  
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42 19 gender disparities in the prevalence and severity of depressive and anxiety symptoms among  
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44 20 internal migrant workers in Shenzhen; 2) to explore factors associated with the severity of  
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46 21 depressive and anxiety symptoms.  
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## 54 23 **Methods**

### 55 24 **Sample and sampling**

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58 25 This study adopted the sample of the parent study, and the sample size was calculated to  
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1 estimate the prevalence of suicide ideation among internal migrant workers in Shenzhen based  
2 on the following equation:

$$n = Z_{1-\alpha/2}^2 p(1-p)/d^2$$

3  
4 Based on a prior study that reported the prevalence of suicide ideation was 19.9% among  
5 internal migrant workers in Shenzhen<sup>26</sup>, the parent study set the significant level  $\alpha$  at 0.01, the  
6 quantity  $d$  for permissible error as 0.02, and the sample size was 2644; meanwhile, considering  
7 the possible clustering effect and sample loss, the parent study used a positive design effect of  
8 1.20 to set the adjusted sample size as 3200.

9 During 2018 to 2019, with a multistage sampling strategy, the parent study first randomly  
10 selected 4 out of 10 districts in Shenzhen, then randomly selected 8 labor intensive factories to  
11 recruit participants. For each factory, the parent study randomly selected 400 participants. The  
12 parent study recruited migrant workers who: 1) aged 18 years old and above, 2) were born  
13 elsewhere or did not register in Shenzhen's Hukou (household registration) system, 3) provided  
14 written consent. Internal migrant workers who had a history of severe mental disorders that  
15 might impede completing the survey were excluded.

## 16 Procedure

17 Before the field survey, the study team contacted with liaisons in selected factories, and the  
18 liaisons delivered written consents to selected migrant workers based on the sampling frame.  
19 The study team and the liaisons determined a date and gathered participants to finish the field  
20 survey after participants provided consents. Considering mental health problems were sensitive  
21 information, we required all participants to complete the survey while keeping social distance.

22 During the field survey, experienced and well-trained investigators would help participants  
23 complete questionnaires and remind participants to complete missing items.

## 24 Measurements

25 The study team developed the sociodemographic questionnaire to collect participants'

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3 1 characteristics including age, gender, education, marriage, monthly personal income, length of  
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5 2 staying in Shenzhen, adaption, self-perceived discrimination, drinking, smoking and number  
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7 3 of mental health source.

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10 4 We applied the Chinese version of Patient Health Questionnaire-9 (PHQ-9) to measure the  
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12 5 severity of depressive symptoms, which has shown great reliability and validity<sup>27 28</sup>. The items  
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14 6 capture 9 symptom criteria for clinical depression diagnosis from Diagnostic and Statistical  
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16 7 Manual of Mental Disorders, Fourth Edition (DSM-IV). Each item can be scored from 0 (“Not  
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18 8 at all”) to 3 (“Nearly every day”), and the total score ranges from 0 to 27 with a higher score  
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20 9 indicating a more severity of depressive symptoms; and a total score of 5, 10, 15 and 20  
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22 10 indicates mild, moderate, moderately severe and severe depression<sup>27</sup>. We set the cut-off point  
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24 11 at 5 to screen for depressive symptoms. The Cronbach’s alpha was 0.880 in this study.

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27 12 We applied the Chinese version of the Generalized Anxiety Disorder-7 (GAD-7) measure  
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29 13 the severity of anxiety symptoms, which has shown great reliability and validity<sup>29 30</sup>. The times  
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31 14 reflect all symptom criteria for GAD from DSM-IV. Each item can be scored from 0 (“Not at  
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33 15 all”) to 3 (“Nearly every day”), and the total score ranges from 0 to 21 with a higher score  
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35 16 indicating a more severity of anxiety symptoms; and a total score of 5, 10, and 15 indicates  
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37 17 mild, moderate and severe anxiety<sup>29</sup>. We set the cut-off point at 5 to screen for anxiety  
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39 18 symptoms. The Cronbach’s alpha was 0.906 in this study.

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42 19 We applied the Chinese version of 6-item UCLA Loneliness Scale (ULS-6) to measure  
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44 20 loneliness, which has been translated and validated in China<sup>31 32</sup>. The total score ranges from 6  
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46 21 to 24 with a higher score indicating a more severity of loneliness. The Cronbach’s alpha was  
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48 22 0.859 in this study.

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51 23 We applied the Chinese version of the Barratt Impulsiveness Scale (BIS-11) to measure  
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53 24 impulsiveness, which has been translated and validated in Chinese population<sup>33</sup>. The total score  
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55 25 ranges from 0 to 100 with a higher score indicating a higher level of impulsiveness. The  
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1 Cronbach's alpha was 0.794 in this study.

2 We applied the Social Support Rating Scale (SSRS) to measure social support, which was  
3 a 10-item scale developed and had been widely used in China with great reliability and  
4 validity<sup>34-37</sup>. The total ranges from 12 to 66 with a higher score indicating a higher level of  
5 social support. The Cronbach's alpha was 0.804 in this study.

6 We applied the Simplified Coping Style Questionnaire (SCSQ) to explore how participants  
7 cope with daily stress or events, which was 20-item scale developed in China<sup>38</sup>. There are two  
8 subscales, positive coping and negative coping, and a higher mean score of each subscale  
9 indicates being more inclined to adopt the coping strategy. The Cronbach's alpha was 0.863 in  
10 this study.

11 We applied the Chinese version of Meaning in Life Questionnaire (C-MLQ) to measure  
12 how participants assessed the presence of and searched for meaning in life, which was a 10-  
13 item scale and had been translated and validated in China<sup>39 40</sup>. The total score ranges from 10  
14 to 70 with a higher score indicating more satisfied in life. The Cronbach's alpha was 0.844 in  
15 this study.

### 16 **Statistical analysis**

17 In this study, we analyzed data with R (version 3.5.1) and set the statistical significance at  
18 0.05<sup>41</sup>.

### 19 **Data preparation**

20 Before analysis, we recoded participants' marital status into two categories: singled and  
21 married/coupled. We categorized participants' education level into four groups: primary school  
22 and below ( $\leq 6$  years of education), junior high school (7 ~ 9 years of education), high school  
23 (10 ~ 12 years of education), and college and above ( $\geq 13$  years of education). We categorized  
24 participants' personal monthly income into four groups:  $\leq \$439.49$  ( $\text{¥}2999$ ),  $\$439.64 \sim 732.58$   
25 ( $\text{¥}3000 \sim 4999$ ),  $\$732.73 \sim 1465.31$  ( $\text{¥}5000 \sim 9999$ ), and  $\geq \$1465.46$  ( $\text{¥}10000$ ).



## 1 **Analytic plan**

2 To compare the characteristics between male and female participants, we applied one-way  
3 analysis of variance (ANOVA) or Wilcoxon rank test (if the data were of skewed distribution)  
4 for continuous variables, and Chi-square test for categorical variables. Descriptive analysis was  
5 conducted by R package “psych”<sup>42</sup>.

6 We created dummy variables for categorical variables, and the first category of each variable  
7 the reference group was the reference group in regression analysis. Considering the clustering  
8 effect of the sample, we conducted univariate multilevel linear regression analysis between the  
9 severity of depressive symptoms/anxiety symptoms and potential associated variables  
10 including sociodemographic factors, loneliness, impulsiveness, social support, coping strategy  
11 and meaning of life, and then to conduct multivariate multilevel linear regression analysis. In  
12 multivariate analysis, we adopted a stepwise backward strategy, and the baseline model was  
13 the first model with explanatory variables that showed significance in the univariate analysis  
14 ( $p < 0.05$ ). We chose the Akaike information criterion (AIC), the Bayesian information criterion  
15 (BIC) and adjusted R-squared and to assess the fitness of models, and lower values of the  
16 parameters indicated better model fitness. Analysis were conducted by R package “car” and  
17 “lme4” and “MASS”<sup>43-45</sup>.

## 18 **Patient and Public Involvement**

19 This study was conducted without patient and public involvement.

## 21 **Results**

22 The parent study recruited 3200 participants, and there were 105 participants did not provide  
23 complete information on PHQ-9 or GAD-7, who were excluded from analysis in this study. Of  
24 3095 eligible participants, there were 2032 males and 1063 females. The differences of  
25 sociodemographic information between eligible and non-eligible participants were not

1 significant.

2 Overall, the age of participants ranged from 18 to 62 years old with a mean of  $34.38 \pm 9.03$ .

3 There were 1959 (63.30%, 1959/3095) participants being married or coupled. There were 47.21%

4 (1461/3095) and 43.49% (1346/3095) of participants have finished junior high school and high

5 school. A majority of participants (64.46%, 1995/3095) received monthly personal income

6 between \$439.64 ~ 732.58. The length of stay in Shenzhen ranged from one month to 34 years

7 with a mean of  $7.53 \pm 6.17$  years. There were 89.63% of participants (2774/3095) adapted to

8 living in Shenzhen, and there were 75.12% of participants (2325/3095) reported not being

9 discriminated. The prevalence of smoking and drinking was 31.21% (966/3095) and 42.58%

10 (1318/3095) respectively. The total number of mental health resource ranged from 0 to 9 with

11 a mean of  $1.35 \pm 0.95$ . The score of ULS-6 ranged from 6 to 24 with a mean of  $9.89 \pm 3.86$ .

12 The score of BIS-11 ranged from 25 to 88 with a mean of  $51.43 \pm 8.78$ . The score of SSRS

13 ranged from 14 to 63 with a mean of  $38.85 \pm 8.63$ . The score of positive coping ranged from 0

14 to 36 with a mean of  $21.39 \pm 7.47$ . The score of negative coping ranged from 0 to 24 with a

15 mean of  $8.14 \pm 4.72$ . The score of CMLQ ranged from 10 to 70 with a mean of  $49.94 \pm 10.95$ .

16 The score of PHQ-9 ranged from 0 to 27 with a mean of  $3.31 \pm 4.34$ ; and the prevalence of

17 depressive symptoms was 27.85% (862/3095). The score of GAD-7 ranged from 0 to 21 with

18 a mean of  $2.30 \pm 3.53$ ; and the prevalence of anxiety symptoms was 19.26% (596/3095).

19 We observed gender disparities in several aspects. First, comparing with female

20 participants, we found male participants were more likely to be singled (43.90% vs. 22.95%),

21 to receive high school education and above (55.56% vs. 42.17%), to receive personal income

22 over \$732.73 (¥5000) (21.8% vs. 11.1%), to smoke (46.31% vs. 2.35%) and to drink (53.48%

23 vs. 21.07%). We also found male participants were less impulsive, reported lower social

24 support were more satisfied in life. Further, we reported the mean scores of PHQ-9 (3.66 vs.

25 3.14) and GAD-7 (2.69 vs. 2.09) were higher in females than in males, and the prevalence of

1 depressive and anxiety symptoms were also higher among females (30.57% vs. 26.43% and  
2 22.67% vs. 17.47%). More details were shown in Table 1.

3 Table 1 Demographic information of participants

	Overall N=3095	Gender		<i>p</i>
		Male n=2032	Female n=1063	
Age (mean, SD)	34.38 (9.03)	34.75 (9.59)	33.69 (7.78)	<0.01
Marriage (n, %)				<0.01
Single	1136 (36.70%)	892 (43.90%)	244 (22.95%)	
Married/coupled	1959 (63.30%)	1140 (56.10%)	819 (77.05%)	
Education (n, %)				<0.01
Primary school	61 (1.97%)	32 (1.57%)	29 (2.73%)	
Junior high school	1461 (47.21%)	871 (42.86%)	590 (55.50%)	
High school	1346 (43.49%)	1003 (49.36%)	343 (32.67%)	
College and above	227 (7.33%)	126 (6.20%)	101 (9.5%)	
Monthly personal income (n, %)				<0.01
≤\$439.49	539 (17.42%)	372 (18.31%)	167 (15.71%)	
\$439.64~732.58	1995 (64.46%)	1217 (59.89%)	778 (73.19%)	
\$732.73~1465.31	531 (17.16%)	419 (20.62%)	112 (10.54%)	
≥\$1465.46	30 (0.97%)	24 (1.18%)	6 (0.56%)	
Years in Shenzhen (mean, SD)	7.53 (6.17)	7.28 (6.18)	8.03 (6.11)	<0.01
Adaption (n, %)				0.88
Yes	2774 (89.63%)	1823 (89.71%)	951 (89.46%)	
No	321 (10.37%)	209 (10.29%)	112 (10.54%)	
Discrimination (n, %)				0.02
Yes	770 (24.88%)	532 (26.18%)	238 (22.39%)	
No	2325 (75.12%)	1500 (73.82%)	825 (77.61%)	
Smoking (n, %)				<0.01
Yes	966 (31.21%)	941 (46.31%)	25 (2.35%)	
No	2129 (68.79%)	1091 (53.69%)	1038 (97.65%)	
Drinking (n, %)				<0.01
Yes	1318 (42.58%)	1094 (53.84%)	224 (21.07%)	
No	1777 (57.42%)	938 (46.16%)	839 (78.93%)	
Number of mental health source (mean, SD)	1.35 (0.95)	1.34 (0.96)	1.35 (0.92)	0.85
Loneliness (ULS-6) (mean, SD)	9.89 (3.86)	2.09 (3.36)	2.69 (3.79)	0.42
Impulsiveness (BIS-11) (mean, SD)	51.43 (8.78)	50.51 (8.97)	53.18 (8.11)	<0.01
Social support (SSRS) (mean, SD)	38.85(8.63)	38.40 (8.75)	39.70 (8.32)	<0.01
Coping (mean, SD)				
Positive coping	21.39 (7.47)	21.45 (7.53)	21.26 (7.37)	0.51
Negative coping	8.14 (4.72)	8.16 (4.74)	8.10 (4.68)	0.71
Meaning of life (C-MLQ) (mean, SD)	49.94 (10.95)	50.50 (11.13)	48.85 (10.53)	<0.01
Mean score of the PHQ-9 (mean, SD)	3.32 (4.43)	3.14 (4.26)	3.66 (4.47)	<0.01
Depressive symptoms (n, %)				<0.01
No	2233	1495	738	
Yes	862	537	325	
Mean score of the GAD-7 (mean, SD)	2.30 (3.53)	2.09 (3.36)	2.69 (3.79)	<0.01
Anxiety symptoms (n, %)				<0.01
No	2499	1677	822	
Yes	596	355	241	

## Linear regression analysis of depressive symptoms

Table 2 showed the results of univariate linear regression analysis for depressive symptoms. We found age, marriage status, monthly personal income, years in Shenzhen, adaption, discrimination, smoking, drinking, number of mental health source, loneliness, impulsiveness, social support, coping strategies and meaning of life were associated with depressive symptoms. Therefore, we included these variables into multivariate multilevel linear regression analysis (Model 1).

Table 2 Results of univariate multilevel linear regression analysis for depressive and anxiety symptoms

	PHQ 9 score			GAD-7 score		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Age	-0.066	-0.085	-0.046	-0.037	-0.053	-0.021
Gender						
Male	--	--	--	--	--	--
Female	-0.093	-0.45	0.28	0.15	-0.15	0.45
Marriage						
Single	--	--	--	--	--	--
Married/coupled	-0.75	-1.07	-0.42	-0.29	-0.56	-0.023
Education						
Primary school	--	--	--	--	--	--
Junior high school	0.28	-0.74	1.49	-0.091	-0.96	0.84
High school	0.68	-0.59	1.64	0.21	-0.90	0.90
College and above	0.93	-0.19	2.27	0.75	-0.14	1.85
Monthly personal income						
≤\$439.49	--	--	--	--	--	--
\$439.64~732.58	0.18	-0.24	0.59	-0.028	-0.3	0.31
\$732.73~1465.31	-0.72	-1.27	-0.16	-0.59	-1.04	-0.14
≥\$1465.46	3.80	2.22	5.38	2.74	1.46	4.02
Years in Shenzhen	-0.050	-0.075	-0.025	-0.022	-0.042	-0.0013
Adaption						
Yes	--	--	--	--	--	--
No	1.83	1.48	2.17	1.11	0.83	1.40
Discrimination						
Yes	--	--	--	--	--	--
No	-0.80	-1.05	-0.55	-0.61	-0.81	-0.41
Smoking						
Yes	--	--	--	--	--	--
No	-0.59	-0.93	-0.24	-0.21	-0.49	0.072
Drinking						
Yes	--	--	--	--	--	--
No	-0.84	-1.05	-0.62	-0.53	-0.71	-0.35
Number of mental health source	-0.28	-0.45	-0.12	-0.19	-0.333	-0.056
Loneliness (ULS-6)	0.62	0.58	0.65	0.51	0.48	0.54
Impulsiveness (BIS-11)	0.20	0.18	0.21	0.15	0.13	0.16
Social support (SSRS)	-0.14	-0.16	-0.12	-0.095	-0.11	-0.081
Coping						
Positive coping	-0.058	-0.078	-0.038	-0.040	-0.057	-0.023

Negative coping	0.24	0.21	0.27	0.18	0.16	0.21
Meaning of life (CMLQ)	-0.055	-0.069	-0.042	-0.040	-0.051	-0.028

In Model 1, the AIC was 16337.21, the BIC was 16457.10, and the adjusted R-squared was 0.4020. We step-wisely removed years in Shenzhen, smoking, number of mental health source and positive coping strategy from the analysis. Finally, we got the final model (Model 2). Comparing with Model 1, Model 2 improved in model fitness with an AIC of 16331.71, a BIC of 16428.31, and an adjusted R-squared of 0.4003.

Table 3 showed that the severity of depressive symptoms would increase 0.46, 0.086 and 0.11 unit for each unit of loneliness, impulsiveness and negative coping increased, respectively. Comparing with singled participants, the severity of depressive symptoms among married/coupled participants would be 0.26 unit higher; comparing with participants with monthly personal income of \$439.49 and below, the severity of depressive symptoms among those with income over \$1465.46 would be 2.30 units higher; and the severity of depressive symptoms would be 0.87 unit higher among participants did not adapt to living in Shenzhen. The severity of depressive symptoms would decrease 0.045, 0.022 and 0.015 unit for each unit of age, social support and meaning of life increased. Comparing with participants who reported discrimination and who reported drinking, the severity of depressive symptoms among those who did not report discrimination and did not drink would be 0.33 and 0.26 unit lower.

Table 3 Results of the stepwise multilevel linear regression analysis of depressive symptoms

	Model 1			Model 2		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Age	-0.043	-0.062	-0.023	-0.045	-0.063	-0.027
Marriage						
Singled	--			--		
Married/coupled	0.27	0.044	0.50	0.26	0.032	0.48
Monthly personal income						
≤\$439.49	--	--	--	--	--	--
\$439.64~732.58	0.25	-0.084	0.58	0.24	-0.095	0.57
\$732.73~1465.31	0.039	-0.42	0.49	0.020	-0.42	0.46
≥\$1465.46	2.34	1.08	3.59	2.30	1.05	3.55
Years in Shenzhen	-0.0076	-0.031	0.016	--	--	--
Adaption						

1							
2							
3	Yes	--	--	--	--	--	--
4	No	0.86	0.57	1.14	0.87	0.59	1.15
5	Discrimination						
6	Yes	--	--	--	--	--	--
7	No	-0.34	-0.54	-0.13	-0.33	-0.53	-0.13
8	Smoking						
9	Yes	--	--	--	--	--	--
10	No	-0.17	-0.45	0.12	--	--	--
11	Drinking						
12	Yes	--	--	--	--	--	--
13	No	-0.24	-0.43	-0.061	-0.26	-0.44	-0.089
14	Number of mental						
15	health source	-0.015	-0.15	0.12	--	--	--
16	Loneliness (ULS-6)	0.46	0.43	0.50	0.46	0.43	0.50
17	Impulsiveness (BIS-11)	0.084	0.068	0.10	0.086	0.070	0.10
18	Social support (SSRS)	-0.019	-0.037	-0.0023	-0.022	-0.038	-0.0049
19	Coping						
20	Positive coping	-0.0073	-0.027	0.013	--	--	--
21	Negative coping	0.12	0.086	0.15	0.11	0.085	0.14
22	Meaning of life						
23	(CMLQ)	-0.014	-0.025	-0.0017	-0.015	-0.026	-0.0029
24	AIC		16337.21			16331.71	
25	BIC		16457.10			16428.31	
26	Adjusted R-squared		0.4020			0.4003	

27 Note: \* Model 1 is the initial model of the multilevel linear regression analysis. Model 2 is the final model of the analysis  
 28 after four iterations. \*\* Estimate stands for the coefficient of each variable. \*\*\*AIC stands for the Akaike information  
 29 criterion; BIC stands for the Bayesian information criterion.  
 30  
 31

### 32 **Linear regression analysis of anxiety symptoms**

33 Table 2 showed the results of univariate linear regression analysis for anxiety symptoms.  
 34 We found age, marriage, monthly personal income, years in Shenzhen, adaption,  
 35 discrimination, drinking, number of mental health source, loneliness, impulsiveness, social  
 36 support, coping strategies and meaning of life were associated with anxiety symptoms, and we  
 37 included these variables into multivariate multilevel linear regression analysis (Model 3).  
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45 In Model 3, the AIC was 15121.74, the BIC was 15236.45, and the adjusted R-squared was  
 46 0.3845. We step-wisely removed years in Shenzhen, drinking, number of mental health source,  
 47 social support, positive coping strategy and meaning of life from the analysis. Finally, we got  
 48 the final model (Model 4). Comparing with Model 3, Model 4 improved in model fitness with  
 49 an AIC of 15116.08 and a BIC of 15194.57.  
 50  
 51  
 52  
 53  
 54  
 55

56 Table 4 showed that the severity of anxiety symptoms would increase 0.42, 0.065 and 0.080  
 57 unit for each unit of loneliness, impulsiveness and negative coping increased, respectively.  
 58  
 59  
 60

1 Comparing with participants with monthly personal income of \$439.49 and below, the severity  
 2 of anxiety symptoms among those with income over \$1465.46 would be 1.57 units higher; and  
 3 the severity of anxiety symptoms would be 0.38 unit higher among migrant workers did not  
 4 adapt to living in Shenzhen. Comparing with participants who reported discrimination, the  
 5 severity of anxiety symptoms among those who did not report discrimination would be 0.23  
 6 unit lower.

7 Table 4 Results of the stepwise multilevel linear regression analysis of anxiety symptoms

	Model 3			Model 4		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Age	-0.030	-0.046	-0.014	-0.029	-0.044	-0.014
Marriage						
Single	--	--	--	--	--	--
Married/coupled	0.30	0.11	0.49	0.27	0.10	0.45
Monthly personal income						
≤\$439.49	--	--	--	--	--	--
\$439.64~732.58	0.054	-0.22	0.33	0.056	-0.22	0.33
\$732.73~1465.31	-0.014	-0.39	0.35	0.0043	-0.36	0.37
≥\$1465.46	1.58	0.55	2.61	1.57	0.54	2.60
Years in Shenzhen	0.0027	-0.016	0.022	--	--	--
Adaption						
Yes	--	--	--	--	--	--
No	0.38	0.14	0.61	0.38	0.15	0.61
Discrimination						
Yes	--	--	--	--	--	--
No	-0.22	-0.38	-0.051	-0.23	-0.39	-0.063
Drinking						
Yes	--	--	--	--	--	--
No	-0.077	-0.22	0.068	--	--	--
Number of mental health source	-0.0040	-0.11	0.11	--	--	--
Loneliness (ULS-6)	0.42	0.39	0.45	0.42	0.39	0.45
Impulsiveness (BIS-11)	0.060	0.046	0.074	0.065	0.053	0.078
Social support (SSRS)	-0.0025	-0.017	0.012	--	--	--
Coping						
Positive coping	-0.0044	-0.021	0.012	--	--	--
Negative coping	0.086	0.062	0.11	0.080	0.059	0.10
Meaning of life (CMLQ)	-0.0095	-0.019	0.00034	--	--	--
AIC		15121.74			15116.08	
BIC		15236.45			15194.57	
Adjusted R-squared		0.3845			0.3845	

8 Note: \* Model 3 is the initial model of the multilevel linear regression analysis. Model 4 is the final model of the analysis  
 9 after six iterations. \*\* Estimate stands for the coefficient of each variable. \*\*\*AIC stands for the Akaike information  
 10 criterion; BIC stands for the Bayesian information criterion.  
 11



## 1 Discussion

2 We identified several key findings based on a sample of 3095 internal migrant workers in  
3 Shenzhen, China: a) the overall prevalence of depressive and anxiety symptoms was 27.85%  
4 and 19.26%, which was lower than the previous study in Shenzhen<sup>13</sup>; b) gender disparities were  
5 observed that the prevalence of depressive and anxiety was higher in females, and the  
6 symptoms were also more severe in them; c) age, marriage, income, adaption to living in  
7 Shenzhen, being discriminated, drinking, loneliness, impulsiveness, social support, coping  
8 strategies and meaning of life were associated with the severity of depressive or anxiety  
9 symptoms; d) we observed gender disparities among sociodemographic characteristics and  
10 psychological factors that male migrant workers were older, more likely to be married, to  
11 receive more education and income, to feel being discriminated, to drink, to be more satisfied  
12 with life, and to have a lower level of impulsiveness and social support.

13 To understand the mental health problems among internal migrant workers in China, it is  
14 necessary to be familiar with the “Hukou” system. The “Hukou” system, known as the  
15 household registration system, is implemented to classify the place of registration (urban or  
16 rural residence areas) and the type of registration (agriculture or non-agriculture)<sup>46</sup>. Due to the  
17 registration, internal migrant workers, who are usually rural to urban migrants, have limited  
18 access to social welfare provided by the local governments of their destinations. Empirical  
19 studies have reported the associations between mental health and social inequities resulted from  
20 the registration system, including labor rights, wages, employment benefits, reimbursement for  
21 health care, limited access to public schools for migrant children<sup>2-13</sup>.

22 Internal migrant workers in Shenzhen are faced with increased mental health problems than  
23 local community residents. A large epidemiology study among community residents from  
24 seven Chinese provinces reported the mean score of PHQ-9 and GAD-7 was 3.95 and 2.71,  
25 respectively, and it also reported the score of GAD-7 was higher in females than in males (2.75



1 vs. 2.66)<sup>47</sup>. Further, this study comprised a sample of 2002 residents in Guangdong province  
2 and the mean score of PHQ-9 and GAD-7 in the sub-sample was 2.46 and 1.91, respectively,  
3 and gender differences were not reported in the subsample<sup>47</sup>. In comparison, we reported the  
4 mean score of PHQ-9 and GAD-7 among migrant workers in Shenzhen was 3.31 and 2.30,  
5 respectively, which were both higher than that in the mentioned study. An epidemiology study  
6 in 2009, applying the Composite International Diagnostic Interview (CIDI), reported the  
7 prevalence of depression and anxiety in Shenzhen was 9.15% and 12.58% among registered  
8 residents, and it was 9.74% and 14.92% among non-registered residents<sup>48</sup>. However, because  
9 of the non-diagnostic tools this study applied, we were limited to compare results.

10 The prevalence of depression and anxiety, including depressive and anxiety symptoms,  
11 varies among studies cross China, and we contribute the variation to explanations. First, cross-  
12 sectional studies applied different tools to screen for depression and anxiety, such as the Center  
13 of Epidemiologic Studies Depression (CES-D), the Symptom Checklist 90 (SCL-90), the Self-  
14 rating Depression Scale (SDS), the Patient Health Questionnaire Depression Module (PHQ-9),  
15 the Beck's Depression Inventory (BDI), the Generalized Anxiety Disorder Scale (GAD-7), the  
16 Self-rating Anxiety Scale (SAS) and the Beck's Anxiety Inventory (BAI)<sup>10-13 47 49-51</sup>. And even  
17 applying the same scale, studies may choose different cut-off points to report the prevalence,  
18 for example, we chose the cut-off point at 5 for PHQ-9 and GAD-7 while Wang set the cut-off  
19 point at 7 for both scales<sup>47</sup>. Second, studies recruited different sub-groups of Chinese internal  
20 migrant workers. In this study, participants came from labor intensive factories living in factory  
21 campuses which were micro-societal systems; other studies recruited participants from  
22 different industries like catering, retail and service etc. Third, the prevalence also varies cross  
23 different samples of internal migrant workers because of sampling methods and sample size.  
24 Fourth, more developed cities, like first-tier cities (i.e. Beijing, Shanghai, Guangzhou and  
25 Shenzhen), are selective based on migrants' skills, where working and living are much more

1 stressful than the rest<sup>52</sup>.

2 We identified factors associated with depressive and anxiety symptoms from the social  
3 ecological framework, and our results were consistent with previous studies that lower  
4 sociodemographic status was associated with internal migrant workers' mental health  
5 problems<sup>10 53 54</sup>. Gender as a factor at the individual level, it crosses all levels of the framework  
6 and results in institutional effects leading to the gender disparities in mental health among  
7 internal migrant workers. Empirical studies among Chinese internal migrant workers reported  
8 that female migrant workers were younger, less educated and paid 20% to 30% less than their  
9 male counterparts<sup>7 55 56</sup>. Generally, rural households have lower educational expectations for  
10 girls, especially among poorer households, that lead to a higher dropout rate for girls<sup>57</sup>; and  
11 shortened education indicates females are younger and less skilled when they enter the labor  
12 market in urban cities resulting in the inequality of wages<sup>58</sup>. We found female migrant workers  
13 have stayed longer in Shenzhen the males, which may enable them a longer time to build social  
14 networks to increase their social support and reduce perceived discrimination in return. We  
15 reported female migrant workers perceived lower meaning in life, and it may result from the  
16 labor intensity and the inequality in wages. We believe the institutional gender disparities or  
17 even inequities might play an important role, and we encourage future research to collect  
18 detailed information, hypothesize the mechanism between mental health problems and gender  
19 disparities in sociodemographic factors, and test these hypotheses.

20 We recognize a few limitations of this study. First, the parent study did not aim to investigate  
21 the prevalence of depression and anxiety (including depressive and anxiety symptoms) among  
22 internal migrant workers from labor intensive factories in Shenzhen, and the sample did not  
23 recruit migrant workers from other industries, hence it was difficult to estimate the  
24 representativeness of our findings comparing with the whole migrant worker population in  
25 Shenzhen. Second, because the parent study did not focus on gender disparities among migrant

1 workers, we did not collect further information such as disparities in labor intensity, living  
2 environment, economic pressure, work related stress, and, especially, the interaction between  
3 gender disparities and the “Hukou” system, hence we could not conceptualize frameworks to  
4 explain the mechanism from gender disparities to mental health problems. Third, as a cross-  
5 sectional study, we could not draw causal inferences from the findings. We encourage future  
6 studies to use longitudinal design to investigate the causal effects of gender disparities on  
7 migrant workers’ mental health to develop strategies to improve migrant workers’ mental  
8 health.

## 10 **Conclusion**

11 Among internal migrant workers in Shenzhen, females reported higher prevalence and  
12 severity of depressive and anxiety symptoms than the males, and the differences are associated  
13 with disparities resulting from institutional gender inequality. Interventions to improve the  
14 mental health of internal migration population in China should be embedded with strategies  
15 improving gender equality from individual to societal perspectives.

## 17 **Funding**

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19 Innovation Commission (JCY20170413101017457), and Tiebang Liu is the PI of the project.

## 21 **Conflict of interest**

22 The authors declare that they have not conflict of interest.

## 24 **Ethical Statement**

25 The Ethics Committee of Shenzhen Kangning Hospital reviewed and approved the protocol,

1 including the on-line informed consent process, and approved analysis of de-identified data  
2 (KN-2020-04).  
3

#### 4 **Contribution**

5 FH developed the plan for analysis, analyzed the data, drafted and revised the paper. HL  
6 designed the survey instruments, monitored data collection, developed the plan for analysis  
7 and revised the paper. XP, LY, ZZ and HX designed the survey instruments, sent out  
8 recruitment advertisement, assisted in data collection and revised the paper. TL initiated the  
9 project, designed the study, and revised the paper. All authors had full access to all the data in  
10 the study and take responsibility for the integrity of the data and the accuracy of the data  
11 analysis. All authors read and approved the final manuscript.

#### 12 **Acknowledgments**

13 We sincerely thank all participants who completed the survey. We sincerely acknowledge  
14 coordination work of liaisons from selected factories.  
15

#### 16 **Data sharing statement**

17 The data on which this manuscript is based are not available to public. The data from this  
18 study are under certain restrictions according to the Shenzhen Science and Technology  
19 Innovation Commission and always under the supervision of the principal investigator of the  
20 study. Thus, there are access restrictions to the data. However, at any time, researchers can  
21 contact the principal investigator (Tiebang Liu, liutbsz@126.com) for data sharing.  
22

#### 23 **References**

1. National Health Commission of the People's Republic of China. China Migrant Population Development Report 2018. Beijing: National Health Commission of the People's Republic of China, 2018.
2. Wong DFK, Li C, He X. Rural migrant workers in urban China: living a marginalised life. *International Journal of Social Welfare* 2007;16(1):32-40.
3. Chan KW. Migration and development in China: Trends, geography and current issues. *Migration and Development* 2012;1(2):187-205.
4. Phillips MR. Foxconn and China's suicide puzzle. *The Wall Street Journal* 2010 Wednesday, June 2;13.
5. Lam KK, Johnston JM. Depression and health-seeking behaviour among migrant workers in Shenzhen. *International Journal of Social Psychiatry* 2015;61(4):350-57.
6. Lin Y, Zhang Q, Chen W, et al. Association between social integration and health among internal migrants in ZhongShan, China. *PloS One* 2016;11(2):e0148397.
7. Shao C, Meng X, Cui S, et al. Income-related health inequality of migrant workers in China and its decomposition: an analysis based on the 2012 China labor-force dynamics survey data. *Journal of the Chinese Medical Association* 2016;79(10):531-537.
8. Zhong B, Chan S, Liu T, et al. Mental health of the old-and new-generation migrant workers in China: who are at greater risk for psychological distress? *Oncotarget* 2017;8(35):59791.
9. Wen M, Zheng Z, Niu J. Psychological distress of rural-to-urban migrants in two Chinese cities: Shenzhen and Shanghai. *Asian Population Studies* 2017;13(1):5-24.
10. Qiu P, Yang Y, Chen Q, et al. Depression and its impact factors among migrant workers in Chengdu. *Modern Preventive Medicine* 2010;37(22):4263-66.
11. Chen Z, Zhang X, Chen X, et al. Relationship between depression and self-rated health among floating populations. *Chinese Journal of Health Education* 2006;22(10):747-49.
12. Xu Y, Ji Y, Yuan Y, et al. Depressive symptoms and related factors among floating population. *Chinese Mental Health Journal* 2012;26(2):112-17.
13. Ding J, Zhou Z, Liu T, et al. Depression, anxiety and suicide risk among migrant workers in Shenzhen. 2012 Annual Guangdong Preventive Medicine Academic Conference Compilation. Guangzhou: Guangdong Preventive Medicine Association, 2013.
14. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet* 2018;392(10159):1789-858.
15. Riecher-Rössler A. Prospects for the classification of mental disorders in women. *European Psychiatry* 2010;25(4):189-96.
16. Afifi M. Gender differences in mental health. *Singapore Medical Journal* 2007;48(5):385.
17. Riecher-Rössler A. Sex and gender differences in mental disorders. *The Lancet Psychiatry* 2017; 4(1): 8-9.
18. Zhong B, Liu T, Huang J, et al. Acculturative stress of Chinese rural-to-urban migrant workers: a qualitative study. *PloS One* 2016;11(6):e0157530.
19. He X, Wong DFK. A comparison of female migrant workers' mental health in four cities in China. *International Journal of Social Psychiatry* 2011;59(2):114-22.
20. You L, Jin D, Yang H, et al. Psychological health and relevant factors among enterprise employees in Shenzhen. *China Journal of Health Psychology* 2013;21(10):1495-97.
21. Zheng L, Tan Q, Xue X. Investigation on mental health and the influencing factors of 1716 migrant workers in Shenzhen City. *Strait Journal of Preventive Medicine* 2012;18(1):9-11.
22. Sun Z. Women's depressed condition and its influencing factors in a factory in Shenzhen. *Chinese Primary Health Care* 2011;25(10):32-33.
23. Lin D, Fang X, Lin X, et al. The relationship between mobility, depression and smoking , alcohol use among rural-to-urban female migrants in Beijing. *Chinese Journal of Clinical Psychology* 2006;14(6):614-16.
24. Wang Q, Fu X, Wei Y, et al. The study on anxiety and its influence factors of floating population in Chengdu. *Journal of Preventive Medicine Information* 2007;23(5):544-46.
25. Shenzhen Statistical Bureau. Bulletin on Statistics of Economic and Social Development of Shenzhen. Shenzhen: Statistical Bureau of Shenzhen, 2019.
26. Guo H, Luo Y, Wen J, et al. Suicide ideation among migrant workers in Shenzhen. *Chinese Medicine Modern Distance Education of China* 2020; (1): 149.
27. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure.

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- Journal of General Internal Medicine* 2001;16(9):606-13.
28. Sun X, Li Y, Yu C, et al. Reliability and validity of depression scales of Chinese version: a systematic review. *Chinese Journal of Epidemiology* 2017;38(1):110-16.
29. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine* 2006;166(10):1092-97.
30. He X, Li C, Qian J, Cui H, and Wu W. Reliability and validity of a gneralized anxiety scale in general hospital outpatients. *Shanghai Archieves of Psychiatry* 2010;22(4):200-03.
31. Hays RD, DiMatteo MR. A short-form measure of loneliness. *Journal of Personality Assessment* 1987;51(1):69-81.
32. Li Z. The evaluation and application of the Chinese version of the Short-form UCLA Loneliness Scale (ULS-8). Central South University, 2012.
33. Li, Phillips MR, Xu D, et al. Reliability and validity of an adapted Chinese version of Barratt Impulsiveness Scale. *Chinese Mental Health Journal* 2011;25(08):610-15.
34. Xiao S. Social support rating scale. *Chinese Mental Health Journal* 1993;Suppl: 42-46.
35. Liu J, Li F, Lian Y. Investigation of reliability and validity of the social support scale. *Journal of Xinjiang Medical Univerity* 2008;31(1):1-3.
36. Su L, Wei B, Ling X, et al. Study on the reliability, validity and norm of scial support scale in Chuang peasants. *Modern Preventive Medicine* 2009;36(23):4411-13.
37. Xie R, He G, Koszycki D, et al. Prenatal social support, postnatal social support, and postpartum depression. *Annals of Epidemiology* 2009;19(9):637-43.
38. Xie Y. Reliability and validity of the simplified Coping Style Questionnaire. *Chinese Journal of Clinical Psychology* 1998;6(2):114-15.
39. Wang M, Dai X. Chinese Meaning in Life Questionnaire revised in college students and its reliabiity and validity test. *Chinese Journal of Clinical Psychology* 2008;16(5):459-61.
40. Steger MF, Frazier P, Oishi S, et al. The meaning in life questionnaire: Assessing the presence of and search for meaning in life. *Journal of Counseling Psychology* 2006;53(1):80.
41. R: A language and environment for statistical computing [program], 2013.
42. psych: procedures for personality and psychological research [program], 2017.
43. Fox J, Weisberg S, Adler D, et al. Package ‘car’. *Vienna: R Foundation for Statistical Computing* 2012
44. Bates D, Maechler M, Bolker B, et al. Package ‘lme4’. *Convergence* 2015;12(1)
45. Ripley B, Venables B, Bates DM, et al. Package ‘mass’. *Cran R* 2013;538
46. Guo Y, Zhao L. The impact of Chinese Hukou reforms on migrant students' cognitive and non-cognitive outcomes. *Children and Youth Services Review*, 2019, 101: 341-351.
47. Wang W. Psychological Health Status in Seven Provinces in China and Brief Intervention for Alcohol Abuse. Shanghai Jiao Tong University, 2014.
48. Hu J, Hu C, Duan W, et al. Survey on mental disorders among registered residents and non-registered residents in Shenzhen *Chinese Journal of Epidemiology* 2009;30(6):543-48.
49. Yan X, Wang X, Qin Y, et al. Prenatal anxiety and its influential factors among floating women from rural area. *Chinese Journal of Public Health* 2015;31(2):235-37.
50. Zhou Z, Xu Y, Jin D, et al. Influencing factors of suicide ideation among migrant service workers in Shenzhen city. *Chinese Journal of Public Health* 2016;32(7):948-52.
51. Liu X, Liu Y, Pan R, et al. Anxiety and depression survey analysis among migrant workers of leather industry in Shenzhen. *Journal of Medical Theory and Practice* 2012;25(16):1972-74.
52. Hu W, Wang R. Which Chinese cities are more inclusive and why? *Cities* 2019;86:51-61.
53. Zhong B, Liu T, Chiu HF, et al. Prevalence of psychological symptoms in contemporary Chinese rural-to-urban migrant workers: an exploratory meta-analysis of observational studies using the SCL-90-R. *Social Psychiatry and Psychiatric Epidemiology* 2013;48(10):1569-81.
54. Lin Y, Zhang Q, Chen W, et al. The social income inequality, social integration and health status of internal migrants in China. *International Journal for Equity in Health* 2017;16(1):139.
55. Magnani E, Zhu R. Gender wage differentials among rural-urban migrants in China. *Regional Science and Urban Economics* 2012;42(5):779-93.
56. Xu S, Tian L. An empirical study on gender differences in Income of migrant workers from Jiangsu, Zhejiang and Shanghai. *Guizhou Social Sciences* 2015;305(5):34-39.
57. Danke L, Tasang MC. Household decisions and gender inequality in education in rural China. *China: An International Journal* 2003;1(2):224-48.
58. Wei J, Luo Z, Weng Z. Impact of human capital factors on employment and income levels of nascent migrant workers. *Economic Research Guide* 2013;191(3):151-53.



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## STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page number
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3,4
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5,6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6,7
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6,7
		<i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
Variables	7	(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	No applicable
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Data sources/measurement	8*	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7,8,9
Bias	9	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7,8,9
Study size	10	Describe any efforts to address potential sources of bias	17
Quantitative variables	11	Explain how the study size was arrived at	6,7
Statistical methods	12	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
		(a) Describe all statistical methods, including those used to control for confounding	10
		(b) Describe any methods used to examine subgroups and interactions	No applicable
		(c) Explain how missing data were addressed	7
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	10
		(e) Describe any sensitivity analyses	No applicable

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<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	No applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10,11,12
		(b) Indicate number of participants with missing data for each variable of interest	10, 11
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	No applicable
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	No applicable
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	No applicable
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	10,11,12
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-16
		(b) Report category boundaries when continuous variables were categorized	10,11
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	No applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	No applicable
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19,20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17-20
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).

# BMJ Open

## Gender disparities in depressive and anxiety symptoms among internal migrant workers in Shenzhen: A cross-sectional study

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<b>Primary Subject Heading</b>:	Mental health
Secondary Subject Heading:	Public health
Keywords:	PUBLIC HEALTH, Depression & mood disorders < PSYCHIATRY, Anxiety disorders < PSYCHIATRY, SOCIAL MEDICINE, EPIDEMIOLOGY

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4 1 **Gender disparities in depressive and anxiety symptoms among internal migrant**  
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11 4 **Fengsu Hou** Ph.D.<sup>1, \*</sup>, **Huiming Liu** Ph.D.<sup>2, \*</sup>, **Xiaodong Peng** M.S.<sup>1</sup>, **Liqin You** M.S.<sup>1</sup>,  
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## 1 **Abstract**

### 2 **Objectives**

3 To investigate the gender disparities in the prevalence and severity of depressive and anxiety  
4 symptoms and associated factors among internal migrant workers in Shenzhen.

### 5 **Design**

6 Cross-sectional study.

### 7 **Setting**

8 Labor intensive factories in Shenzhen, Guangdong, China.

### 9 **Participants**

10 We recruited 3200 internal migrant workers who aged over 18 years old and above and did not  
11 register in Shenzhen's household registration system. There were 3095 participants eligible for  
12 this study.

### 13 **Methods**

14 Participants completed sociodemographic questionnaire, the Patient Health Questionnaire-9,  
15 the Generalized Anxiety Disorder-7, the UCLA Loneliness Scale, the Barratt Impulsiveness  
16 Scale, the Social Support Rating Scale, the Simplified Coping Style Questionnaire and  
17 Meaning in Life Questionnaire. We applied Chi-square test, analysis of variance, Wilcoxon  
18 rank test, Fisher's exact test, and univariate and multivariate multilevel linear regression  
19 analysis.

### 20 **Results**

21 The overall prevalence of depressive and anxiety symptoms was 27.85% and 19.26% among  
22 internal migrant workers. We reported gender disparities of depressive and anxiety symptoms  
23 among participants that the prevalence of depressive and anxiety symptoms was higher in  
24 females (30.57% vs. 26.43% and 22.67% vs. 17.47%), and the symptoms were more severe  
25 among females. Female migrant workers were more likely to be singled, have lower

1 prevalence of smoking and drinking, receive less education and monthly income, have higher  
2 level of impulsiveness and social support and lower level of meaning in life. We found age,  
3 marriage, income, adaption to living in Shenzhen, being discriminated, drinking, loneliness,  
4 impulsiveness, social support, coping strategies and meaning of life were associated with the  
5 severity of depressive and anxiety symptoms among internal migrant workers in Shenzhen.

## 6 **Conclusion**

7 Gender inequality may be the institutional factor leading to disparities in depressive and  
8 anxiety symptoms among internal migrant workers. Interventions should be embedded with  
9 strategies improving gender equality.

10  
11 **Keywords :** Depression, Anxiety, Gender disparity, Migrant workers, China

## 12 13 **Strengths and limitations of this study**

- 14 1. This is a cross-sectional study with a large sample of Chinese internal migrant workers in  
15 Shenzhen exploring the gender disparities in the prevalence and severity of depressive and  
16 anxiety symptoms.
- 17 2. We report factors associated with the severity of depressive and anxiety symptoms among  
18 Chinese internal migrant workers.
- 19 3. This study recruited participants from labor intensive factories that limited the  
20 generalizability to internal migrant workers in other industries.
- 21 4. We were limited to detailed information on gender disparities and could not conceptualize  
22 frameworks to explain the mechanism from gender disparities to mental health problems.

## 1 Introduction

2 Internal migrant workers have made important contributions to China's accomplishments  
3 in economics, industrialization and urbanization in recent decades. In 2018, the internal  
4 migrant population has been up to 244 million, accounting for 17.4% of China's total  
5 population<sup>1</sup>. Based on China's household registration system, the "Hukou" policy, migrant  
6 workers or the "floating population" are defined as people who leave their registered residence  
7 areas (e.g., cities, towns and villages) for engaging in various jobs in non-residence areas. The  
8 coastal urban cities, like Shenzhen in the Pearl River Delta area, are the major destinations of  
9 the internal migration.

10 Migrant workers are vulnerable to both physical and psychological problems because of the  
11 "Hukou" policy that migrants don't share the equal social benefits as the registered household  
12 residents, including education, employment, health care and social services in urban cities<sup>2,3</sup>.  
13 After a series of Foxconn migrant worker suicides in Shenzhen, 2010, the mental health of  
14 migrant workers in China, especially depression, anxiety and suicide, has gained tremendous  
15 attention; and a growing number of studies have examined the relationship between internal  
16 migration and mental health through different perspectives, such as help-seeking, income-  
17 related inequality and social integration<sup>4-9</sup>. The prevalence of mental health problems of  
18 migrant workers varies among inland and coastal urban cities. For example, the prevalence of  
19 depressive symptoms varied from 16.5% in Beijing, 23.7% in Chengdu, 34.2% in Wuxi to  
20 37.3% in Shenzhen<sup>10-13</sup>.

21 Women are in greater risk for mental health problems than men<sup>14,15</sup>. The increased risk  
22 cannot be simply attributed to biological differences, it results from the interactions between  
23 biological factors and social determinants including gender stereotypes and roles, social stigma  
24 and inequality, and social autonomy<sup>16,17</sup>. Internal migration and related changes naturally serve  
25 as their primary source of stressors for accumulative stress leading to mental health problems<sup>18</sup>.



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3 1 In He and Wong' s study of 959 female migrant workers from 12 factories in Shanghai,  
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5 2 Kunshan, Dongguan and Shenzhen, about 24% of participants were in poor mental health,  
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7 3 measured by the Brief Symptom Inventory, and the rate was the highest in Shenzhen (35%)<sup>19</sup>.  
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9 4 Other studies, applying the Symptom Check List 90 (SCL-90), reported female migrant  
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11 5 workers gained higher scores in most of the sub-scales than the Chinese norms, and the  
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13 6 prevalence of any mental health symptoms was also higher than the males<sup>20 21</sup>. Few studies  
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15 7 reported the prevalence of a specific mental health problem among female migrant workers.  
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17 8 For example, in Beijing, a study reported the prevalence of depression was 22.6% among  
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19 9 female migrant workers, which was close to another study in Shenzhen reporting the  
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21 10 prevalence was 22.4%<sup>22 23</sup>; and another study in Chengdu reported the prevalence of anxiety  
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23 11 was 22.72% among female migrant workers, and there was no gender differences<sup>24</sup>.

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28 12 Shenzhen is one of the pilot cities in China to develop the Psychosocial Service System  
29  
30 13 (PSS). There were about 8.48 million internal migrants in Shenzhen accounting for 65.1% of  
31  
32 14 its total population in 2018, and a large portion of the migrants working in labor-intensive  
33  
34 15 industries have gained great attention in the PSS development<sup>25</sup>. This study is a part of the  
35  
36 16 Social Epidemiological and Biological Study of Suicide Behaviors Among Factory Migrant  
37  
38 17 Workers in Shenzhen, which aims to investigate the social, biological and mental health factors  
39  
40 18 associated with suicide, suicide ideation, suicide plan and suicide attempts among internal  
41  
42 19 migrant workers in Shenzhen. The current study aims 1) to investigate the gender disparities  
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44 20 in the prevalence and severity of depressive and anxiety symptoms among internal migrant  
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46 21 workers in Shenzhen; 2) to explore factors associated with the severity of depressive and  
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48 22 anxiety symptoms.  
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## 1 **Methods**

### 2 **Sample and sampling**

3 This study adopted the sample of the parent study, and the sample size was calculated to  
4 estimate the prevalence of suicide ideation among internal migrant workers in Shenzhen based  
5 on the following equation:

$$6 \quad n = Z_{1-\alpha/2}^2 p(1-p)/d^2$$

7 Based on a prior study that reported the prevalence of suicide ideation was 19.9% among  
8 internal migrant workers in Shenzhen<sup>26</sup>, the parent study set the significant level  $\alpha$  at 0.01, the  
9 quantity  $d$  for permissible error as 0.02, and the sample size was 2644; meanwhile, considering  
10 the possible clustering effect and sample loss, the parent study used a positive design effect of  
11 1.20 to set the adjusted sample size as 3200.

12 During 2018 to 2019, with a multistage sampling strategy, the parent study first randomly  
13 selected 4 out of 10 districts in Shenzhen, then randomly selected 8 labor intensive factories to  
14 recruit participants. For each factory, the parent study randomly selected 400 participants. The  
15 parent study recruited migrant workers who: 1) aged 18 years old and above, 2) were born  
16 elsewhere or did not register in Shenzhen's Hukou (household registration) system, 3) provided  
17 written consent. Internal migrant workers who had a history of severe mental disorders that  
18 might impede completing the survey were excluded.

### 19 **Procedure**

20 Before the field survey, the study team contacted with liaisons in selected factories, and the  
21 liaisons delivered written consents to selected migrant workers based on the sampling frame.  
22 The study team and the liaisons determined a date and gathered participants to finish the field  
23 survey after participants provided consents. Considering mental health problems were sensitive  
24 information, we required all participants to complete the survey while keeping social distance.

25 During the field survey, experienced and well-trained investigators helped participants

1  
2  
3 1 complete questionnaires and reminded participants to complete missing items.  
4

## 5 2 **Measurements**

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7  
8 3 The study team developed the sociodemographic questionnaire to collect participants'  
9  
10 4 characteristics including age, gender, education, marriage, monthly personal income, length of  
11  
12 5 staying in Shenzhen, adaption, self-perceived discrimination, drinking, smoking and number  
13  
14 6 of mental health source.

15  
16  
17 7 We applied the Chinese version of Patient Health Questionnaire-9 (PHQ-9) to measure the  
18  
19 8 severity of depressive symptoms, which has shown great reliability and validity<sup>27 28</sup>. The items  
20  
21 9 capture 9 symptom criteria for clinical depression diagnosis from Diagnostic and Statistical  
22  
23 10 Manual of Mental Disorders, Fourth Edition (DSM-IV). Each item can be scored from 0 (“Not  
24  
25 11 at all”) to 3 (“Nearly every day”), and the total score ranges from 0 to 27 with a higher score  
26  
27 12 indicating a more severity of depressive symptoms; and a total score of 5, 10, 15 and 20  
28  
29 13 indicates mild, moderate, moderately severe and severe depression<sup>27</sup>. We set the cut-off point  
30  
31 14 at 5 to screen for depressive symptoms. The Cronbach’s alpha was 0.880 in this study.  
32  
33

34  
35 15 We applied the Chinese version of the Generalized Anxiety Disorder-7 (GAD-7) measure  
36  
37 16 the severity of anxiety symptoms, which has shown great reliability and validity<sup>29 30</sup>. The times  
38  
39 17 reflect all symptom criteria for GAD from DSM-IV. Each item can be scored from 0 (“Not at  
40  
41 18 all”) to 3 (“Nearly every day”), and the total score ranges from 0 to 21 with a higher score  
42  
43 19 indicating a more severity of anxiety symptoms; and a total score of 5, 10, and 15 indicates  
44  
45 20 mild, moderate and severe anxiety<sup>29</sup>. We set the cut-off point at 5 to screen for anxiety  
46  
47 21 symptoms. The Cronbach’s alpha was 0.906 in this study.  
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50  
51 22 We applied the Chinese version of 6-item UCLA Loneliness Scale (ULS-6) to measure  
52  
53 23 loneliness, which has been translated and validated in China<sup>31 32</sup>. The total score ranges from 6  
54  
55 24 to 24 with a higher score indicating a more severity of loneliness. The Cronbach’s alpha was  
56  
57 25 0.859 in this study.  
58  
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1 We applied the Chinese version of the Barratt Impulsiveness Scale (BIS-11) to measure  
2 impulsiveness, which has been translated and validated in Chinese population<sup>33</sup>. The total score  
3 ranges from 0 to 100 with a higher score indicating a higher level of impulsiveness. The  
4 Cronbach's alpha was 0.794 in this study.

5 We applied the Social Support Rating Scale (SSRS) to measure social support, which was  
6 a 10-item scale developed and has been widely used in China with great reliability and  
7 validity<sup>34-37</sup>. The total ranges from 12 to 66 with a higher score indicating a higher level of  
8 social support. The Cronbach's alpha was 0.804 in this study.

9 We applied the Simplified Coping Style Questionnaire (SCSQ) to explore how participants  
10 cope with daily stress or events, which was 20-item scale developed in China<sup>38</sup>. There are two  
11 subscales, positive coping and negative coping, and a higher mean score of each subscale  
12 indicates being more inclined to adopt the coping strategy. The Cronbach's alpha was 0.863 in  
13 this study.

14 We applied the Chinese version of Meaning in Life Questionnaire (C-MLQ) to measure  
15 how participants assessed the presence of and searched for meaning in life, which was a 10-  
16 item scale and had been translated and validated in China<sup>39 40</sup>. The total score ranges from 10  
17 to 70 with a higher score indicating more satisfied in life. The Cronbach's alpha was 0.844 in  
18 this study.

### 19 **Statistical analysis**

20 In this study, we analyzed data with R (version 3.5.1) and set the statistical significance at  
21 0.05<sup>41</sup>.

### 22 **Data preparation**

23 Before analysis, we recoded participants' marital status into two categories: singled and  
24 married/coupled. We categorized participants' education level into four groups: primary school  
25 and below ( $\leq 6$  years of education), junior high school (7 ~ 9 years of education), high school

1 (10 ~ 12 years of education), and college and above ( $\geq 13$  years of education). We categorized  
2 participants' personal monthly income into four groups:  $\leq \$439.49$  ( $\yen 2999$ ),  $\$439.64 \sim 732.58$   
3 ( $\yen 3000 \sim 4999$ ),  $\$732.73 \sim 1465.31$  ( $\yen 5000 \sim 9999$ ), and  $\geq \$1465.46$  ( $\yen 10000$ ).

#### 4 **Analytic plan**

5 To compare the characteristics between male and female participants, we applied one-way  
6 analysis of variance (ANOVA) or Wilcoxon rank test (if the data were of skewed distribution)  
7 for continuous variables, and Chi-square test for categorical variables. Descriptive analysis was  
8 conducted by R package "psych"<sup>42</sup>.

9 We created dummy variables for categorical variables, and the first category of each variable  
10 the reference group was the reference group in regression analysis. Considering the clustering  
11 effect of the sample, we conducted univariate multilevel linear regression analysis between the  
12 severity of depressive symptoms/anxiety symptoms and potential associated variables  
13 including sociodemographic factors, loneliness, impulsiveness, social support, coping strategy  
14 and meaning of life, and then to conduct multivariate multilevel linear regression analysis. In  
15 multivariate analysis, we adopted a stepwise backward strategy, and the baseline model was  
16 the first model with explanatory variables that showed significance in the univariate analysis  
17 ( $p < 0.05$ ). We chose the Akaike information criterion (AIC), the Bayesian information criterion  
18 (BIC) and adjusted R-squared and to assess the fitness of models, and lower values of the  
19 parameters indicated better model fitness. Analysis were conducted by R package "car" and  
20 "lme4" and "MASS"<sup>43-45</sup>.

#### 21 **Patient and Public Involvement**

22 This study was conducted without patient and public involvement.

#### 24 **Results**

25 The parent study recruited 3200 participants, and there were 105 participants did not provide

1 complete information on PHQ-9 or GAD-7, who were excluded from analysis in this study. Of  
2 3095 eligible participants, there were 2032 males and 1063 females. The differences of  
3 sociodemographic information between eligible and non-eligible participants were not  
4 significant.

5 Overall, the age of participants ranged from 18 to 62 years old with a mean of  $34.38 \pm 9.03$ .  
6 There were 1959 (63.30%, 1959/3095) participants being married or coupled. There were 47.21%  
7 (1461/3095) and 43.49% (1346/3095) of participants have finished junior high school and high  
8 school. A majority of participants (64.46%, 1995/3095) received monthly personal income  
9 between \$439.64 ~ 732.58. The length of stay in Shenzhen ranged from one month to 34 years  
10 with a mean of  $7.53 \pm 6.17$  years. There were 89.63% of participants (2774/3095) adapted to  
11 living in Shenzhen, and there were 75.12% of participants (2325/3095) reported not being  
12 discriminated. The prevalence of smoking and drinking was 31.21% (966/3095) and 42.58%  
13 (1318/3095) respectively. The total number of mental health resource ranged from 0 to 9 with  
14 a mean of  $1.35 \pm 0.95$ . The score of ULS-6 ranged from 6 to 24 with a mean of  $9.89 \pm 3.86$ .  
15 The score of BIS-11 ranged from 25 to 88 with a mean of  $51.43 \pm 8.78$ . The score of SSRS  
16 ranged from 14 to 63 with a mean of  $38.85 \pm 8.63$ . The score of positive coping ranged from 0  
17 to 36 with a mean of  $21.39 \pm 7.47$ . The score of negative coping ranged from 0 to 24 with a  
18 mean of  $8.14 \pm 4.72$ . The score of CMLQ ranged from 10 to 70 with a mean of  $49.94 \pm 10.95$ .  
19 The score of PHQ-9 ranged from 0 to 27 with a mean of  $3.31 \pm 4.34$ ; and the prevalence of  
20 depressive symptoms was 27.85% (862/3095). The score of GAD-7 ranged from 0 to 21 with  
21 a mean of  $2.30 \pm 3.53$ ; and the prevalence of anxiety symptoms was 19.26% (596/3095).

22 We observed gender disparities in several aspects. First, comparing with female  
23 participants, we found male participants were more likely to be singled (43.90% vs. 22.95%),  
24 to receive high school education and above (55.56% vs. 42.17%), to receive personal income  
25 over \$732.73 (¥5000) (21.8% vs. 11.1%), to smoke (46.31% vs. 2.35%) and to drink (53.48%

1 vs. 21.07%). We also found male participants were less impulsive, reported lower social support, and were more satisfied in life. Further, we reported the mean score of PHQ-9 (3.66 vs. 3.14) and GAD-7 (2.69 vs. 2.09) were higher in females than in males, and the prevalence of depressive and anxiety symptoms were also higher among females (30.57% vs. 26.43% and 22.67% vs. 17.47%). More details were shown in Table 1.

6 Table 1 Demographic information of participants

	Overall N=3095	Gender		<i>p</i>
		Male n=2032	Female n=1063	
Age (mean, SD)	34.38 (9.03)	34.75 (9.59)	33.69 (7.78)	<0.01
Marriage (n, %)				<0.01
Single	1136 (36.70%)	892 (43.90%)	244 (22.95%)	
Married/coupled	1959 (63.30%)	1140 (56.10%)	819 (77.05%)	
Education (n, %)				<0.01
Primary school	61 (1.97%)	32 (1.57%)	29 (2.73%)	
Junior high school	1461 (47.21%)	871 (42.86%)	590 (55.50%)	
High school	1346 (43.49%)	1003 (49.36%)	343 (32.67%)	
College and above	227 (7.33%)	126 (6.20 %)	101 (9.5%)	
Monthly personal income (n, %)				<0.01
≤\$439.49	539 (17.42%)	372 (18.31%)	167 (15.71%)	
\$439.64~732.58	1995 (64.46%)	1217 (59.89%)	778 (73.19%)	
\$732.73~1465.31	531 (17.16%)	419 (20.62%)	112 (10.54%)	
≥\$1465.46	30 (0.97%)	24 (1.18%)	6 (0.56%)	
Years in Shenzhen (mean, SD)	7.53 (6.17)	7.28 (6.18)	8.03 (6.11)	<0.01
Adaption (n, %)				0.88
Yes	2774 (89.63%)	1823 (89.71%)	951 (89.46%)	
No	321 (10.37%)	209 (10.29%)	112 (10.54%)	
Discrimination (n, %)				0.02
Yes	770 (24.88%)	532 (26.18%)	238 (22.39%)	
No	2325 (75.12%)	1500 (73.82%)	825 (77.61%)	
Smoking (n, %)				<0.01
Yes	966 (31.21%)	941 (46.31%)	25 (2.35%)	
No	2129 (68.79%)	1091 (53.69%)	1038 (97.65%)	
Drinking (n, %)				<0.01
Yes	1318 (42.58%)	1094 (53.84%)	224 (21.07%)	
No	1777 (57.42%)	938 (46.16%)	839 (78.93%)	
Number of mental health source (mean, SD)	1.35 (0.95)	1.34 (0.96)	1.35 (0.92)	0.85
Loneliness (ULS-6) (mean, SD)	9.89 (3.86)	2.09 (3.36)	2.69 (3.79)	0.42
Impulsiveness (BIS-11) (mean, SD)	51.43 (8.78)	50.51 (8.97)	53.18 (8.11)	<0.01
Social support (SSRS) (mean, SD)	38.85(8.63)	38.40 (8.75)	39.70 (8.32)	<0.01
Coping (mean, SD)				
Positive coping	21.39 (7.47)	21.45 (7.53)	21.26 (7.37)	0.51
Negative coping	8.14 (4.72)	8.16 (4.74)	8.10 (4.68)	0.71
Meaning of life (C-MLQ) (mean, SD)	49.94 (10.95)	50.50 (11.13)	48.85 (10.53)	<0.01
Mean score of the PHQ-9 (mean, SD)	3.32 (4.43)	3.14 (4.26)	3.66 (4.47)	<0.01
Depressive symptoms (n, %)				



No	2233	1495	738	<0.01
Yes	862	537	325	
Mean score of the GAD-7` (mean, SD)	2.30 (3.53)	2.09 (3.36)	2.69 (3.79)	<0.01
Anxiety symptoms (n, %)				
No	2499	1677	822	<0.01
Yes	596	355	241	

**Linear regression analysis of depressive symptoms**

Table 2 showed the results of univariate multilevel linear regression analysis for depressive symptoms. We found age, marriage status, monthly personal income, years in Shenzhen, adaption, discrimination, smoking, drinking, number of mental health source, loneliness, impulsiveness, social support, coping strategies and meaning of life were associated with depressive symptoms. Therefore, we included these variables into multivariate multilevel linear regression analysis (Model 1).

Table 2 Results of univariate multilevel linear regression analysis for depressive and anxiety symptoms

	PHQ 9 score			GAD-7 score		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Age	-0.066	-0.085	-0.046	-0.037	-0.053	-0.021
Gender						
Male	--	--	--	--	--	--
Female	-0.093	-0.45	0.28	0.15	-0.15	0.45
Marriage						
Single	--	--	--	--	--	--
Married/coupled	-0.75	-1.07	-0.42	-0.29	-0.56	-0.023
Education						
Primary school	--	--	--	--	--	--
Junior high school	0.28	-0.74	1.49	-0.091	-0.96	0.84
High school	0.68	-0.59	1.64	0.21	-0.90	0.90
College and above	0.93	-0.19	2.27	0.75	-0.14	1.85
Monthly personal income						
≤\$439.49	--	--	--	--	--	--
\$439.64~732.58	0.18	-0.24	0.59	-0.028	-0.3	0.31
\$732.73~1465.31	-0.72	-1.27	-0.16	-0.59	-1.04	-0.14
≥\$1465.46	3.80	2.22	5.38	2.74	1.46	4.02
Years in Shenzhen	-0.050	-0.075	-0.025	-0.022	-0.042	-0.0013
Adaption						
Yes	--	--	--	--	--	--
No	1.83	1.48	2.17	1.11	0.83	1.40
Discrimination						
Yes	--	--	--	--	--	--
No	-0.80	-1.05	-0.55	-0.61	-0.81	-0.41
Smoking						
Yes	--	--	--	--	--	--
No	-0.59	-0.93	-0.24	-0.21	-0.49	0.072
Drinking						
Yes	--	--	--	--	--	--
No	-0.84	-1.05	-0.62	-0.53	-0.71	-0.35



Number of mental health source	-0.28	-0.45	-0.12	-0.19	-0.333	-0.056
Loneliness (ULS-6)	0.62	0.58	0.65	0.51	0.48	0.54
Impulsiveness (BIS-11)	0.20	0.18	0.21	0.15	0.13	0.16
Social support (SSRS)	-0.14	-0.16	-0.12	-0.095	-0.11	-0.081
Coping						
Positive coping	-0.058	-0.078	-0.038	-0.040	-0.057	-0.023
Negative coping	0.24	0.21	0.27	0.18	0.16	0.21
Meaning of life (CMLQ)	-0.055	-0.069	-0.042	-0.040	-0.051	-0.028

In Model 1, the AIC was 16337.21, the BIC was 16457.10, and the adjusted R-squared was 0.4020. We step-wisely removed years in Shenzhen, smoking, number of mental health source and positive coping strategy from the analysis. Finally, we got the final model (Model 2). Comparing with Model 1, Model 2 improved in model fitness with an AIC of 16331.71, a BIC of 16428.31, and an adjusted R-squared of 0.4003.

Table 3 showed that the severity of depressive symptoms would increase 0.46, 0.086 and 0.11 unit for each unit of loneliness, impulsiveness and negative coping increased, respectively. Comparing with singled participants, the severity of depressive symptoms among married/coupled participants would be 0.26 unit higher; comparing with participants with monthly personal income of \$439.49 and below, the severity of depressive symptoms among those with income over \$1465.46 would be 2.30 units higher; and the severity of depressive symptoms would be 0.87 unit higher among participants did not adapt to living in Shenzhen. The severity of depressive symptoms would decrease 0.045, 0.022 and 0.015 unit for each unit of age, social support and meaning of life increased. Comparing with participants who reported discrimination and who reported drinking, the severity of depressive symptoms among those who did not report discrimination and did not drink would be 0.33 and 0.26 unit lower.

Table 3 Results of the stepwise multilevel linear regression analysis of depressive symptoms

	Model 1			Model 2		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Age	-0.043	-0.062	-0.023	-0.045	-0.063	-0.027
Marriage						
Singled	--			--		
Married/coupled	0.27	0.044	0.50	0.26	0.032	0.48
Monthly personal						

income							
≤\$439.49	--	--	--	--	--	--	--
\$439.64~732.58	0.25	-0.084	0.58	0.24	-0.095	0.57	
\$732.73~1465.31	0.039	-0.42	0.49	0.020	-0.42	0.46	
≥\$1465.46	2.34	1.08	3.59	2.30	1.05	3.55	
Years in Shenzhen	-0.0076	-0.031	0.016	--	--	--	
Adaption							
Yes	--	--	--	--	--	--	
No	0.86	0.57	1.14	0.87	0.59	1.15	
Discrimination							
Yes	--	--	--	--	--	--	
No	-0.34	-0.54	-0.13	-0.33	-0.53	-0.13	
Smoking							
Yes	--	--	--	--	--	--	
No	-0.17	-0.45	0.12	--	--	--	
Drinking							
Yes	--	--	--	--	--	--	
No	-0.24	-0.43	-0.061	-0.26	-0.44	-0.089	
Number of mental health source	-0.015	-0.15	0.12	--	--	--	
Loneliness (ULS-6)	0.46	0.43	0.50	0.46	0.43	0.50	
Impulsiveness (BIS-11)	0.084	0.068	0.10	0.086	0.070	0.10	
Social support (SSRS)	-0.019	-0.037	-0.0023	-0.022	-0.038	-0.0049	
Coping							
Positive coping	-0.0073	-0.027	0.013	--	--	--	
Negative coping	0.12	0.086	0.15	0.11	0.085	0.14	
Meaning of life (CMLQ)	-0.014	-0.025	-0.0017	-0.015	-0.026	-0.0029	
AIC		16337.21			16331.71		
BIC		16457.10			16428.31		
Adjusted R-squared		0.4020			0.4003		

Note: \* Model 1 is the initial model of the multilevel linear regression analysis. Model 2 is the final model of the analysis after four iterations. \*\* Estimate stands for the coefficient of each variable. \*\*\*AIC stands for the Akaike information criterion; BIC stands for the Bayesian information criterion.

### Linear regression analysis of anxiety symptoms

Table 2 showed the results of univariate multilevel linear regression analysis for anxiety symptoms. We found age, marriage, monthly personal income, years in Shenzhen, adaption, discrimination, drinking, number of mental health source, loneliness, impulsiveness, social support, coping strategies and meaning of life were associated with anxiety symptoms, and we included these variables into multivariate multilevel linear regression analysis (Model 3).

In Model 3, the AIC was 15121.74, the BIC was 15236.45, and the adjusted R-squared was 0.3845. We step-wisely removed years in Shenzhen, drinking, number of mental health source, social support, positive coping strategy and meaning of life from the analysis. Finally, we got the final model (Model 4). Comparing with Model 3, Model 4 improved in model fitness with

1 an AIC of 15116.08 and a BIC of 15194.57.

2 Table 4 showed that the severity of anxiety symptoms would increase 0.42, 0.065 and 0.080  
3 unit for each unit of loneliness, impulsiveness and negative coping increased, respectively.  
4 Comparing with participants with monthly personal income of \$439.49 and below, the severity  
5 of anxiety symptoms among those with income over \$1465.46 would be 1.57 units higher; and  
6 the severity of anxiety symptoms would be 0.38 unit higher among migrant workers did not  
7 adapt to living in Shenzhen. Comparing with participants who reported discrimination, the  
8 severity of anxiety symptoms among those who did not report discrimination would be 0.23  
9 unit lower.

10 Table 4 Results of the stepwise multilevel linear regression analysis of anxiety symptoms

	Model 3			Model 4		
	Estimate	95%CI		Estimate	95%CI	
		Lower	Upper		Lower	Upper
Age	-0.030	-0.046	-0.014	-0.029	-0.044	-0.014
Marriage						
Singled	--	--	--	--	--	--
Married/coupled	0.30	0.11	0.49	0.27	0.10	0.45
Monthly personal income						
≤\$439.49	--	--	--	--	--	--
\$439.64~732.58	0.054	-0.22	0.33	0.056	-0.22	0.33
\$732.73~1465.31	-0.014	-0.39	0.35	0.0043	-0.36	0.37
≥\$1465.46	1.58	0.55	2.61	1.57	0.54	2.60
Years in Shenzhen	0.0027	-0.016	0.022	--	--	--
Adaption						
Yes	--	--	--	--	--	--
No	0.38	0.14	0.61	0.38	0.15	0.61
Discrimination						
Yes	--	--	--	--	--	--
No	-0.22	-0.38	-0.051	-0.23	-0.39	-0.063
Drinking						
Yes	--	--	--	--	--	--
No	-0.077	-0.22	0.068	--	--	--
Number of mental health source	-0.0040	-0.11	0.11	--	--	--
Loneliness (ULS-6)	0.42	0.39	0.45	0.42	0.39	0.45
Impulsiveness (BIS-11)	0.060	0.046	0.074	0.065	0.053	0.078
Social support (SSRS)	-0.0025	-0.017	0.012	--	--	--
Coping						
Positive coping	-0.0044	-0.021	0.012	--	--	--
Negative coping	0.086	0.062	0.11	0.080	0.059	0.10
Meaning of life (CMLQ)	-0.0095	-0.019	0.00034	--	--	--
AIC		15121.74			15116.08	
BIC		15236.45			15194.57	
Adjusted R-squared		0.3845			0.3845	

11 Note: \* Model 3 is the initial model of the multilevel linear regression analysis. Model 4 is the final model of the analysis  
12 after six iterations. \*\* Estimate stands for the coefficient of each variable. \*\*\*AIC stands for the Akaike information

1  
2  
3 criterion; BIC stands for the Bayesian information criterion.  
4  
5

### 6 7 **Discussion**

8  
9 We identified several key findings based on a sample of 3095 internal migrant workers in  
10 Shenzhen, China: a) the overall prevalence of depressive and anxiety symptoms was 27.85%  
11 and 19.26%, which was lower than the previous study in Shenzhen<sup>13</sup>; b) gender disparities were  
12 observed that the prevalence of depressive and anxiety was higher in females, and the  
13 symptoms were also more severe in them; c) age, marriage, income, adaption to living in  
14 Shenzhen, being discriminated, drinking, loneliness, impulsiveness, social support, coping  
15 strategies and meaning of life were associated with the severity of depressive or anxiety  
16 symptoms; d) we observed gender disparities among sociodemographic characteristics and  
17 psychological factors that male migrant workers were older, more likely to be married, to  
18 receive more education and income, to feel being discriminated, to drink, to be more satisfied  
19 with life, and to have a lower level of impulsiveness and social support.  
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34 To understand the mental health problems among internal migrant workers in China, it is  
35 necessary to be familiar with the “Hukou” system. The “Hukou” system, known as the  
36 household registration system, is implemented to classify the place of registration (urban or  
37 rural residence areas) and the type of registration (agriculture or non-agriculture)<sup>46</sup>. Due to the  
38 registration, internal migrant workers, who are usually rural to urban migrants, have limited  
39 access to social welfare provided by the local governments of their destinations. Empirical  
40 studies have reported the associations between mental health and social inequities resulted from  
41 the registration system, including labor rights, wages, employment benefits, reimbursement for  
42 health care, limited access to public schools for migrant children<sup>2-13</sup>.  
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55 Noticeably, internal migrant workers in Shenzhen are faced with increased mental health  
56 problems than local community residents. A large epidemiology study among community  
57 residents from seven Chinese provinces reported the mean score of PHQ-9 and GAD-7 was  
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1 3.95 and 2.71, respectively, and it also reported the score of GAD-7 was higher in females than  
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1 3.95 and 2.71, respectively, and it also reported the score of GAD-7 was higher in females than  
2 in males (2.75 vs. 2.66)<sup>47</sup>. Further, this study comprised a sample of 2002 residents in  
3 Guangdong province and the mean score of PHQ-9 and GAD-7 in the sub-sample was 2.46  
4 and 1.91, respectively, and gender differences were not reported in the subsample<sup>47</sup>. In  
5 comparison, we reported the mean score of PHQ-9 and GAD-7 among migrant workers in  
6 Shenzhen was 3.31 and 2.30, respectively, which were both higher than that in the mentioned  
7 study. An epidemiology study in 2009, applying the Composite International Diagnostic  
8 Interview (CIDI), reported the prevalence of depression and anxiety in Shenzhen was 9.15%  
9 and 12.58% among registered residents, and it was 9.74% and 14.92% among non-registered  
10 residents<sup>48</sup>. However, because of the non-diagnostic tools this study applied, we were limited  
11 to compare results.

12 The prevalence of depression and anxiety, including depressive and anxiety symptoms,  
13 varies among studies cross China, and we contribute the variation to following explanations.  
14 First, cross-sectional studies applied different tools to screen for depression and anxiety, such  
15 as the Center of Epidemiologic Studies Depression (CES-D), the Symptom Checklist 90 (SCL-  
16 90), the Self-rating Depression Scale (SDS), the Patient Health Questionnaire Depression  
17 Module (PHQ-9), the Beck's Depression Inventory (BDI), the Generalized Anxiety Disorder  
18 Scale (GAD-7), the Self-rating Anxiety Scale (SAS) and the Beck's Anxiety Inventory (BAI)<sup>10-  
19 13 47 49-51</sup>. And even applying the same scale, studies may choose different cut-off points to  
20 report the prevalence, for example, we chose the cut-off point at 5 for PHQ-9 and GAD-7 while  
21 Wang set the cut-off point at 7 for both scales<sup>47</sup>. Second, studies recruited different sub-groups  
22 of Chinese internal migrant workers. In this study, participants came from labor intensive  
23 factories living in factory campuses which were micro-societal systems; other studies recruited  
24 participants from different industries like catering, retail and service etc. Third, the prevalence  
25 also varies cross different samples of internal migrant workers because of sampling methods

1 and sample size. Fourth, more developed cities, like first-tier cities (i.e. Beijing, Shanghai,  
2 Guangzhou and Shenzhen), are selective based on migrants' skills, where working and living  
3 are much more stressful than the rest<sup>52</sup>.

4 We identified factors associated with depressive and anxiety symptoms from the social  
5 ecological framework, and our results were consistent with previous studies that lower  
6 sociodemographic status was associated with internal migrant workers' mental health  
7 problems<sup>10 53 54</sup>. Gender as a factor at the individual level, it crosses all levels of the framework  
8 and results in institutional effects leading to the gender disparities in mental health among  
9 internal migrant workers. Empirical studies among Chinese internal migrant workers reported  
10 that female migrant workers were younger, less educated and paid 20% to 30% less than their  
11 male counterparts<sup>7 55 56</sup>. Generally, rural households have lower educational expectations for  
12 girls, especially among poorer households, that lead to a higher dropout rate for girls<sup>57</sup>; and  
13 shortened education indicates females are younger and less skilled when they enter the labor  
14 market in urban cities resulting in the inequality of wages<sup>58</sup>. We found female migrant workers  
15 have stayed longer in Shenzhen than the males, which may enable them a longer time to build  
16 social networks to increase their social support and reduce perceived discrimination in return.  
17 We reported female migrant workers perceived lower meaning in life, and it may result from  
18 the labor intensity and the inequality in wages. We believe the institutional gender disparities  
19 or even inequities might play an important role, and we encourage future research to collect  
20 detailed information, hypothesize the mechanism between mental health problems and gender  
21 disparities in sociodemographic factors, and test these hypotheses.

22 We recognize a few limitations of this study. First, the parent study did not aim to investigate  
23 the prevalence of depression and anxiety (including depressive and anxiety symptoms) among  
24 internal migrant workers from labor intensive factories in Shenzhen, and the sample did not  
25 recruit migrant workers from other industries, hence it was difficult to estimate the

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3 1 representativeness of our findings comparing with the whole migrant worker population in  
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5 2 Shenzhen. Second, because the parent study did not focus on gender disparities among migrant  
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7 3 workers, we did not collect further information such as disparities in labor intensity, living  
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9 4 environment, economic pressure, work related stress, and, especially, the interaction between  
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11 5 gender disparities and the “Hukou” system, hence we could not conceptualize frameworks to  
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13 6 explain the mechanism from gender disparities to mental health problems. Third, as a cross-  
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15 7 sectional study, we could not draw causal inferences from the findings. We encourage future  
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17 8 studies to use longitudinal design to investigate the causal effects of gender disparities on  
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19 9 migrant workers’ mental health to develop strategies to improve migrant workers’ mental  
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## 29 12 **Conclusion**

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31 13 Among internal migrant workers in Shenzhen, females reported higher prevalence and  
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33 14 severity of depressive and anxiety symptoms than the males, and the differences are associated  
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35 15 with disparities resulting from institutional gender inequality. Interventions to improve the  
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37 16 mental health of internal migration population in China should be embedded with strategies  
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39 17 improving gender equality from individual to societal perspectives.  
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## 45 19 **Funding**

46  
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48 20 This study is funded by the Science and Technology Plan of Shenzhen Science and Technology  
49  
50 21 Innovation Commission (JCY20170413101017457), and Tiebang Liu is the PI of the project.  
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## 52 22 53 23 **Conflict of interest**

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56 24 The authors declare that they have not conflict of interest.  
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## 1 **Ethical Statement**

2 The Ethics Committee of Shenzhen Kangning Hospital reviewed and approved the protocol,  
3 including the on-line informed consent process, and approved analysis of de-identified data  
4 (KN-2020-04).

## 6 **Contribution**

7 FH developed the plan for analysis, analyzed the data, drafted and revised the paper. HL  
8 designed the survey instruments, monitored data collection, developed the plan for analysis  
9 and revised the paper. XP, LY, ZZ and HX designed the survey instruments, sent out  
10 recruitment advertisement, assisted in data collection and revised the paper. TL initiated the  
11 project, designed the study, and revised the paper. All authors had full access to all the data in  
12 the study and take responsibility for the integrity of the data and the accuracy of the data  
13 analysis. All authors read and approved the final manuscript.

## 14 **Acknowledgments**

15 We sincerely thank all participants who completed the survey. We sincerely acknowledge  
16 coordination work of liaisons from selected factories.

## 18 **Data sharing statement**

19 The data on which this manuscript is based are not available to public. The data from this  
20 study are under certain restrictions according to the Shenzhen Science and Technology  
21 Innovation Commission and always under the supervision of the principal investigator of the  
22 study. Thus, there are access restrictions to the data. However, at any time, researchers can  
23 contact the principal investigator (Tiebang Liu, liutbsz@126.com) for data sharing.



## References

1. National Health Commission of the People's Republic of China. China Migrant Population Development Report 2018. Beijing: National Health Commission of the People's Republic of China, 2018.
2. Wong DFK, Li C, He X. Rural migrant workers in urban China: living a marginalised life. *International Journal of Social Welfare* 2007;16(1):32-40.
3. Chan KW. Migration and development in China: Trends, geography and current issues. *Migration and Development* 2012;1(2):187-205.
4. Phillips MR. Foxconn and China's suicide puzzle. *The Wall Street Journal* 2010 Wednesday, June 2;13.
5. Lam KK, Johnston JM. Depression and health-seeking behaviour among migrant workers in Shenzhen. *International Journal of Social Psychiatry* 2015;61(4):350-57.
6. Lin Y, Zhang Q, Chen W, et al. Association between social integration and health among internal migrants in ZhongShan, China. *PloS One* 2016;11(2):e0148397.
7. Shao C, Meng X, Cui S, et al. Income-related health inequality of migrant workers in China and its decomposition: an analysis based on the 2012 China labor-force dynamics survey data. *Journal of the Chinese Medical Association* 2016;79(10):531-537.
8. Zhong B, Chan S, Liu T, et al. Mental health of the old-and new-generation migrant workers in China: who are at greater risk for psychological distress? *Oncotarget* 2017;8(35):59791.
9. Wen M, Zheng Z, Niu J. Psychological distress of rural-to-urban migrants in two Chinese cities: Shenzhen and Shanghai. *Asian Population Studies* 2017;13(1):5-24.
10. Qiu P, Yang Y, Chen Q, et al. Depression and its impact factors among migrant workers in Chengdu. *Modern Preventive Medicine* 2010;37(22):4263-66.
11. Chen Z, Zhang X, Chen X, et al. Relationship between depression and self-rated health among floating populations. *Chinese Journal of Health Education* 2006;22(10):747-49.
12. Xu Y, Ji Y, Yuan Y, et al. Depressive symptoms and related factors among floating population. *Chinese Mental Health Journal* 2012;26(2):112-17.
13. Ding J, Zhou Z, Liu T, et al. Depression, anxiety and suicide risk among migrant workers in Shenzhen. 2012 Annual Guangdong Preventive Medicine Academic Conference Compilation. Guangzhou: Guangdong Preventive Medicine Association, 2013.
14. GBD 2017 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet* 2018;392(10159):1789-858.
15. Riecher-Rössler A. Prospects for the classification of mental disorders in women. *European Psychiatry* 2010;25(4):189-96.
16. Afifi M. Gender differences in mental health. *Singapore Medical Journal* 2007;48(5):385.
17. Riecher-Rössler A. Sex and gender differences in mental disorders. *The Lancet Psychiatry* 2017; 4(1): 8-9.
18. Zhong B, Liu T, Huang J, et al. Acculturative stress of Chinese rural-to-urban migrant workers: a qualitative study. *PloS One* 2016;11(6):e0157530.
19. He X, Wong DFK. A comparison of female migrant workers' mental health in four cities in China. *International Journal of Social Psychiatry* 2011;59(2):114-22.
20. You L, Jin D, Yang H, et al. Psychological health and relevant factors among enterprise employees in Shenzhen. *China Journal of Health Psychology* 2013;21(10):1495-97.
21. Zheng L, Tan Q, Xue X. Investigation on mental health and the influencing factors of 1716 migrant workers in Shenzhen City. *Strait Journal of Preventive Medicine* 2012;18(1):9-11.
22. Sun Z. Women's depressed condition and its influencing factors in a factory in Shenzhen. *Chinese Primary Health Care* 2011;25(10):32-33.
23. Lin D, Fang X, Lin X, et al. The relationship between mobility, depression and smoking , alcohol use among rural-to-urban female migrants in Beijing. *Chinese Journal of Clinical Psychology* 2006;14(6):614-16.
24. Wang Q, Fu X, Wei Y, et al. The study on anxiety and its influence factors of floating population in Chengdu. *Journal of Preventive Medicine Information* 2007;23(5):544-46.
25. Shenzhen Statistical Bureau. Bulletin on Statistics of Economic and Social Development of Shenzhen. Shenzhen: Statistical Bureau of Shenzhen, 2019.
26. Guo H, Luo Y, Wen J, et al. Suicide ideation among migrant workers in Shenzhen. *Chinese Medicine Modern Distance Education of China* 2020; (1): 149.

27. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine* 2001;16(9):606-13.
28. Sun X, Li Y, Yu C, et al. Reliability and validity of depression scales of Chinese version: a systematic review. *Chinese Journal of Epidemiology* 2017;38(1):110-16.
29. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine* 2006;166(10):1092-97.
30. He X, Li C, Qian J, Cui H, and Wu W. Reliability and validity of a generalized anxiety scale in general hospital outpatients. *Shanghai Archives of Psychiatry* 2010;22(4):200-03.
31. Hays RD, DiMatteo MR. A short-form measure of loneliness. *Journal of Personality Assessment* 1987;51(1):69-81.
32. Li Z. The evaluation and application of the Chinese version of the Short-form UCLA Loneliness Scale (ULS-8). Central South University, 2012.
33. Li, Phillips MR, Xu D, et al. Reliability and validity of an adapted Chinese version of Barratt Impulsiveness Scale. *Chinese Mental Health Journal* 2011;25(08):610-15.
34. Xiao S. Social support rating scale. *Chinese Mental Health Journal* 1993;Suppl: 42-46.
35. Liu J, Li F, Lian Y. Investigation of reliability and validity of the social support scale. *Journal of Xinjiang Medical University* 2008;31(1):1-3.
36. Su L, Wei B, Ling X, et al. Study on the reliability, validity and norm of social support scale in Chuang peasants. *Modern Preventive Medicine* 2009;36(23):4411-13.
37. Xie R, He G, Koszycki D, et al. Prenatal social support, postnatal social support, and postpartum depression. *Annals of Epidemiology* 2009;19(9):637-43.
38. Xie Y. Reliability and validity of the simplified Coping Style Questionnaire. *Chinese Journal of Clinical Psychology* 1998;6(2):114-15.
39. Wang M, Dai X. Chinese Meaning in Life Questionnaire revised in college students and its reliability and validity test. *Chinese Journal of Clinical Psychology* 2008;16(5):459-61.
40. Steger MF, Frazier P, Oishi S, et al. The meaning in life questionnaire: Assessing the presence of and search for meaning in life. *Journal of Counseling Psychology* 2006;53(1):80.
41. R: A language and environment for statistical computing [program], 2013.
42. psych: procedures for personality and psychological research [program], 2017.
43. Fox J, Weisberg S, Adler D, et al. Package 'car'. *Vienna: R Foundation for Statistical Computing* 2012
44. Bates D, Maechler M, Bolker B, et al. Package 'lme4'. *Convergence* 2015;12(1)
45. Ripley B, Venables B, Bates DM, et al. Package 'mass'. *Cran R* 2013;538
46. Guo Y, Zhao L. The impact of Chinese Hukou reforms on migrant students' cognitive and non-cognitive outcomes. *Children and Youth Services Review*, 2019, 101: 341-351.
47. Wang W. Psychological Health Status in Seven Provinces in China and Brief Intervention for Alcohol Abuse. Shanghai Jiao Tong University, 2014.
48. Hu J, Hu C, Duan W, et al. Survey on mental disorders among registered residents and non-registered residents in Shenzhen *Chinese Journal of Epidemiology* 2009;30(6):543-48.
49. Yan X, Wang X, Qin Y, et al. Prenatal anxiety and its influential factors among floating women from rural area. *Chinese Journal of Public Health* 2015;31(2):235-37.
50. Zhou Z, Xu Y, Jin D, et al. Influencing factors of suicide ideation among migrant service workers in Shenzhen city. *Chinese Journal of Public Health* 2016;32(7):948-52.
51. Liu X, Liu Y, Pan R, et al. Anxiety and depression survey analysis among migrant workers of leather industry in Shenzhen. *Journal of Medical Theory and Practice* 2012;25(16):1972-74.
52. Hu W, Wang R. Which Chinese cities are more inclusive and why? *Cities* 2019;86:51-61.
53. Zhong B, Liu T, Chiu HF, et al. Prevalence of psychological symptoms in contemporary Chinese rural-to-urban migrant workers: an exploratory meta-analysis of observational studies using the SCL-90-R. *Social Psychiatry and Psychiatric Epidemiology* 2013;48(10):1569-81.
54. Lin Y, Zhang Q, Chen W, et al. The social income inequality, social integration and health status of internal migrants in China. *International Journal for Equity in Health* 2017;16(1):139.
55. Magnani E, Zhu R. Gender wage differentials among rural-urban migrants in China. *Regional Science and Urban Economics* 2012;42(5):779-93.
56. Xu S, Tian L. An empirical study on gender differences in Income of migrant workers from Jiangsu, Zhejiang and Shanghai. *Guizhou Social Sciences* 2015;305(5):34-39.
57. Danke L, Tasang MC. Household decisions and gender inequality in education in rural China. *China: An International Journal* 2003;1(2):224-48.

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1 58. Wei J, Luo Z, Weng Z. Impact of human capital factors on employment and income levels of nascent  
2 migrant workers. *Economic Research Guide* 2013;191(3):151-53.  
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For peer review only

## STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	Page number
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3,4
<b>Introduction</b>			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5,6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
<b>Methods</b>			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6,7
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6,7
		<i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
Variables	7	(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	No applicable
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Data sources/measurement	8*	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7,8,9
Bias	9	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7,8,9
Study size	10	Describe any efforts to address potential sources of bias	17
Quantitative variables	11	Explain how the study size was arrived at	6,7
Statistical methods	12	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
		(a) Describe all statistical methods, including those used to control for confounding	10
		(b) Describe any methods used to examine subgroups and interactions	No applicable
		(c) Explain how missing data were addressed	7
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	10
		<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed	
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	No applicable

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<b>Results</b>			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	No applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10,11,12
		(b) Indicate number of participants with missing data for each variable of interest	10, 11
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	No applicable
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	No applicable
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	No applicable
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	10,11,12
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11-16
		(b) Report category boundaries when continuous variables were categorized	10,11
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	No applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	No applicable
<b>Discussion</b>			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19,20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17-20
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
<b>Other information</b>			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).