

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

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## ABSTRACT

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

**Design** Cross-sectional study.

**Setting** Labour intensive factories in Shenzhen, Guangdong, China.

**Participants** We recruited 3200 internal migrant workers who aged over 18 years old and above and did not register in Shenzhen's household registration system. 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  $\chi^2$  test, analysis of variance, Wilcoxon rank test, Fisher's exact test and univariate and multivariate multilevel linear regression analysis.

**Results** The overall prevalence of depressive and anxiety symptoms was 27.85% and 19.26% among internal migrant workers. We reported gender disparities of depressive and anxiety symptoms among participants that the prevalence of depressive and anxiety symptoms was higher in women (30.57% vs 26.43% and 22.67% vs 17.47%), and the symptoms were more severe among women. 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. We found age, 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 depressive and anxiety symptoms among internal migrant workers in Shenzhen.

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

## INTRODUCTION

Internal migrant workers have made important contributions to China's

## Strengths and limitations of this study

- This is a cross-sectional study with a large sample of Chinese internal migrant workers in Shenzhen exploring the gender disparities in the prevalence and severity of depressive and anxiety symptoms.
- We report factors associated with the severity of depressive and anxiety symptoms among Chinese internal migrant workers.
- This study recruited participants from labour intensive factories that limited the generalisability to internal migrant workers in other industries.
- We were limited to detailed information on gender disparities and could not conceptualise frameworks to explain the mechanism from gender disparities to mental health problems.

accomplishments in economics, industrialisation and urbanisation in recent decades. In 2018, the internal migrant population has been 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 their registered residence areas (eg, cities, towns and villages) for engaging in various jobs in non-residence areas. The coastal urban cities, like Shenzhen in the Pearl River Delta area, are the major destinations of the internal migration.

Migrant workers are vulnerable to both physical and psychological problems because of the 'Hukou' policy that migrants do not share the equal social benefits as the registered household residents, including education, employment, healthcare 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 internal 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>

Women are in greater risk for mental health problems than men.<sup>14 15</sup> The increased risk cannot be simply attributed to biological differences, it results from the interactions between biological factors and social determinants including gender stereotypes and roles, social stigma and inequality, and social autonomy.<sup>16 17</sup> Internal migration and related changes naturally serve as their primary source of stressors for accumulative stress leading to mental health problems.<sup>18</sup> In He and Wong's study of 959 female migrant workers from 12 factories in Shanghai, Kunshan, Dongguan and Shenzhen, about 24% of participants were in poor mental health, measured by the Brief Symptom Inventory, and the rate was the highest in Shenzhen (35%).<sup>19</sup> Other studies, applying the Symptom Check List 90 (SCL-90), reported female migrant workers gained higher scores in most of the subscales than the Chinese norms, and the prevalence of any mental health symptoms was also higher than the men.<sup>20 21</sup> Few studies reported the prevalence of a specific mental health problem among female migrant workers. For example, in Beijing, a study reported the prevalence of depression was 22.6% among female migrant workers, which was close to another study in Shenzhen reporting the prevalence was 22.4%<sup>22 23</sup>; and another study in Chengdu reported the prevalence of anxiety was 22.72% among female migrant workers, and there was no gender differences.<sup>24</sup>

Shenzhen is one of the pilot cities in China to develop the Psychosocial Service System (PSS). There were about 8.48 million internal migrants in Shenzhen accounting for 65.1% of its total population in 2018, and a large portion of the migrants working in labour-intensive industries have gained great attention in the PSS development.<sup>25</sup> This study is a part of the Social Epidemiological and Biological Study of Suicide Behaviors Among Factory Migrant Workers in Shenzhen, which aims to investigate the social, biological and mental health factors associated with suicide, suicide ideation, suicide plan and suicide attempts among internal migrant workers in Shenzhen. The current study aims (1) to investigate the gender disparities in the prevalence and severity of depressive and anxiety symptoms among internal migrant workers in Shenzhen; (2) to explore factors associated with the severity of depressive and anxiety symptoms.

## METHODS

### Sample and sampling

This study adopted the sample of the parent study, and the sample size was calculated to estimate the prevalence

of suicide ideation among internal migrant workers in Shenzhen based on the following equation:

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

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

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

### Procedure

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

During the field survey, experienced and well-trained investigators helped participants complete questionnaires and reminded participants to complete missing items.

### Measurements

The study team developed the sociodemographic questionnaire to collect participants' characteristics including age, gender, education, marriage, monthly personal income, length of staying in Shenzhen, adaption, self-perceived discrimination, drinking, smoking and number of mental health source.

We applied the Chinese version of Patient Health Questionnaire-9 (PHQ-9) to measure the severity of depressive symptoms, which has shown great reliability and validity.<sup>27 28</sup> The items capture nine symptom criteria for clinical depression diagnosis from Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). Each item can be scored from 0 ('not at all') to 3 ('nearly every day'), and the total score ranges from 0 to 27 with a higher score indicating a more severity of depressive symptoms; and a total score of 5, 10, 15 and 20 indicates mild, moderate, moderately severe and severe

depression.<sup>27</sup> We set the cut-off point at 5 to screen for depressive symptoms. The Cronbach's alpha was 0.880 in this study.

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

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

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

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

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

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

### Statistical analysis

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

### Data preparation

Before analysis, we recoded participants' marital status into two categories: singled and married/coupled. We categorised participants' education level into four groups: primary school and below ( $\leq 6$  years of education), junior high school (7–9 years of education), high school (10–12 years of education) and college and above ( $\geq 13$  years

of education). We categorised participants' personal monthly income into four groups:  $\leq \$439.49$  (¥2999),  $\$439.64$ – $\$732.58$  (¥3000–¥4999),  $\$732.73$ – $\$1465.31$  (¥5000–¥9999) and  $\geq \$1465.46$  (¥10 000).

### Analytic plan

To compare the characteristics between male and female participants, we applied one-way analysis of variance or Wilcoxon rank test (if the data were of skewed distribution) for continuous variables, and  $\chi^2$  test for categorical variables. Descriptive analysis was conducted by R package 'psych'.<sup>42</sup>

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

### Patient and public involvement

This study was conducted without patient and public involvement.

## RESULTS

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

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%, 1959/3095) participants being married or coupled. There were 47.21% (1461/3095) and 43.49% (1346/3095) of participants have finished junior high school and high school. A majority of participants (64.46%, 1995/3095) received monthly personal income between  $\$439.64$  and  $\$732.58$ . The length of stay in Shenzhen ranged from 1 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 C-MLQ 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 depressive symptoms 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 symptoms was 19.26% (596/3095).

We observed gender disparities in several aspects. First, comparing with female participants, we found male participants were more likely to be singled (43.90% vs 22.95%), to receive high school education and above (55.56% vs 42.17%), to receive personal income over \$732.73 (¥5000) (21.8% vs 11.1%), to smoke (46.31% vs 2.35%) and to drink (53.48% 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 women than in men, and the prevalence of depressive and anxiety symptoms were also higher among women (30.57% vs 26.43% and 22.67% vs 17.47%). More details were shown in [table 1](#).

### 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).

In model 1, the AIC was 16 337.21, the BIC was 16 457.10, and the adjusted R-squared was 0.4020. We stepwisely 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 16 331.71, a BIC of 16 428.31 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.

### 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 15 121.74, the BIC was 15 236.45, and the adjusted R-squared was 0.3845. We stepwisely 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 an AIC of 15 116.08 and a BIC of 15 194.57.

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

## DISCUSSION

We identified several key findings based on a sample of 3095 internal migrant workers in Shenzhen, China: (1) the overall prevalence of depressive and anxiety symptoms was 27.85% and 19.26%, which was lower than the previous study in Shenzhen<sup>13</sup>; (2) gender disparities were observed that the prevalence of depressive and anxiety was higher in women, and the symptoms were also more severe in them; (3) age, 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 depressive or anxiety symptoms; (4) we observed gender disparities among 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,

**Table 1** Demographic information of participants

	Overall N=3095	Gender		P value
		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
Singed	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	

BIS-11, Barratt Impulsiveness Scale; C-MLQ, Chinese version of Meaning in Life Questionnaire; GAD-7, Generalized Anxiety Disorder-7; PHQ-9, Patient Health Questionnaire-9; SSRS, Social Support Rating Scale; ULS-6, 6-item UCLA Loneliness Scale.

**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						
Singled	-	-	-	-	-	-
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 (C-MLQ)	-0.055	-0.069	-0.042	-0.040	-0.051	-0.028

BIS-11, Barratt Impulsiveness Scale; C-MLQ, Chinese version of Meaning in Life Questionnaire; GAD-7, Generalized Anxiety Disorder-7; SSRS, Social Support Rating Scale; ULS-6, 6-item UCLA Loneliness Scale.

to be more satisfied with life, and to have a lower level of impulsiveness and social support.

To understand the mental health problems among internal migrant workers in China, it is necessary to be

familiar with the 'Hukou' system. The 'Hukou' system, known as the household registration system, is implemented to classify the place of registration (urban or rural residence areas) and the type of registration (agriculture

**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						
Single	-			-		
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 (C-MLQ)	-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		

\*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, Akaike information criterion; BIC, Bayesian information criterion; BIS-11, Barratt Impulsiveness Scale; C-MLQ, Chinese version of Meaning in Life Questionnaire; SSRS, Social Support Rating Scale; ULS-6, 6-item UCLA Loneliness Scale.

or non-agriculture).<sup>46</sup> Due to the registration, internal migrant workers, who are usually rural to urban migrants, have limited access to social welfare provided by the local governments of their destinations. Empirical studies have reported the associations between mental health and social inequities resulted from the registration system, including labour rights, wages, employment benefits,

reimbursement for healthcare, limited access to public schools for migrant children.<sup>2–13</sup>

Noticeably, internal 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

**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 (C-MLQ)	-0.0095	-0.019	0.00034	-	-	-
AIC	15 121.74			15 116.08		
BIC	15 236.45			15 194.57		
Adjusted R-squared	0.3845			0.3845		

\*Model 3 is the initial model of the multilevel linear regression analysis. Model 4 is the final model of the analysis after six iterations.

†Estimate stands for the coefficient of each variable.

AIC, Akaike information criterion; BIC, Bayesian information criterion; BIS-11, Barratt Impulsiveness Scale; C-MLQ, Chinese version of Meaning in Life Questionnaire; SSRS, Social Support Rating Scale; ULS-6, 6-item UCLA Loneliness Scale.

and 2.71, respectively, and it also reported the score of GAD-7 was higher in women than in men (2.75 vs 2.66).<sup>47</sup> Further, this study comprised a sample of 2002 residents in Guangdong province and the mean score of PHQ-9 and GAD-7 in the subsample was 2.46 and 1.91, respectively, and gender differences were not reported in the subsample.<sup>47</sup> In comparison, we reported the mean score of PHQ-9 and GAD-7 among migrant workers in Shenzhen was 3.31 and 2.30, respectively, which were both higher than that in the mentioned study. An epidemiology study in 2009, applying the Composite International Diagnostic Interview, reported the prevalence of depression

and anxiety in Shenzhen was 9.15% and 12.58% among registered residents, and it was 9.74% and 14.92% among non-registered residents.<sup>48</sup> However, because of the non-diagnostic tools this study applied, we were limited to compare results.

The prevalence of depression and anxiety, including depressive and anxiety symptoms, varies among studies cross China, and we contribute the variation to following explanations. First, cross-sectional studies applied different tools to screen for depression and anxiety, such as the Center of Epidemiologic Studies Depression, the SCL-90, the Self-rating Depression Scale, the PHQ-9, the



Beck's Depression Inventory, the GAD-7, the Self-rating Anxiety Scale and the Beck's Anxiety Inventory.<sup>10-13 47 49-51</sup> And even applying the same scale, studies may choose different cut-off points to report the prevalence, for example, we chose the cut-off point at 5 for PHQ-9 and GAD-7 while Wang set the cut-off point at 7 for both scales.<sup>47</sup> Second, studies recruited different subgroups of Chinese internal migrant workers. In this study, participants came from labour intensive factories living in factory campuses which were micro-societal systems; other studies recruited participants from different industries like catering, retail and service and so on. Third, the prevalence also varies cross different samples of internal migrant workers because of sampling methods and sample size. Fourth, more developed cities, like first-tier cities (ie, Beijing, Shanghai, Guangzhou and Shenzhen), are selective based on migrants' skills, where working and living are much more stressful than the rest.<sup>52</sup>

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

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

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

## CONCLUSION

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

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