

Correlation between occupational health literacy and workers' anxiety: a cross-sectional study based on the furniture manufacturing industry in Guangdong, China

Manqi Huang

Guangdong Province Hospital for Occupational Disease Prevention and Treatment

XinYang Yu

Guangdong Province Hospital for Occupational Disease Prevention and Treatment

Hongrong Yu

Guangzhou Medical University

Huiqing Chen

Guangdong Province Hospital for Occupational Disease Prevention and Treatment

Junle Wu

Guangdong Province Hospital for Occupational Disease Prevention and Treatment

Qingping Liu

Anhui University of Science and Technology

Min Yang

youngman1996@163.com

Guangdong Province Hospital for Occupational Disease Prevention and Treatment

Research Article

Keywords: occupational health literacy, anxiety, mental health, manufacture of furniture, manufacturing workers, working years, weekly working hours

Posted Date: May 29th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-9538835/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Public Health on September 3rd, 2026. See the published version at <https://doi.org/10.1186/s12889-026-29329-2>.

Abstract

Background

With a transformation of the disease spectrum, mental health has become a major global public health challenge. Due to a long-term occupational exposure, the manufacturing workers have a high prevalence of anxiety. Occupational health literacy (OHL) can maintain and promote worker's health, but the evidence regarding its relationship with anxiety is limited. This study aims to investigate the relationship between OHL and anxiety among workers in the manufacture of furniture in Guangdong, China.

Methods A cross-sectional design was adopted. A total of 2666 workers from the manufacture of furniture industries in Guangdong were chosen using stratified cluster random sampling. The National OHL Surveillance Questionnaire and the Generalized Anxiety Disorder 7-item scale were used to assess OHL and anxiety respectively. The association between OHL and anxiety was analyzed using binary logistic regression, followed by subgroup analyses and interaction testing.

Results The OHL level of the participants was 45.7%, and the prevalence of anxiety was 17.9%. Multivariable logistic regression showed that after adjustment for sociodemographic and occupational characteristics, OHL was significantly negatively associated with anxiety (OR = 0.63, 95% CI: 0.51–0.78, $P < 0.001$). Compared with workers with inadequate OHL, those with adequate OHL experience a reduction in anxiety risk by 36.8%. Subgroup analyses indicated that the protective effect of OHL was more evident among workers with ≤ 5 working years, monthly incomes of 3000–<5000 yuan or 5000–<7000 yuan, shorter weekly working hours, and those who don't need to work at night. Interaction tests suggested that working years and weekly working hours regulated the association between OHL and anxiety ($P < 0.05$).

Conclusion The study reveals a correlation between OHL and anxiety, and adequate OHL is associated with low anxiety. We suggest that enterprises should attach importance to the improvement of OHL to alleviate workers' anxiety. Meanwhile, enterprises should strengthen occupational health training for newly hired employees and establish reasonable working hours to enhance intervention effectiveness.

Background

As the disease spectrum changes, mental health issues have become a major public health challenge worldwide^[1]. According to the Global Burden of Disease Study 2019, the estimated number of global mental disorder cases increased from 650 million in 1990 to 970 million in 2019, with a 48.1% increase. Among these disorders, the prevalence and disability weight of anxiety are relatively higher than many others^[2]. In 2021, the global number of people with anxiety reached 360 million, accounting for 63.1% of mental health disorders, and is predicted to rise to 520 million by 2024^[3]. Multiple studies have confirmed that anxiety not only affects workers' physical and mental health but also associates with a decline in quality of life, high absenteeism, and an increase in disease burden^[4–7]. Manufacturing workers tend to have a high prevalence of anxiety, largely due to prolonged exposure to occupational

hazards, including high-intensity labor, repetitive tasks and unreasonable work systems^[8–9]. Manufacture of furniture is an important component of traditional manufacturing. Workers in these industries not only face the common occupational hazards mentioned above but also suffer specific exposures such as wood dust, noise, and volatile organic compounds^[10–11]. Moreover, due to frequent bending, carrying heavy furniture and using handheld tools, these industries' workers may experience musculoskeletal disorders^[12]. All of these may lead to greater risk for complex health issues and psychological stress among workers.

Occupational health literacy (OHL) refers to workers' ability to acquire basic knowledge about occupational health, adopt healthy work styles and lifestyles, prevent the risk of occupational diseases and work-related illnesses, and maintain and promote their own health^[13]. The World Health Organization has identified health literacy (HL) as a key influencing factor of health, as it affects individuals' capacity to understand health information and make decisions that are beneficial to health^[14]. Low HL is associated with poorer health outcomes, such as increased risk of chronic diseases and higher mortality, as well as impacts on mental health disorders^[15]. Limited HL limits individuals' access to understand, evaluate, and use health information, leading to poorer health choices and consequently, a decline in psychological regulation^[16]. Research further suggests that adequate HL is associated with reduced mental health stigma and lower reluctance to seek help^[17]. This indicates that HL may promote mental health not only by influencing individual behaviors but also by altering attitudes toward mental illness. A cross-sectional study in South Korea found that low HL was associated with an increase in anxiety among adults, and the anxiety risk for individuals with low health literacy is 1.93 times higher than that for those with high health literacy^[18]. However, most existing studies on the relationship between HL and mental health have focused on mental HL^[19–20]. Only a few industries such as metallurgy^[21] have examined the relationship between OHL and mental health. Overall, there is still insufficient evidence regarding the association between OHL and anxiety.

To fill this gap, this study focuses on workers in the manufacture of furniture and aims to explore the association between OHL and anxiety. First, we described the OHL level and the prevalence of anxiety in this population. Second, we assessed the association between OHL and anxiety and performed stratified analyses by occupational characteristics. The findings are expected to provide a scientific basis for developing mental health promotion strategies for these industries. They also offer references for improving OHL intervention systems for manufacturing workers in China.

Methods

Study participants and sampling

Participants come from the Guangdong Province Key Populations Occupational Health Literacy Surveillance Project. The project was a cross-sectional survey covering 21 cities in the whole province, designed to evaluate OHL levels in Guangdong. This study followed the National Technical Plan for

Occupational Health Literacy Surveillance and Intervention among Key Populations^[22]. A stratified cluster random sampling method was used to recruit workers in the manufacture of furniture in Guangdong Province. Enterprises were categorized according to the number of employees, as large (≥ 1000 employees), medium ($300 < 1000$ employees), small ($20 < 300$ employees), or micro (< 20 employees)^[23]. Stratified based on enterprise size, and survey units were selected proportionally through cluster sampling. In each selected enterprise, frontline workers were randomly sampled according to their employee ID number. The participants who met the criteria were: (1) aged between 16 and 59 years; (2) having at least half a year of work experience; (3) having normal cognitive function and willing to participate in this study. Exclusion criteria were: (1) individuals with mental disorder or those who had recently taken psychotropic drugs; (2) recent experience of a significant event that had caused emotional fluctuations and made the individual difficult to calm down; (3) individuals unable to complete the questionnaire or answer it independently. According to the sampling plan^[22], large enterprises accounted for no more than 10% of all surveyed enterprises, and micro-enterprises with fewer than 10 employees were excluded. The target sample sizes per enterprise were 80–160 for large enterprises, 40–60 for medium enterprises, and 10–40 for small and micro-enterprises. Using the sampling method mentioned above, a total of 60 enterprises were selected, including 4 large enterprises, 12 medium enterprises, and 44 small and micro enterprises. A total of 2757 questionnaires were collected, of which 91 were excluded. Among them, there was including 15 that did not meet the inclusion criteria for age, 6 with less than six months of working years, 59 with a completion time of less than 3 minutes, and 11 with duplicate responses. Finally, 2666 valid questionnaires were obtained, with a valid response rate of 96.7%. The enrollment process of the study participants is shown in Fig. 1.

This study was carried out by a professional research team, consisting of public health physicians, disease prevention and control workers, and community staff. A pre-investigation was performed prior to the formal investigation. During the formal survey, face-to-face interviews were conducted with workers at their workplaces. The investigators fully informed the workers of the significance, objectives, and precautions of the study. An electronic questionnaire was used, and the workers answered the questionnaire by scanning a QR code. This study was approved by the Medical Ethics Committee of Guangdong Province Hospital for Occupational Disease Prevention and Treatment (GDHOD MEC 2023075), and all participants were informed and agreed to participate in this study.

Measurement instruments

Basic characteristics and OHL

The National Key Populations Occupational Health Literacy Surveillance Individual Questionnaire^[22], developed by the National Institute of Occupational Health and Poison Control, Chinese Center for Disease Control and Prevention, was used. One section of the questionnaire collected demographic information, including sociodemographic characteristics (gender, age, ethnicity, household registration, marital status, education level) and occupational characteristics (monthly income, working years,

enterprise size, weekly working hours, and night work). Another part of the questionnaire surveyed OHL, which comprises four dimensions: knowledge of occupational health laws, knowledge of occupational health protection, skills of occupational health protection, and healthy work pattern and behaviors. Each dimension contains 11, 14, 4, and 12 items respectively, totaling 41 items. Scoring followed the 2022 Key Populations Occupational Health Literacy Level Calculation Standard^[24]. Multiple-choice items in the skills of occupational health protection dimension are 4 points, single choice items are 3 points, and items in the other dimensions are 1 point, for a total score of 50. Respondents scoring at least 80% of the total score were considered to have adequate OHL, and the overall OHL level was defined as the proportion of workers with adequate OHL among all surveyed workers^[25–26].

Anxiety

Anxiety of this study participants was assessed using the Generalized Anxiety Disorder 7-item scale, which has been widely used in Chinese populations and exhibits good reliability and validity^[27]. This scale consists of seven items and uses the 4-point Likert scale. Not at all, several days, over a week, and almost every day correspond to scores of 0 to 3, with a total score of 21. Scores of 0–4 were classified as no anxiety, while scores of 5 or higher indicated the presence of anxiety, and this cutoff point has been adopted in previous studies^[28–29]. The Cronbach's α coefficient for this scale in this study was 0.949.

Variables and covariates

To examine the association between OHL and anxiety, anxiety was treated as the dependent variable and OHL as the independent variable. Sociodemographic characteristics include gender (male, female), age (< 30, 30–<40, 40–<50, $\geq$ 50 years), ethnicity (Han, other), household registration (non-rural, rural), marital status (unmarried, married, other), and education level (primary school or below, junior high school, senior high school, higher education). Occupational characteristics include monthly income (< 3000 yuan, 3000–<5000 yuan, 5000–<7000 yuan, $\geq$ 7000 yuan), working years ($\leq$ 5, > 5–10, > 10–20, > 20 years), enterprise size (small and micro, medium, large), weekly working hours ($\leq$ 40, 41–44, 45–48, 49–54, $\geq$ 55 hours), and night work (no, yes). The sociodemographic characteristics and occupational characteristics were considered potential confounders.

Statistical analysis

Continuous variables were expressed as means and standard deviations, while categorical variables were represented using frequency and rate. To examine the associations between OHL, potential confounders, and anxiety, group comparisons were performed using the Pearson's chi-squared test. Binary logistic regression models were used to assess the association between OHL and anxiety, with three progressively adjusted models: Model 1 was unadjusted; Model 2 adjusted for sociodemographic variables; and Model 3 further adjusted for occupational characteristics. Results were presented as odds

ratios (OR) with 95% confidence intervals (CI). Subgroup analyses and interaction tests were conducted based on occupational characteristics that were statistically significant in the multivariable logistic regression analysis, to evaluate the stability and heterogeneity of the effect across different subgroups. All analyses were performed using R 4.4.2, with a two-sided significance level set at $\alpha = 0.05$.

Results

Participant characteristics

A total of 2666 frontline workers were included in this study. The majority were male (64.3%), with a mean age of 39.2 years (range: 16–59 years). Most participants were of Han ethnicity (88.9%), held rural household registration (87.7%), and were married (81.1%). Education levels were relatively low, with junior high school being the most common (53.0%). Monthly income was concentrated at 3,000–<5,000 yuan (46.1%), followed by 5,000–<7,000 yuan (36.2%). The average working years was 5.9 years, and a higher proportion of workers (53.5%) were employed in small and micro-enterprises. The results show that 45.7% of the participants had adequate OHL, and the prevalence of anxiety was 17.9%. As shown in Table 1, significant differences in anxiety were observed by education level, monthly income, working years, weekly working hours, night work status, and OHL ($P < 0.05$).

Table 1
Distribution characteristics of anxiety across different demographic characteristics

Characteristics	N(%)	Anxiety	Without anxiety	P value
Total	2666(100)	477(17.9)	2189(82.1)	
OHL				< 0.001
Adequate	1447(54.3)	298(20.6)	1149(79.4)	
Inadequate	1219(45.7)	179(14.7)	1040(85.3)	
Gender				0.873
Male	1713(64.3)	308(18.0)	1405(82.0)	
Female	953(35.7)	169(17.7)	784(82.3)	
Age(years)				0.172
<30	418(15.7)	90(21.5)	328(78.5)	
30 ~ < 40	1025(38.4)	183(17.9)	842(82.1)	
40 ~ < 50	772(29.0)	129(16.7)	643(83.3)	
≥ 50	451(16.9)	75(16.6)	376(83.4)	
Ethnicity				0.106
Han	2370(88.9)	414(17.5)	1956(82.5)	
Other	296(11.1)	63(21.3)	233(78.7)	
Household registration				0.211
Non-rural	329(12.3)	67(20.4)	262(79.6)	
Rural	2337(87.7)	410(17.5)	1927(82.5)	
Marital status				0.265
Unmarried	447(16.8)	92(20.6)	355(79.4)	
Married	2163(81.1)	375(17.3)	1788(82.7)	
Other	56(2.1)	10(17.9)	46(82.1)	
Education level				0.026
primary school or below	297(11.1)	57(19.2)	240(80.8)	
junior high school	1414(53.0)	231(16.3)	1183(83.7)	
senior high school	639(24.0)	115(18.0)	524(82.0)	
higher education	316(11.9)	74(23.4)	242(76.6)	

Characteristics	N(%)	Anxiety	Without anxiety	P value
Monthly income (yuan)				< 0.001
< 3000	156(5.9)	55(35.3)	101(64.7)	
3000 ~ < 5000	1230(46.1)	199(16.2)	1031(83.8)	
5000 ~ < 7000	966(36.2)	157(16.3)	809(83.7)	
≥ 7000	314(11.8)	66(21.0)	248(79.0)	
Working years (years)				0.027
≤ 5	1706(64.0)	277(16.2)	1429(83.8)	
> 5 ~ 10	520(19.5)	107(20.6)	413(79.4)	
> 10 ~ 20	342(12.8)	74(21.6)	268(78.4)	
> 20	98(3.7)	19(19.4)	79(80.6)	
Enterprise size				0.287
Small and micro	1427(53.5)	240(16.8)	1187(83.2)	
Medium	690(25.9)	130(18.8)	560(81.2)	
Large	549(20.6)	107(19.5)	442(80.5)	
Weekly working hours (hours)				0.002
≤ 40	693(26.0)	124(17.9)	569(82.1)	
> 40 ~ 44	547(20.5)	71(13.0)	476(87.0)	
> 44 ~ 48	503(18.9)	86(17.1)	417(82.9)	
> 48 ~ 54	398(14.9)	80(20.1)	318(79.9)	
≥ 55	525(19.7)	116(22.1)	409(77.9)	
Night work				< 0.001
No	2250(84.4)	374(16.6)	1876(83.4)	
Yes	416(15.6)	103(24.8)	313(75.2)	

P < 0.05 was considered statistically significant.

Association between OHL and anxiety

Multivariable logistic regression models were used to examine the association between OHL and anxiety through a hierarchical adjustment strategy, as shown in Table 2. In the unadjusted Model 1, OHL was significantly and negatively associated with anxiety, with workers who had adequate OHL showing a

lower risk (OR = 0.66, 95% CI: 0.54–0.81, $P < 0.001$). After adjusting for sociodemographic variables (gender, age, ethnicity, household registration, marital status, and education level) in Model 2, the association remained significant (OR = 0.63, 95% CI: 0.51–0.78, $P < 0.001$). In Model 3, which further adjusted for occupational characteristics (monthly income, working years, enterprise size, weekly working hours, and night work), the negative association persisted (OR = 0.63, 95% CI: 0.51–0.78, $P < 0.001$). After full adjustment for potential confounders, workers with adequate OHL had an approximately 36.8% lower risk of anxiety compared to those inadequate OHL. These findings suggest that OHL is an independent protective factor against anxiety.

Table 2
Correlation between occupational health literacy and anxiety among study participants

Variable	OR	95%CI	P value
Model 1	0.66	0.54 ~ 0.81	< 0.001
Model 2	0.63	0.51 ~ 0.78	< 0.001
Model 3	0.63	0.51 ~ 0.78	< 0.001

OR odds ratio, 95% CI 95% confidence interval, $P < 0.05$ was considered statistically significant. Model 1 was unadjusted. Model 2 adjusted for sociodemographic variables including gender, age, ethnicity, household registration, marital status, and educational level; Model 3 further adjusted for work-related characteristic variables including monthly income, working years, enterprise size, weekly working hours, and night work based on Model 2.

Subgroup analysis

Stratified analyses were performed on the variables that were statistically significant in the multivariate logistic regression analysis, including length of service, monthly income, weekly working hours, and night shift work. The results are shown in Fig. 2. The results showed that OHL was negatively associated with anxiety across most subgroups. In terms of working years, the protective effect of OHL was strongest among workers with ≤ 5 years of service (OR = 0.52, 95% CI: 0.40–0.68). For monthly income, significant protective effects were observed in the 3000–<5000 yuan (OR = 0.71, 95% CI: 0.52–0.97) and 5000–<7000 yuan (OR = 0.51, 95% CI: 0.35–0.73) groups. Regarding weekly working hours, the protective effect was significant for those working ≤ 40 hours/week (OR = 0.48, 95% CI: 0.31–0.72) and > 40 –44 hours/week (OR = 0.41, 95% CI: 0.24–0.68). For night work, a significant protective effect was found among workers without night work (OR = 0.64, 95% CI: 0.51–0.81). Interaction tests revealed that the multiplicative interaction terms for OHL with working years and weekly working hours were statistically significant ($P < 0.05$), indicating that both factors moderated the association between OHL and anxiety. In contrast, the interactions with monthly income and night work were not statistically significant.

Discussion

The primary objective of this study was to investigate the association between OHL and anxiety among furniture manufacturing workers. Based on a population-based cross-sectional survey, we described the OHL level and the prevalence of anxiety in this population and found a negative correlation between OHL and anxiety. Furthermore, we observed that occupational characteristics, including working years and weekly working hours, significantly moderated this relationship. Our finding provides important insights for the development of targeted intervention strategies. The results showed that the level of overall OHL in this population was 45.7%, which is lower than the average level among manufacturing workers nationwide in 2022 (52.6%) and the overall level among key populations in China's secondary industry (56.5%)^[30–31], and also lower than that reported among port employees in Shenzhen, Guangdong Province (72.9%)^[32]. This difference may be attributed to the dual influence of industry characteristics and enterprise distribution. Compared with heavy industries such as automobiles and machinery manufacturing, the manufacture of furniture is relatively low, which provides fertile ground for the emergence of small and micro enterprises. Thus, these industries are characterized by a predominance of small and micro enterprises. Small and micro enterprises are constrained by production scale, capital investment, and management capacity, leading to relatively weak systematization of occupational health training and standardized provision of protective equipment^[33]. As a result, workers may have limited access to occupational health knowledge and skills^[34]. A study on the consistency analysis of practice orientation of a healthy enterprise program in China found that, compared to environmental, cultural, and training factors, high-risk industries tend to focus more on preventing and controlling occupational diseases and hazards during production^[35]. As a traditional manufacturing industry, the manufacture of furniture faces workplace hazards such as noise, dust, and volatile organic compounds^[12]. Workers in this industry require a high level of health protection awareness and capability. Paradoxically, enterprise management may emphasize hazard control, while investing insufficiently in improving OHL. This may partly explain the relatively low OHL level observed in this population and highlight the need for the coverage depth and pertinence of occupational health education and promotion efforts.

In this study, 17.9% of participants were found to have anxiety. Anxiety is common among manufacturing workers in China. A mental health survey conducted at an automobile manufacturing company in Sichuan Province reported that 21.1% of workers experienced anxiety^[36]. This may reflect the multiple sources of stress faced by workers, including occupational exposures, long-term repetitive work, and the interference of shift systems on circadian rhythms^[37–38]. In addition, the rapid application of artificial intelligence in manufacturing has replaced some jobs, reduced companies' dependence on workers and increasing job insecurity and stress, which may negatively affect mental health^[39]. The key finding of this study is the negative association between OHL and anxiety. Workers with adequate OHL had a 36.8% lower risk of anxiety. The core function of OHL is to enable workers to acquire, understand, and apply occupational health knowledge and skills^[40]. This helps them identify workplace hazards and take protective measures^[41]. This sense of control over the environment and work can reduce the psychological pressure caused by uncertainty, and in turn, alleviate anxiety^[42–43]. Furthermore, workers

with higher OHL are more likely to adopt healthy lifestyles, which may buffer the impact of work related stress on emotional health^[44].

It is worth noting that occupational characteristics exhibited complex modifying effects on the association between OHL and anxiety, consistent with previous reports^[45–46]. In the subgroup analysis by working years, the protective effect of OHL was most pronounced among workers with ≤ 5 years of service, which is consistent with previous reports. Zhang and colleagues reported that adequate OHL was strongly associated with lower occupational stress, and that the protective effect was more evident among workers with shorter working hours^[21]. New workers are at a critical stage of shaping their occupational roles and developing health related behaviors. High OHL can help them adapt to the work environment faster, establish healthy work patterns, and prevent the accumulation of early occupational stress that may lead to anxiety^[47]. With longer working years, prolonged exposure may reduce workers' sensitivity to occupational hazards, and the guiding role of OHL may be partially replaced by habit^[48–49]. The subgroup analysis also showed that the protective effect of OHL was significant among workers who work ≤ 44 hours per week, while it weakens in the group with long working hours. This suggests that excessive working hours may weaken the protective capacity of OHL on mental health through cumulative fatigue and insufficient time for recovery^[50]. Interaction tests confirmed that working years and weekly working hours moderated the association between OHL and anxiety, providing insights for the development of targeted interventions. For new workers, occupational health training should be strengthened to fully utilize its protective role. For those with long working hours, For long-term workers, it is necessary to combine comprehensive measures of working hour management and health promotion to break the constraints of long-term working hours on the effectiveness of OHL. This study did not find significant interactions between OHL and monthly income or night work. The OR of OHL in each subgroup of monthly income were all below 1, indicating a consistent protective direction across income levels. Similarly, OHL showed a protective trend in both night work and non-night work groups. These findings suggest that the protective effect of OHL is relatively universal, but the strength of the effect varies among different subgroups. Future research could further explore other potential moderating factors.

Several limitations of this study should be acknowledged. Due to the cross-sectional design of the study, it is not possible to establish a causal relationship between OHL and anxiety. Whether workers with lower OHL are more susceptible to anxiety, or whether anxiety impairs the ability to acquire and apply occupational health knowledge, still needs to be verified through longitudinal research. Anxiety was assessed using a self-report scale. Although the scale has good reliability and validity, responses may be influenced by participants' mood at the time of assessment, comprehension ability, and other factors. Moreover, the scale does not distinguish between clinical subtypes or severity levels of anxiety. Although this study controlled for multiple potential confounding factors, it is still difficult to quantify and eliminate all variations caused by measurement errors, and there may be unmeasured confounding variables such as social support, coping styles, work control, and other psychosocial factors. The study participants were recruited from the furniture manufacturing industry in Guangdong Province. As a major

manufacturing province, Guangdong's industrial structure and worker characteristics may differ from those in other regions. Therefore, the generalizability of the findings needs to be validated across broader geographic regions and industries. Future studies could use prospective cohort designs to clarify the causal direction and underlying mechanisms linking OHL and anxiety. Incorporating multidimensional mental health indicators, such as depression, occupational stress, and burnout, would allow for a more comprehensive assessment of the mental health effects of OHL. In addition, intervention studies aimed at improving OHL and evaluating its impact on mental health outcomes would be valuable.

Conclusion

In summary, this study investigated the OHL level and the prevalence of anxiety among workers in the manufacture of furniture and found a negative association between them. This association was more pronounced among workers with shorter working years and moderate working hours. These findings suggest that improving OHL may serve as an effective strategy for preventing anxiety in manufacturing workers. Particular attention should be given to strengthening occupational health training for new employees and managing working hours to enhance the protective role of OHL. This study provides epidemiological evidence to support the development of mental health promotion strategies for manufacturing workers and offers empirical insights for further improving occupational health literacy intervention systems in China.

Abbreviations

OHL Occupational health literacy

HL Health literacy

Declarations

Acknowledgments

We express our gratitude to all the dedicated staff who contributed to this study.

Authors' contributions

Huang Manqi and Yang Min designed and conceptualized the study. Chen Huiqing, Yu Xinyang, Wu Junle collected the data. Yu Hongrong, and Liu Qingping organized the data. Huang Manqi performed the data analysis and drafted the manuscript. Yang Min reviewed and validated the manuscript and secured the funding. All authors have read and approved the final manuscript for publication.

Funding

This study was supported by the Medical Scientific Research Foundation of Guangdong Province of China (A2025138) and the Guangzhou Innovation Environment Plan Project (2060702).

Data availability

The data supporting this study are available from the corresponding author upon reasonable request.

Ethic approval and consent to participate

This study adhered to the principles of the Declaration of Helsinki and was approved by the Medical Ethics Committee of Guangdong Province Hospital for Occupational Disease Prevention and Treatment (Approval No. GDHOD MEC 2023069). Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author's information

¹Guangdong Province Hospital for Occupational Disease Prevention and Treatment, Guangzhou, 510300, Guangdong, China. ²School of Public Health, Guangzhou Medical University, Guangzhou, 511436, Guangdong, China. ³School of Public Health, Anhui University of Science and Technology, Hefei, 231100, Anhui, China.

References

1. Castaldelli-Maia JM, Bhugra D. Analysis of global prevalence of mental and substance use disorders within countries: focus on sociodemographic characteristics and income levels. *Int Rev Psychiatry*. 2022;34:6–15.
2. GBD 2019 Mental Disorders Collaborators. Global, regional, and national burden of 12 mental disorders in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Psychiatry*. 2022;9:137–50.
3. Zhang Z, Chen X, Wu S, et al. Global, regional and national burden of anxiety and depression disorders from 1990 to 2021, and forecasts up to 2040. *J Affect Disord*. 2026;393:120299.
4. Mutz J, Hoppen TH, Fabbri C, et al. Anxiety disorders and age-related changes in physiology. *Br J Psychiatry*. 2022;221:528–37.
5. Hohls JK, König HH, Quirke E, et al. Anxiety, depression and quality of life-a systematic review of evidence from longitudinal observational studies. *Int J Environ Res Public Health*. 2021;18:12022.

6. Narusyte J, Ropponen A, Wang M, et al. Sickness absence among young employees in private and public sectors with a history of depression and anxiety. *Sci Rep*. 2022;12:18695.
7. Tian W, Yan G, Xiong S, et al. Burden of depressive and anxiety disorders in China and its provinces, 1990–2021: findings from the Global Burden of Disease Study 2021. *Br J Psychiatry*. 2026;228:18–28.
8. Meng J, Meng X. Psychological distress among Chinese manufacturing employees: prevalence and a symptom network analysis. *Psych J*. 2025;14:603–13.
9. Gutiérrez García RA, Sánchez Ruiz A, Serrano Carrera AJ, et al. Depression, anxiety, burnout, and substance use disorders among auto workers and COVID-19 as a stressor in Mexico. *Front Public Health*. 2026;13:1723282.
10. Gonçalves FD, Carvalho LH, Rodrigues JA, et al. Wood-based panels and volatile organic compounds (VOCs): an overview on production. emission sources *Anal Molecules*. 2025;30:3195.
11. Hwang I, Kim K, Ryu SH, et al. Data on the effect of wood-based panel-emitted volatile organic compounds on mice. *Data Brief*. 2025;62:111965.
12. Chaisurin P, Tantranon K, Kaewthummanukul T, et al. Examining the relationships between occupational exposures and health outcomes among informal wood furniture workers in Thailand. *New Solut*. 2026;35:424–35.
13. National Institute for Occupational Health and Poison Control. Occupational Health Literacy for Chinese Workers-Basic Knowledge and Skills. (2022 Edition). 2022.https://niohp.chinacdc.cn/sndt/202203/t20220307_257538.htm. Accessed 11 Mar 2026.
14. Pleasant A, O'Leary C, Carmona R. Health literacy: Global Advances with a Focus Upon the Shanghai Declaration on Promoting Health in the 2030 Agenda for Sustainable Development. *Stud Health Technol Inf*. 2020;269:481–96.
15. Craig A, Mabetha K, Gafari O, et al. Health literacy, multimorbidity and its effect on mental health in South African adults: a repeated cross-sectional nationally representative panel study. *Front Public Health*. 2025;13:1622005.
16. Haeri-Mehrizi A, Mohammadi S, Rafifar S, et al. Health literacy and mental health: a national cross-sectional inquiry. *Sci Rep*. 2024;14:13639.
17. Fleary SA, Joseph PL, Gonçalves C, et al. The Relationship Between Health Literacy and Mental Health Attitudes and Beliefs. *Health Lit Res Pract*. 2022;6:e270–9.
18. Seol G, Hwangbo Y, Kim Y, et al. Associations among health literacy, anxiety symptoms, and health-related quality of life in Korean adults: a cross-sectional study with age-stratified analyses. *PLoS ONE*. 2026;21:e0342239.
19. Ding KR, Wang SB, Xu WQ, et al. Low mental health literacy and its association with depression, anxiety and poor sleep quality in Chinese elderly. *Asia Pac Psychiatry*. 2022;14:e12520.
20. Blom S, Lindh F, Lundin A, et al. How gender and low mental health literacy are related to unmet need for mental healthcare: a cross-sectional population-based study in Sweden. *Arch Public Health*. 2024;82:12.

21. Zhang H, Zhao W, He Y, et al. Association between occupational health literacy and occupational stress among workers in metal mining, metallurgy and non-metallic manufacturing in Gansu, China. *BMC Public Health*. 2025;25:4320.
22. Li S, Sun Y, Sun X. Introduction of the national technical plan for monitoring occupational health literacy of key population groups in 2022. *Chin Occup Med*. 2023;50:189–93.
23. National Bureau of Statistics of China. Standards for the classification of large, medium, small, and Micro-sized Enterprises in Statistics. 2017.
https://www.stats.gov.cn/xxgk/tjbz/gjtjbz/202008/t20200811_1782335.html. Accessed Mar 11, 2026.
24. National Institute of Occupational Health and Poison Control, Chinese Center for Disease Control and Prevention. Notice on the Issuance of Standards for calculating occupational health literacy levels among key populations (2022). Beijing: Chinese Center for Disease Control and Prevention; 2023. Report No.: NIOHP Letter [2023] No. 5.
25. YANG M, CHEN H, YU X, et al. Analyzing the impact of individual and enterprise characteristics on occupational health literacy of key populations. *Chin Occup Med*. 2025;52:257–63.
26. Zhou S, Chen H, Wu J, et al. Enterprise characteristics and occupational health literacy among essential service workers in Guangdong Province, China: a cross-sectional study. *Front Public Health*. 2025;13:1632185.
27. Wang W, Bian Q, Zhao Y, et al. Reliability and validity of the Chinese version of the patient health questionnaire (PHQ-9) in the general population. *Gen Hosp Psychiatry*. 2014;36:539–44.
28. Spitzer RL, Kroenke K, Williams JB, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166:1092–7.
29. Li Y, Wang Y, Lv X et al. Effects of factors related to shift work on depression and anxiety in nurses. *Front Public Health* 2022;10:926988.
30. Sun Y, Sun X, Wan X, et al. Occupational health literacy level and its influencing factors among key populations in China in 2022. *China Occup Med*. 2023;50:241–7.
31. Wang J, Li S, Sun Y, et al. Occupational health literacy level and its influencing factors among key populations of secondary industry in China. *Ind Health Occup Dis*. 2024;50:97–102.
32. Wang J, Mo C, Sheng Q, et al. Association of length of service and job category with occupational health literacy of port employees in Shenzhen, China. *BMC Public Health*. 2023;23:1223.
33. Kong JO, Choi Y, Yang S, et al. Challenges from 14 years of experience at Workers' Health Centers in basic occupational health services for micro and small enterprises in Korea: a narrative review. *Ewha Med J*. 2025;48:e7.
34. Khoshakhlagh AH, Malakoutikhah M, Park J, et al. Assessing personal protective equipment usage and its correlation with knowledge, attitudes, performance, and safety culture among workers in small and medium-sized enterprises. *BMC Public Health*. 2024;24:1987.
35. Yang M, Huang L, Peng C, et al. Consistency Analysis of Practice Orientation of the Healthy Enterprise Program in China. *BMC Public Health*. 2025;25:2090.

36. Meng J, Meng X. Psychological distress among Chinese manufacturing employees: prevalence and a symptom network analysis. *Psych J*. 2025;14:603–13.
37. Florez-Acevedo S, Blancas MT, Spector JT. Occupational Heat Exposure & Mental Health Outcomes: A Review and Framework Incorporating Social Determinants of Health to Guide Future Research. *Curr Environ Health Rep*. 2025;12:15.
38. Xu M, Yin X, Gong Y. Lifestyle Factors in the Association of Shift Work and Depression and Anxiety. *JAMA Netw Open*. 2022;37:3–28.
39. Wei W, Li L. The Impact of Artificial Intelligence on the Mental Health of Manufacturing Workers: The Mediating Role of Overtime Work and the Work Environment. *Front Public Health*. 2022;10:862407.
40. Friedrich J, Münch AK, Thiel A, et al. Occupational Health Literacy Scale (OHLS): development and validation of a domain-specific measuring instrument. *Health Promot Int*. 2023;38:daac182.
41. Kickbusch IS. Health literacy: addressing the health and education divide. *Health Promot Int*. 2001;16:289–97.
42. Taouk Y, Spittal MJ, Disney G, et al. Changes in job control and perceptions of general health: A longitudinal analysis of Australian workers, 2005 to 2017. *J Occup. Environ Med*. 2021;63:813–20.
43. Too LS, Leach L, Butterworth P. Cumulative impact of high job demands, low job control and high job insecurity on midlife depression and anxiety: a prospective cohort study of Australian employees. *Occup Environ Med*. 2020;18:oemed–2020.
44. Elkin N. The relationship between health literacy and healthy lifestyle behaviors: A meta-analysis. *Medicine (Baltimore)*. 2024;103:e40260.
45. Meng P, Shi Z, Zhou Z, et al. Effects of occupational health literacy on occupational stress, depressive symptoms, and anxiety among workers in metal products industry in Jiaxing City. *J Environ Occup Med*. 2025;42:1080–7.
46. Cai D, Zeng Y, Chen F et al. Association between occupational health literacy and generalized anxiety disorder among couriers: A cross-sectional survey based in China. *Work*. 2025;82:36–315.
47. Okun A, Guerin R, Smith R, et al. Evaluation of changes in knowledge and attitude among youth after a one-hour introduction to workplace safety and health. *Saf Matters J Saf Res*. 2024;89:306–11.
48. Zhou S, Chen H, Wu J, et al. Associations of socioeconomic and occupational characteristics with occupational health literacy among essential service workers in Guangdong, China *BMC Public Health*. 2025;25:3096.
49. Sedlar N, Irwin A, Martin D, et al. A qualitative systematic review on the application of the normalization of deviance phenomenon within high-risk industries. *J Saf Res*. 2023;84:290–305.
50. Cropley M, Rydstedt LW, Andersen D. Recovery from work: testing the effects of chronic internal and external workload on health and well-being. *J Epidemiol Community Health*. 2020;74:919–24.

Figures

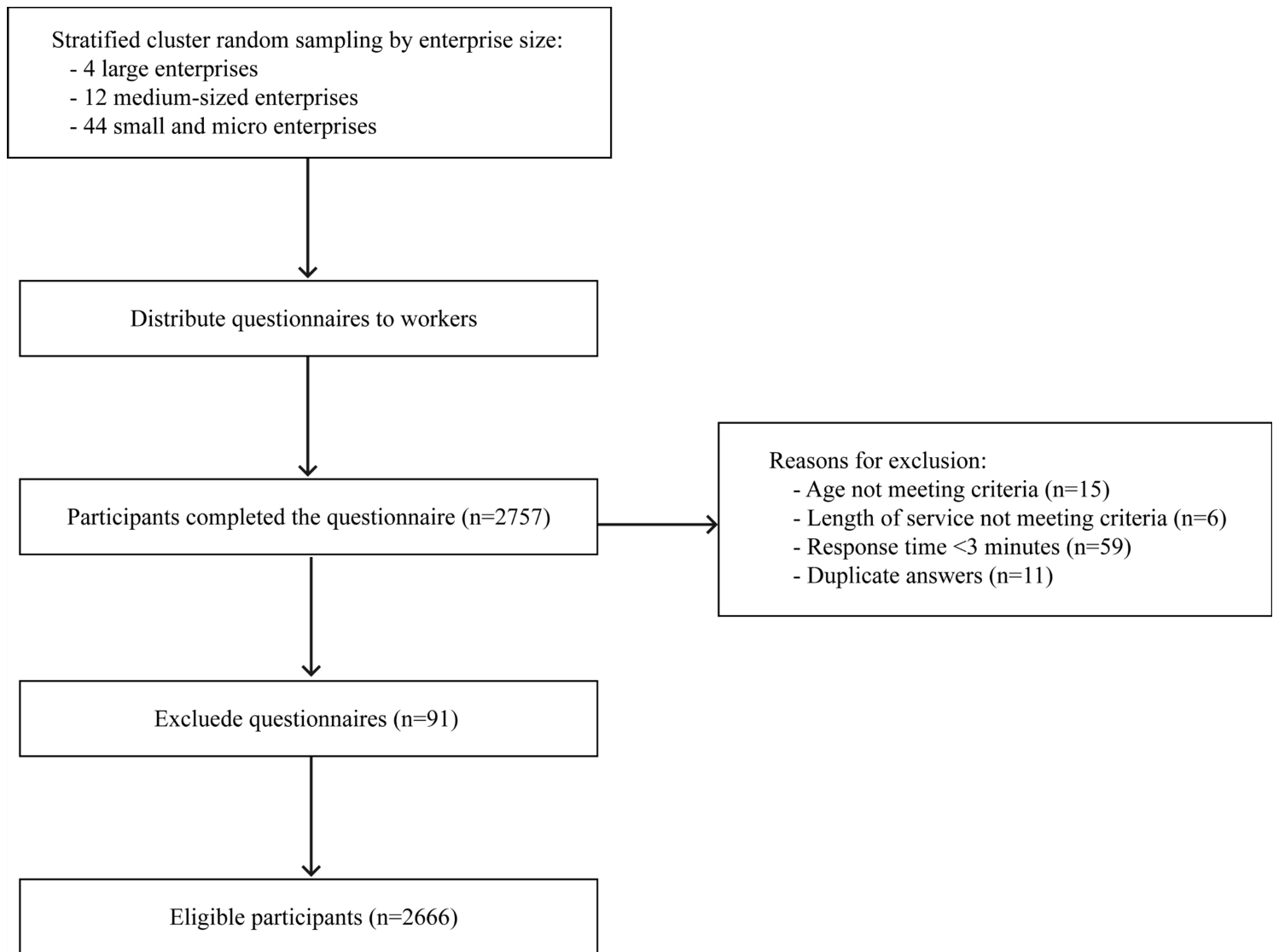


Figure 1

Flowchart.

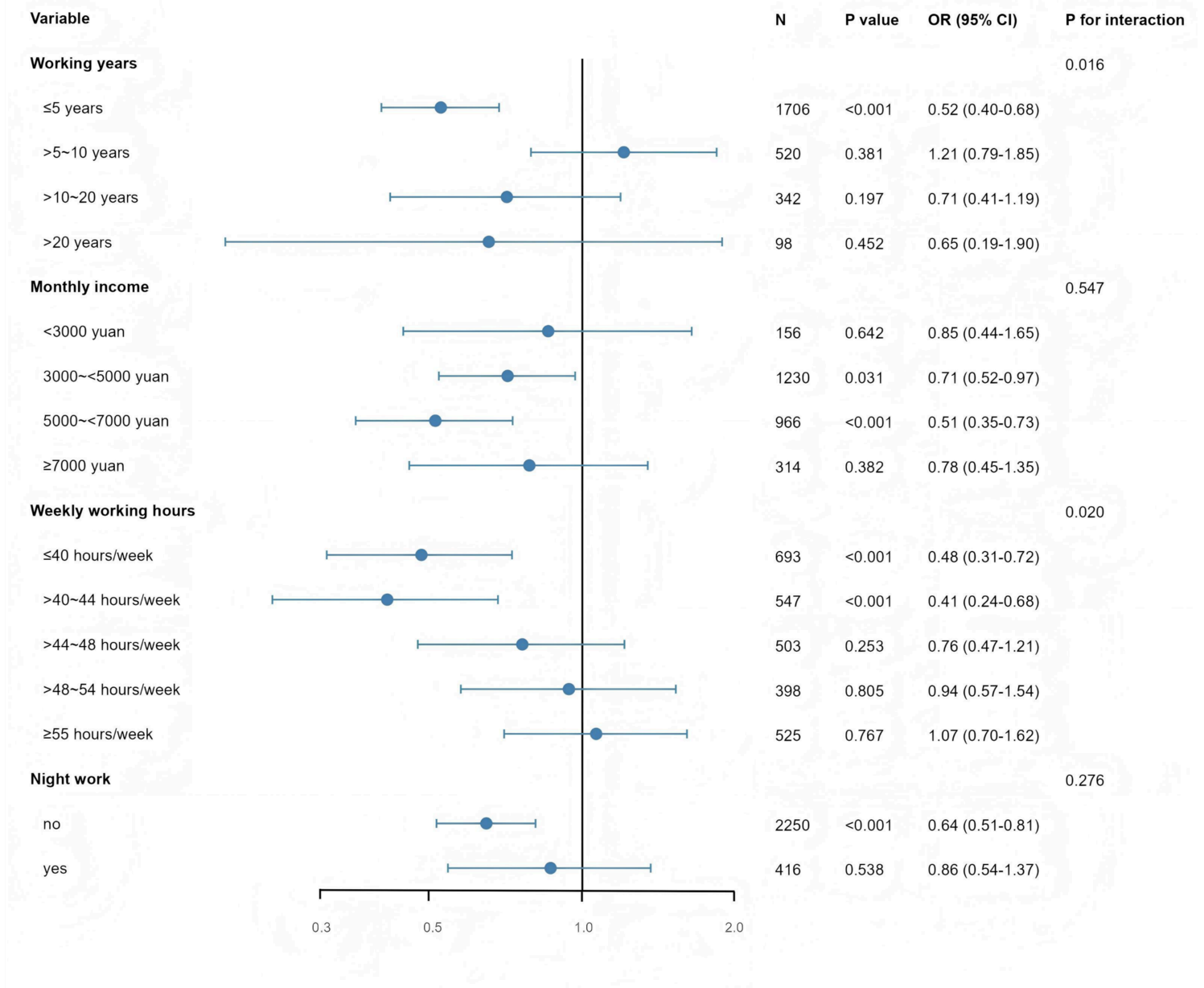


Figure 2

Association between occupational health literacy and anxiety in different subgroups. Adjustments were made for gender, age, ethnicity, household registration, marital status, and educational level. Interaction were calculated separately for occupational health literacy with monthly income, working years, weekly working hours, and night work. OR odds ratio, 95% CI 95% confidence interval, $P < 0.05$ was considered statistically significant.