Prevalence and associated factors of anxiety among the population in an urban area of China: a cross-sectional study

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ABSTRACT

Objective This study was conducted to explore the prevalence and associated factors of anxiety disorder among the population in an urban area of China.

Design A cross-sectional study.

Setting The study was conducted in Shanghai, China.

Participants Residents aged 30–70 years who have lived for over 6 months in Shanghai from December 2018 to April 2019 were included in the study.

Outcome measures The main study outcome was the prevalence of anxiety. The association of demographic information, medical expenses, living habits and sleep conditions with anxiety was also evaluated based on the collected data using structured questionnaires.

Results Among 5063 participants, 498 (9.84%, 95% CI: 9.02% to 10.66%) suffered from anxiety. The female sex, age 60–70 years old, lower educational level, partly self-expenses, higher family medical expenses in the past year, stroke history, hypertension history, dyslipidaemia history, diabetes history, drinking, sleeping on average <6 hours per day and waking up suffocating during sleep were associated with a higher prevalence of anxiety (p<0.05). Multivariate logistic regression analysis showed that age, gender, type of medical expenses, family medical expenses, hours of sleep and waking up suffocating were related to anxiety (p<0.05).

Conclusions Our findings showed an alarmingly high prevalence of anxiety in the population living in an urban area of China. Sleep time <6 hours and waking up suffocating had a significant association with anxiety. These findings suggest that future anxiety prevention programmes in urban areas should incorporate interventions targeted at these factors, such as improving residents’ sleep quality.

INTRODUCTION

Anxiety is one of the most common mental health problems worldwide. Currently, the global prevalence of anxiety disorder is 7.3%, suggesting that 1 in 14 people around the world at any given time is affected by an anxiety disorder. A previous study revealed that more than 33.7% of people have suffered from an anxiety disorder during their lifetime. Anxiety disorders have a negative effect on patients’ mental health and can seriously affect their physical function, social capabilities and social relationships, while in some severe cases, it may also lead to death. In a cohort study, Wu et al found that the death rate of patients with anxiety increased by approximately 25%. Meanwhile, the prevalence of anxiety disorder has been linked to chronic diseases and unhealthy lifestyles, while more than half of people suffering from anxiety disorder have never received any treatment.

According to existing literature, many factors have been associated with poor mental health status among urban people, including gender, marital status, daily labour, chronic medical illness, advanced age, ethnicity and low income. The prevalence of mental disorders among Chinese residents has been reported to be approximately 9.3% in a given year. The prevalence of anxiety disorder among elderly patients with hypertension in Shanghai has grown up to 17.2% in the given 2 weeks. Yet, most of previous studies on anxiety disorder in China focused on special populations, such as children, the elderly and patients with specific diseases. In these
populations, age, gender, education level and sleep status were found to be associated with anxiety.

Furthermore, Shanghai is one of the most developed cities in China, with a population of 24.88 million in 2020.13 As China’s commercial and financial centre, Shanghai had a total Gross Domestic Product of $609.1 billion in 2020, ranking first among all Chinese cities.13,14 However, with the economic development, the pace of urban life is getting faster and faster, which makes people more likely to be anxious.15 Despite the fact that the coverage of universal healthcare encompasses >95% of the Chinese population,16 medical expenses such as type of medical insurance and total amount of medical expense were found to be associated with anxiety in patients with some illness.17 However, the relationship between these factors and the prevalence of anxiety disorder among the general population in China still needs more research.

In this study, a large-sample on-site investigation of the general population aged 30–70 years in Shanghai, China was carried out to examine the prevalence of anxiety disorder among the general population and to provide valid references for the prevention of anxiety in urban areas in China.

METHODS

Participants

The residents aged 30–70 years who lived for ≥6 months in Fengxian District of Shanghai urban areas were recruited in this study from December 2018 to April 2019. A multi-stage stratified random sampling method was designed to identify the participants in Shanghai: (1) one town was randomly selected from eight towns of Fengxian District; (2) among the selected town, six neighborhood committees/administrative villages were selected in accordance with the Probability Proportionate to Size sampling; (3) in each neighborhood committee/administrative village, two resident groups/villager groups that included ≥100 households were randomly selected; (4) in each resident group/villager group, 100 households were randomly selected. During the investigation, if the primarily selected households did not meet the inclusion criteria (such as having no residents aged ≥30 years old, non-resident population) or were unwilling to accept the investigation, the households were replaced. In the process of replacement, residents who were not selected from the same resident/villager group as the investigation households or from adjacent resident/villager groups were selected according to the principle of living nearby. The smallest sampling unit was household. All family members in the selected households who met the criteria of the target population were typically enrolled. At this stage, 5599 residents from 1200 households were selected. Based on the definition of participants in this study, 536 residents were excluded, resulting in 5122 eligible residents. Among the 5122 residents approached for study participation, 59 dropped out from the study, leading to a final sample of 5063 residents with a response rate of 90.43% (figure 1).

Investigation methods

A face-to-face investigation was performed to collect information. Interviewers were medical students in the Shanghai University of Medicine & Health Sciences, who were uniformly trained for 1 week to conduct the interviews before the formal study.

The content of the questionnaire included the following: demographic information (gender, age, education level, monthly income), medical expenses (type of medical expenses, family medical expenses in 2019 (renminbi (RMB)/year), medical history (hypertension, stroke, dyslipidaemia, diabetes, other diseases), living habits (smoking, drinking, drinking tea, exercising), sleep conditions (sleep time, snoring, waking up suffocating), as well as Self-rating Anxiety Scale (SAS) (online supplemental file 1).

SAS, which is an international standard tool for self-assessment of anxiety containing 20 items, was used to assess the anxiety conditions of the participants over 1 week. The score of each item ranges from 1 to 4 (indicating rarely, sometimes, often and always, respectively). The total score of all questions is between 20 and 80, and is multiplied by 1.25 to obtain the standard SAS score. According to the Chinese standard of SAS, the total standard score of 50 is set as the critical point of anxiety.18

Statistical analysis

SPSS (Version 26) statistical software was used for all statistical analyses. Mean±SD was displayed for continuous variables, and frequency and proportion (%) displayed for categorical variables. The single-factor analysis was
RESULTS

General information

A total of 1266 families were investigated in the present study, and 5063 questionnaires were completed, with an average of four participants per household. The average age of the participants was 52.69±11.18 years old, and there were more female (54.86%) than male participants (45.14%). The number of people with monthly income ranging from 2000 to 3999 RMB was the largest (44.62%), while 19.67% of participants had monthly income of <2000 RMB. Moreover, 89.33% of the participants had medical insurance. Also, 71.92% of the participants spent <2000 RMB. Furthermore, 89.33% of the participants had partly self-expense of medical expenses was the highest at 10.15% (p<0.01). The prevalence of anxiety among people with medical history (including stroke, hypertension, dyslipidaemia, diabetes and other diseases) was higher than in people without related medical history (p<0.05).

The participants who slept less than an average of 6 hours per day had a higher prevalence of anxiety than those with more hours of sleep (p<0.01). Also, those who woke up due to suffocation were more likely to suffer from anxiety (p<0.01) (table 1).

Multivariate analysis

According to results from the multivariate analysis, the odds of anxiety among women were 1.42 times higher than among men (p<0.01, OR: 1.42, 95% CI: 1.12 to 1.80). The participants aged >60 years old were more likely to suffer from anxiety than the young participants (p=0.01, OR: 1.49, 95% CI: 1.10 to 2.01). As for those with family medical expenses that amounted to >500 RMB in 1 year, their odds of anxiety were significantly higher than the other participants. The participants who slept an average of <6 hours per day were 1.93 times more likely to suffer from anxiety than those with more hours of sleep (p=0.02, 95% CI: 1.14 to 3.29). Waking up suffocating was identified as a factor associated with anxiety (p=0.04, OR: 1.74, 95% CI: 1.03 to 2.94). Moreover, the participants who were not clear about their snoring status during sleep were more likely to suffer from anxiety than those who did not snore (p<0.01, OR: 1.59, 95% CI: 1.21 to 2.09) (table 1 and figure 3).

DISCUSSION

This study showed that the prevalence of anxiety among population aged 30–70 years old living in Shanghai was 9.84%. Moreover, the prevalence of anxiety was higher in the elderly and women, while insufficient sleep and poor sleep quality were found to be associated with anxiety.

Compared with the anxiety prevalence of 7.3% at any time and 5.0% nationally in a given year in China, the prevalence detected in this study was slightly higher. This result might be related to the different research populations. The target population in this study included those between 30 and 70 years old living in urban areas in China. The result on anxiety prevalence in this population represented anxiety in a developed city in China. However, the China Mental Health Survey carried out by X$^2$ test. The Cochran-Armitage trend test was used for the trend test of rank variables. Multiple logistic regression analysis was performed using a backward elimination method with anxiety as a dependent variable and other variables as independent variables. OR and 95% CI were calculated with p values of 0.05 being considered statistically significant. The prevalence of anxiety in this study was standardised based on the population of Shanghai in the Seventh National Census.

Patient and public involvement

No patients or members of the public were involved in the conception, design and performance of this study.
Table 1  Univariate analysis and multivariable analysis of anxiety among different populations in Shanghai suburb

| Characteristic                  | No  | Anxiety N (%) | Univariate analysis | Multivariable analysis |
|--------------------------------|-----|---------------|--------------------|------------------------|
|                                |     |               | Wald  $\chi^2$  | P value | Crude OR (95% CI) | Wald $c^2$ | P value | Adjusted OR (95% CI) |
| All                            | 5063| 498 (9.84)    | Ref                | Ref                  |            |            |                   |
| Age (years)                    |     |               |                    |                      |            |            |                   |
| 30–44                          | 1406| 104 (7.40)    | Ref                | Ref                  |            |            |                   |
| 45–59                          | 1985| 201 (10.13)   | 7.43 <0.01        | 1.41 (1.10 to 1.81)  | 2.90 0.09  | 1.30 (0.96 to 1.75) |
| 60–70                          | 1672| 193 (11.54)   | 14.83 <0.01       | 1.63 (1.27 to 2.10)  | 6.63 0.01  | 1.49 (1.10 to 2.01) |
| Gender*                        |     |               |                    |                      |            |            |                   |
| Male                           | 2273| 193 (8.49)    | Ref                | Ref                  |            |            |                   |
| Female                         | 2762| 304 (11.01)   | 8.82 <0.01        | 1.33 (1.10 to 1.61)  | 8.38 <0.01| 1.42 (1.12 to 1.80) |
| Education level*               |     |               |                    |                      |            |            |                   |
| Primary school and below       | 1186| 139 (11.72)   | Ref                | Ref                  |            |            |                   |
| High school                    | 2446| 258 (10.55)   | 1.13 0.29         | 0.89 (0.71 to 1.11)  |            |            |                   |
| Undergraduate or above         | 1417| 98 (6.92)     | 17.63 <0.01       | 0.56 (0.43 to 0.73)  |            |            |                   |
| Monthly income (RMB)*          |     |               |                    |                      |            |            |                   |
| <2000                          | 996 | 103 (10.34)   | Ref                | Ref                  |            |            |                   |
| 2000–3999                      | 2225| 260 (11.69)   | 1.24 0.27         | 1.15 (0.90 to 1.46)  |            |            |                   |
| 4000–5999                      | 1238| 92 (7.43)     | 5.82 0.02         | 0.70 (0.52 to 0.93)  |            |            |                   |
| 6000–11 999                    | 460 | 29 (6.30)     | 6.10 0.01         | 0.58 (0.38 to 0.90)  |            |            |                   |
| 12 000 and above               | 67  | 4 (5.97)      | 1.29 0.26         | 0.55 (0.20 to 1.54)  |            |            |                   |
| Type of medical expenses*      |     |               |                    |                      |            |            |                   |
| No self-expense                | 391 | 24 (6.14)     | Ref                | Ref                  |            |            |                   |
| Partly self-expense            | 4146| 421 (10.15)   | 6.36 0.01         | 1.73 (1.13 to 2.64)  | 5.23 0.02  | 1.63 (1.07 to 2.47) |
| Fully self-expense             | 104 | 9 (8.65)      | 0.83 0.36         | 1.45 (0.65 to 3.22)  | 10.88 <0.01| 2.21 (1.38 to 3.55) |
| Family medical expenses in 2019 (RMB/year) |     |               |                    |                      |            |            |                   |
| <500                           | 599 | 32 (5.34)     | Ref                | Ref                  |            |            |                   |
| 500–4999                       | 3616| 342 (9.46)    | 10.46 <0.01       | 1.85 (1.27 to 2.69)  | 5.86 0.02  | 1.67 (1.1 to 2.53)  |
| >5000                          | 813 | 118 (14.51)   | 28.26 <0.01       | 3.01 (2.00 to 4.52)  | 11.75 <0.01| 2.27 (1.42 to 3.63) |
| Stroke history                 |     |               |                    |                      |            |            |                   |
| Yes                            | 148 | 24 (16.22)    | 6.81 0.01         | 1.81 (1.16 to 2.84)  |            |            |                   |
| No                             | 4905| 473 (9.64)    | Ref                | Ref                  |            |            |                   |
| Hypertension history           |     |               |                    |                      |            |            |                   |
| Yes                            | 1243| 144 (11.58)   | 5.84 0.02         | 1.29 (1.05 to 1.58)  |            |            |                   |
| No                             | 3802| 351 (9.23)    | Ref                | Ref                  |            |            |                   |
| Dyslipidaemia history          |     |               |                    |                      |            |            |                   |
| Yes                            | 502 | 63 (12.55)    | 4.77 0.03         | 1.37 (1.03 to 1.82)  |            |            |                   |
| No                             | 4521| 429 (9.49)    | Ref                | Ref                  |            |            |                   |
| Diabetes history               |     |               |                    |                      |            |            |                   |
| Yes                            | 354 | 49 (13.84)    | 7.15 0.01         | 1.54 (1.12 to 2.12)  |            |            |                   |
| No                             | 4672| 441 (9.44)    | Ref                | Ref                  |            |            |                   |
| History of other diseases      |     |               |                    |                      |            |            |                   |
| Yes                            | 245 | 43 (17.55)    | 16.63 <0.01       | 2.04 (1.45 to 2.88)  | 5.16 0.02  | 1.64 (1.07 to 2.52) |
| No                             | 4777| 451 (9.44)    | Ref                | Ref                  |            |            |                   |
| Smoking*                       |     |               |                    |                      |            |            |                   |
| Yes                            | 1133| 97 (8.56)     | 2.72 0.10         | 1.22 (0.96 to 1.53)  |            |            |                   |

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Open access (CMHS) followed the China Chronic Diseases and Risk Factors Surveillance organised by the Chinese Centre for Disease Control and Prevention since 2004 and used the same sampling frame to get the national anxiety prevalence which represented anxiety nationally. Some variables in this study, such as sleep time and waking up suffocating, were not among the variables used in CMHS. Moreover, the prevalence of anxiety was higher in the elderly and women among the population in our study, which is consistent with previous study results.19 20

Table 1 Continued

| Characteristic | No  | Anxiety N (%) | Univariate analysis | Multivariable analysis |
|----------------|-----|---------------|---------------------|------------------------|
|                |     |               | Wald χ²  | P value | Crude OR (95% CI) | Wald χ² | P value | Adjusted OR (95% CI) |
| No 3923        | 401 (10.22) | Ref          |          |          |                       |          |          |                       |
| Drinking*      | Yes 1000 | 79 (7.90)    | 5.03     | 0.02    | 1.33 (1.04 to 1.71)  |          |          |                       |
| No 4044        | 415 (10.26) | Ref          |          |          |                       |          |          |                       |
| Drinking tea*  | Yes 1446 | 132 (9.13)   | 1.29     | 0.26    | 1.13 (0.92 to 1.39)  |          |          |                       |
| No 3593        | 366 (10.19) | Ref          |          |          |                       |          |          |                       |
| Sleep time     | ≥6 hours 4870 | 462 (9.49) | Ref |          |                       |          |          |                       |
| <6 hours 142   | 26 (18.31) | 11.68 <0.01  | 2.14 (1.38 to 3.31) | 5.88 0.02 | 1.93 (1.14 to 3.29)  |          |          |                       |
| Exercising     | Regular 1372 | 114 (8.31)  | Ref |          |                       |          |          |                       |
| Moderate 1494  | 147 (9.84) | 2.02 0.16    | 1.20 (0.93 to 1.56) |          |                       |          |          |                       |
| Little 2062    | 222 (10.77) | 5.60 0.02    | 1.33 (1.05 to 1.69) |          |                       |          |          |                       |
| Snoring*       | Yes 1699  | 159 (9.36)   | 0.39     | 0.53    | 1.07 (0.86 to 1.32)  | <0.01 0.95 | 1.01 (0.76 to 1.33)  |          |          |                       |
| Not clear 759  | 108 (14.23) | 18.78 <0.01  | 1.72 (1.35 to 2.20) | 7.20 0.01 | 1.54 (1.12 to 2.10)  |          |          |                       |
| Waking up suffocating | No 3700 | 310 (8.38)  | Ref |          |                       |          |          |                       |
| Yes 177        | 24 (13.56) | 5.63 0.02    | 1.72 (1.10 to 2.68) | 4.32 0.04 | 1.74 (1.03 to 2.94)  |          |          |                       |
| Not clear 937  | 128 (13.66) | 23.92 <0.01  | 1.73 (1.39 to 2.16) | 11.83 <0.01 | 1.59 (1.21 to 2.09)  |          |          |                       |

*Some missing values. RMB, renminbi.

Figure 2 Anxiety prevalence and 95% CI among different age groups and genders.

Figure 3 Multivariate analysis of anxiety among the population between 30 and 70 years old in an urban area in China. Reference group in different variables: (1) age 30–44 years; (2) male; (3) medical expenses of the whole family in 2019 (RMB/year) <500; (4) no other disease; (5) sleep time over 6 hours; (6) not snoring; (7) not suffocating during sleep. RMB, renminbi.
Gender differences are likely moderated by socialisation processes that prescribe gender-specific expectations regarding the expression of anxiety and the acceptable means of coping with anxiety. These socialisation factors influence expression of traits by shaping patterns of reinforcement that cultivate and promote processes related to anxiety, and the population in this study was just in the socialisation processes.

Numerous studies identified income as the main factor influencing anxiety. However, our study indicated that the greater family medical expense was more likely to make the participant anxious, compared with monthly income. Furthermore, these results showed that the main factor influencing anxiety among the population was the final medical expenses regardless of income. Therefore, the continuous improvement of the medical system, leading to the reduction of medical expense pressures on residents, could have significant meaning for reducing the anxiety and maintaining the mental health of the population.

There is still some controversy about the relationship between chronic diseases, such as hypertension and diabetes, and anxiety. According to a 22-year cohort study conducted in Norway, anxiety is associated with blood pressure decrease. However, most studies suggested that hypertension is the risk factor for anxiety. In our study, we found no significant statistical association between chronic diseases, such as hypertension and diabetes, and anxiety, while other diseases such as tumours that seriously affect patients' lives impacted anxiety. Compared with chronic diseases that are long-lasting and cause chronic damage, the diseases such as a tumour, which substantially damage health and result in great medical expenses, could easily induce anxiety.

In addition to diseases and medical expenses, this study found that insufficient sleep and poor sleep quality were associated with anxiety. Previous studies focused on the relationship between poor sleep quality and anxiety in special populations. In our study, the target population included those aged 30–70 years old, where multiple factors such as diseases, medical expenses, exercise, etc were considered and adjusted in logistic regression. Also, our sample size was substantially larger than in previous studies. While some research found that anxiety as a risk factor could disturb sleep, we found that the association between anxiety and poor sleep might be bidirectional. However, due to the nature of the study, it was impossible to establish the cause–effect relationship.

Different viewpoints on the relationship between poor living habits, such as smoking and drinking, and anxiety have always existed. In a Japanese study, mental disorder was significantly associated with smoking and inversely associated with at-risk drinking. Also, these associations were stronger in younger adults, especially young women. However, some studies showed that smoking and drinking were not associated with anxiety. Nevertheless, our multivariate analysis results did not suggest any relationship between poor living habits and anxiety. One possible reason for this result is that the definition of poor living habits was not separated into subgroups, so it was not detailed enough.

The present study has some limitations. The interview was carried out face-to-face, and the results were based on the participants' self-report, which might be affected by a certain recall bias, despite most objective variables being designed in the questionnaire. The clustering effect of household was not analysed and adjusted due to a lack of household ID. Smoking, alcohol and tea consumption were not separated into subgroups. Finally, this research was a cross-sectional study, and the association might be bidirectional. Further longitudinal follow-up study is required.

**CONCLUSION**

This study aimed to better understand anxiety and the association between sleep quality and anxiety in an urban sample of Shanghai residents. Our results showed that the prevalence of anxiety was high in Shanghai. Being of older age and being female were significantly associated with anxiety. Furthermore, the type of medical expenses and family medical expenses were associated with anxiety. After adjusting for other factors, sleep time <6 hours and waking up suffocating had a significant association with anxiety. These findings suggest that future anxiety prevention programmes in urban areas should include interventions targeted at these factors, such as improving sleep quality and reducing residents' medical expenses.

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**Contributors** Substantial contributions to the conception and design of the work, and the analyses and interpretation of data for the work—QW, JZ, HY, FZ and PZ. Data collection and performed the experiments—JZ and PZ. Drafting the work or revising it critically for important intellectual content—QW, JZ, PJ, FZ and PZ. Final approval of the version to be published—FZ and PZ. All authors read and finally approved the manuscript draft for publication. FZ and PZ are responsible for the overall content as guarantors.

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**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not required.
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### Supplementary File: Definition of the variables used in this study

| term                        | Definition                                                                                                                                 |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| **Age (y)**                 | 30~; 45~; 60~70.                                                                                                                         |
| **Gender**                  | Male; Female.                                                                                                                             |
| **Education level**         | Primary school and below: Without formal education or primary school and below; High school: Junior high school graduate or senior high school or technical secondary school or technical school; Undergraduate or above: College graduate or undergraduate graduate or graduate student or above. |
| **Monthly income (RMB)**   | <2000; 2000-3999; 4000-5999; 6000-11,999; 12,000 and above.                                                                                  |
| **Type of medical expenses**| No self-expenses; partly self-expenses; fully self-expenses.                                                                               |
| **Medical expenses of the whole family in 2019 (RMB/Year)** | <500; 500-4999; >5,000.                                                                                                                   |
| **Stroke history**          | Had a stroke by self-report.                                                                                                              |
| **Hypertension history**    | Suffering from hypertension by self-report.                                                                                               |
| **Dyslipidemia history**    | Suffering from dyslipidemia by self-report.                                                                                               |
| **Diabetes history**        | Suffering from hypertension diabetes by self-report.                                                                                      |
| **History of other diseases** | Suffering from any other diseases by self-report, including atrial fibrillation, coronary heart disease, myocardial infarction, congenital heart disease, valvular heart disease, other types of heart disease, peripheral artery disease, kidney disease. |
| **Smoking**                 | Smoking at least one cigarette per time and continuously or accumulatively for over 6 months in a lifetime by self-report.                |
| **Drinking**                | Drinking at least once in the past 30 days and at least 50ml for alcohol or 250ml for beer or 100ml for wine per time by self-report.     |
| **Drinking tea**            | Drinking tea at least once in the past 30 days and at least 200ml per time by self-report.                                                |
| **Sleeping time**           | Average sleep time ≥6h/day; or <6h/day.                                                                                                    |
| **Exercising**              | Regular exercising: exercise frequency ≥3 times/week and ≥30 minutes/time; Moderate exercising: exercise frequency <3 times/week and <30 minutes/time; Little exercising: exercise frequency <1 time/week and <30 minutes/time. |
| **Snoring**                 | Snoring during sleeping in the past 30 days                                                                                               |
| **Suffocating to wake up**  | Suffocating to wake up during sleeping in the past 30 days                                                                                |
| **Anxiety**                 | Total standard score ≥ 50                                                                                                                 |