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Prevalence and Implications of Anxiety and Depression in Cardiovascular Outpatients Following the COVID-19 Pandemic

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Abstract: *Objective:* To investigate the prevalence of depression and/or anxiety among cardiovascular outpatients in a tertiary general hospital following the COVID-19 pandemic. *Method:* Patients were recruited consecutively from the cardiovascular outpatient department of Weinan Central Hospital, a comprehensive tertiary hospital in the region. Eligible participants were aged 18 years or older, conscious, provided informed consent, and were able to independently complete the questionnaire. On designated survey days, all participants completed a general information form, the three-question method questionnaire, and, for those identified as positive by the initial screening, additional GAD-7 and PHQ-9 assessments. *Results:* A total of 1,355 valid responses were obtained. Initial screening using the three-question method identified 379 positive cases, accounting for 27.97% (379/1,355). The prevalence of depression was approximately 2.89% (39/1,355), anxiety was 4.87% (66/1,355), and mixed anxiety and depression was 15.28% (207/1,355), indicating that mixed conditions were more common. Among patients presenting with cardiac-like symptoms but diagnosed with non-organic heart disease, over 36% were identified in the outpatient department. In this subgroup, the prevalence of anxiety, depression, and mixed conditions was approximately 25.25%, 23.35%, and 19.56%, respectively. These cases, often categorized as cardiac neurosis, are thought to be associated with emotional and psychological factors and are predominantly observed among young and middle-aged individuals. Among patients with organic heart disease, hypertension was the most prevalent condition, affecting approximately 47.75%, followed by coronary heart disease, heart surgery, arrhythmias, and heart failure. Patients with arrhythmias exhibited the highest rates of anxiety (27.71%), depression (26.51%), and mixed conditions (25.30%). Similarly, among hypertensive patients, the prevalence of anxiety, depression, and mixed conditions was approximately 16.23%, 14.06%, and 11.90%, respectively. These prevalence rates exceed national data from similar studies conducted prior to the COVID-19 pandemic. *Conclusion:* A high prevalence of anxiety and depression exists among cardiovascular outpatients in general hospitals, with an increasing trend observed after the pandemic. Establishing a psycho-cardiological medical model is essential for improving the diagnosis and treatment of these patients.

Keywords: COVID-19 pandemic; Psycho-cardiology; Anxiety; Depression

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1. Introduction

Cardiovascular diseases are frequently accompanied by emotional disorders such as anxiety and depression. The field of "psycho-cardiology" investigates and addresses the emotional, social, environmental, and behavioral factors associated with heart diseases [1]. Research increasingly highlights anxiety and depression as independent risk factors that influence the onset, progression, prognosis, and outcomes of cardiovascular conditions [2]. These two factors are both causes and consequences of one another, creating a mutually reinforcing relationship.

Since 1995, Hu and Liu have identified through research that a significant proportion of cardiology outpatients experience anxiety, depression, or both. Based on these findings, the dual-heart clinic and dual-heart ward round models for diagnosis and treatment were proposed. These models have been widely adopted by cardiology healthcare professionals and promoted nationwide. Over the past decade, psycho-cardiology has undergone rapid development, with extensive dual-heart data providing robust evidence to support clinical practice. Despite this progress, standardized psycho-cardiological diagnostic and treatment services have yet to be implemented in certain regions, including the area covered by this study.

The three-year COVID-19 pandemic significantly disrupted daily life, leading to heightened psychological stress and noticeable changes in emotional well-being [3–5]. As COVID-19 transitions to a category B management status, the psychological impact of the pandemic on individuals is becoming more evident in this post-pandemic era. Given the relatively underdeveloped state of psycho-cardiology in the region, this study aims to address this gap by implementing standardized dual-heart diagnosis and treatment models. These efforts will be informed by an assessment of the current prevalence of dual-heart conditions in the area, with the ultimate goal of advancing cardiovascular medicine within hospitals and the broader region.

2. Materials and Methods

2.1. General information

Patients attending the cardiology outpatient clinic at Weinan Central Hospital from May to September 2023 were selected for this study. Inclusion criteria: patients aged 18 years or older, conscious, capable of answering independently, and who provided informed consent. Exclusion criteria: patients who had previously participated in similar surveys, had a history of visiting psychiatric specialties, or were unable to complete the survey due to severe mental or physical dysfunction.

2.2. Methods

This hospital-based cross-sectional study was conducted following the ethical standards established by the Ethics Committee of Weinan Central Hospital. The study received approval from the committee (approval number: 2023Y006-1), and informed consent was obtained from all participants. All researchers and coordinators involved in the study underwent pre-survey training to ensure consistency in the experimental process.

Before or during consultations, coordinators distributed and guided patients in completing a screening questionnaire, which included general information such as age, gender, and occupation. Clinic doctors routinely inquired about the patient's current medical history, past medical history, and medication use. Initial screening for potential issues was conducted using the Three-Question Method [6]. Patients were subsequently provided with self-assessment scales for anxiety and depression (GAD-7 and PHQ-9) to complete the screening process.

Patients identified with mild to moderate conditions based on the self-assessment scales received appropriate diagnoses and treatment. Patients with severe anxiety and/or depression were referred or consulted with psychologists as necessary. Statistical results were categorized into four groups: positive results from the Three-Question Method, pure anxiety, pure depression, and mixed anxiety and depression. Survey days were randomly selected during the study period.

2.3. Observation indicators and criteria

2.3.1. Three-Question Survey

The Three-Question Survey, derived from the 2020 Chinese Expert Consensus on Psychological Prescriptions for Patients Visiting Cardiovascular Medicine Departments, is an initial screening tool for identifying psychological concerns. The survey consists of three questions:

(1) Sleep quality: Have you experienced poor sleep that significantly affects your daytime mental state or requires medication?

(2) Emotional state: Have you felt restless or lost interest in previously enjoyable activities?

(3) Physical discomfort: Have you experienced significant physical discomfort without any organic cardiovascular disease explanation despite multiple examinations?

Responses are limited to "yes" or "no." Patients responding "yes" to two or more questions are considered positive for potential psychological concerns. The Three-Question Survey is valued for its brevity and efficiency in high-paced cardiovascular clinics [6]. Patients with positive results are advised to undergo further screening with self-assessment scales for anxiety and depression.

2.3.2. GAD-7 and PHQ-9 self-assessment scales [6–8]

The Generalized Anxiety Disorder 7-item scale (GAD-7) and the Patient Health Questionnaire 9-item scale (PHQ-9) are widely accepted for their reliability, validity, simplicity, and time efficiency.

(1) GAD-7: This scale consists of seven items designed to assess anxiety. Each item is scored from 0 to 3, with total scores interpreted as follows: < 5 (normal), 5–9 (mild anxiety), 10–14 (moderate anxiety), 15–19 (moderately severe anxiety), and > 20 (severe anxiety).

(2) PHQ-9: This scale comprises nine items aimed at detecting depression. Scoring is similar to GAD-7, with total scores categorized as < 5 (normal), 5–9 (mild depression), 10–14 (moderate depression), 15–19 (moderately severe depression), and > 20 (severe depression).

2.4. Statistical analysis

All patients completing the self-assessment scales were included in the epidemiological analysis. Prevalence rates are presented as percentages. Statistical analysis was performed using SPSS software, with a *P*-value of <0.05 considered statistically significant. This threshold determines the likelihood that observed differences are real rather than due to chance.

3. Results

3.1. General statistical results

A total of 1,377 questionnaires were distributed. After excluding 17 invalid questionnaires and five cases where participants did not provide consent, 1,355 valid responses were included in the analysis, yielding a completion

rate of approximately 98.40%. Among the participants, 680 were male (50.18%) and 675 were female (49.82%). Marital status distribution revealed that 1,271 participants were married (93.87%), 62 were unmarried (4.58%), and 21 fell into other marital categories (1.55%).

The age distribution was predominantly within the 41–60 age group, accounting for 44.58%, followed by the 61–80 age group, which comprised 33.06% (**Figure 1**). Regarding educational attainment, participants with a high school education or below accounted for 62.29%, while those with a college education comprised 23.99% (**Figure 2**). In terms of occupation, farmers constituted the largest group, accounting for 38.52% (**Figure 3**).

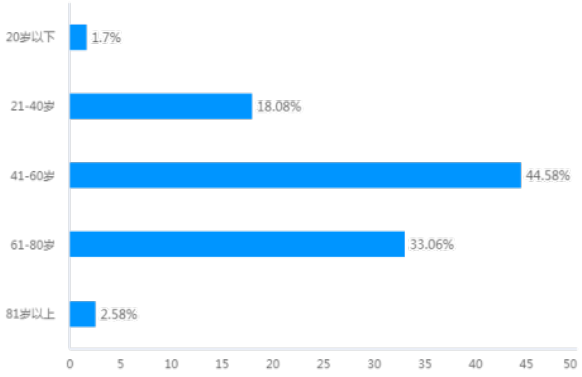

Figure 1. Age distribution of participants

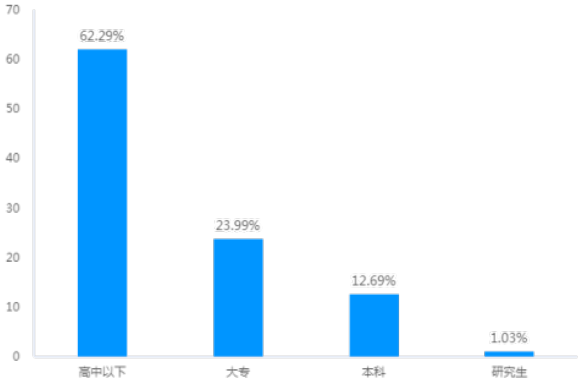

Figure 2. Educational level distribution of participants

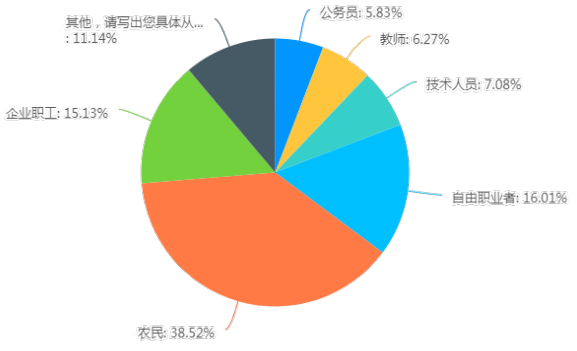

Figure 3. Occupational distribution of participants

3.2. Initial screening results using the Three-Question Survey method

Figure 4 shows that there were 379 positive patients who answered "yes" to two or more questions, accounting for 27.97% (379/1355), which corresponds to ①②+①③+②③+①②③ in **Figure 4**. Patients who answered "no" to all three questions accounted for 39.19%. Besides anxiety and/or depression, insomnia was a common issue: a total of 41.48% of patients reported insomnia, corresponding to ①+①②+①③+①②③ in **Figure 4**. Among them, 18.01% had pure insomnia, represented by ① in **Figure 4**, while 23.47% had mixed insomnia, represented by ①②+①③+①②③ in **Figure 4**.

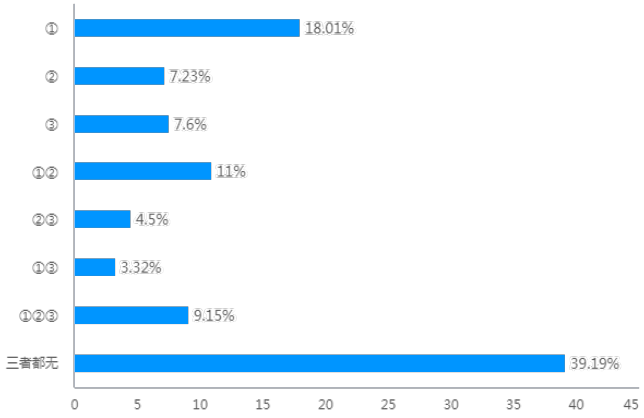

Figure 4. Statistical results from the Three-Question Survey method

3.3. Statistics of depression and/or anxiety state prevalence

A total of 379 valid questionnaires were analyzed. According to the classification statistics, 106 patients with GAD-7/PHQ-9 scores of ≤ 4 were identified as having no anxiety or depression, accounting for 27.97% of the sample. Among the remaining cases, 39 patients with PHQ-9 scores ≥ 5 were diagnosed with pure depressive states, with 35 patients scoring between 5 and 9, indicative of mild depressive states, comprising the majority at approximately 89.74%.

In addition, 66 patients with GAD-7 scores ≥ 5 were identified as having pure anxiety states. Of these, 53 patients scoring between 5 and 9 (mild anxiety) were the most common, accounting for approximately 80.30%. Furthermore, 207 patients with both GAD-7 and PHQ-9 scores ≥ 5 were categorized as having mixed anxiety and depressive states, representing 54.62%. Among these, 177 patients with scores between 5 and 14 (mild to moderate severity) constituted the largest subgroup, accounting for approximately 85.51%.

After adjustment, the total prevalence of pure depressive states among the cardiovascular outpatient population was approximately 2.88% (39/1,355), while pure anxiety states had a prevalence of approximately 4.87% (66/1,355). Mixed anxiety and depressive states were the most prevalent, with a rate of approximately 15.28% (207/1,355). The findings indicate that anxiety was more prevalent than depression, with mixed states being the most common, and most cases were classified as mild to moderate in severity. A summary of self-rating scale results for depression and/or anxiety is provided in **Table 1**.

Table 1. Statistical summary of depression/or anxiety self-rating scale results

GAD7	PHQ9				
	0-4	**5-9**	**10-14**	**15-19**	**> 20**
0-4	106	35	3	1	0
5-9	53	61	22	6	0
10-14	8	20	33	10	1
15-19	4	10	8	18	4
> 20	1	1	5	4	4

3.4. Statistical results of anxiety/depression prevalence among different cardiovascular diseases

As illustrated in **Figure 5**, hypertension was the most common condition, with 647 cases, accounting for approximately 47.75% of the sample. Undiagnosed organic heart disease was the second most prevalent, comprising 36.97%. Other conditions, ranked by frequency, included coronary heart disease, a history of heart surgery, arrhythmia, heart failure, and others.

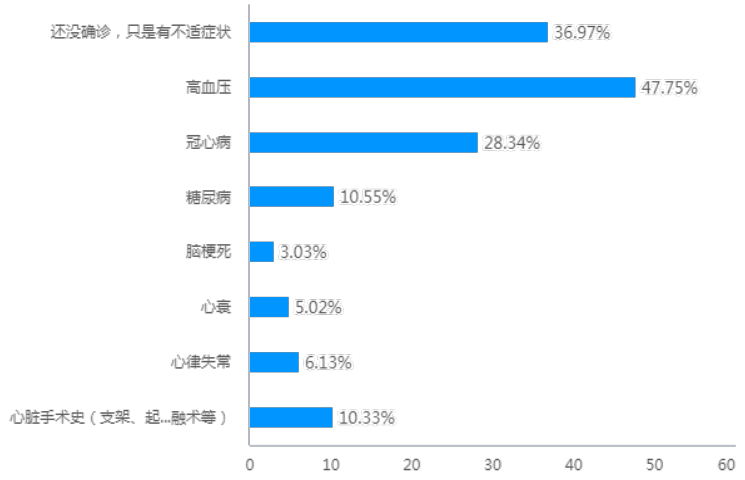

Figure 5. Comorbidities of patients surveyed in this study

Among the disease categories, patients with arrhythmia (83 cases) exhibited the highest rates of comorbid anxiety and/or depression. Specifically, 23 cases (27.71%) were positive for anxiety, 22 cases (26.51%) for depression, and 21 cases (25.30%) for mixed anxiety and depression. Similarly, high rates of comorbid anxiety or depression were observed in common cardiovascular diseases such as hypertension and coronary heart disease. However, these rates were comparatively lower in patients with a history of heart surgery (including procedures such as stent placement or pacemaker implantation) and heart failure. Notably, over one-third of the patients were undiagnosed with organic heart disease, yet their rates of anxiety or depression were also significantly high. Detailed data are provided in **Table 2**.

Table 2. Prevalence of anxiety and depression across various cardiovascular diseases

Cardiovascular disease	Total cases (*n*)	GAD-7 score		PHQ-9 score		Anxiety and depression	
		Anxiety positive cases	Rate (%)	Depression positive cases	Rate (%)	Anxiety and depression positive cases	Rate (%)
Hypertension	647	105	16.23%	91	14.06%	77	11.90%
Coronary heart disease	384	59	15.36%	59	15.36%	50	13.02%
Heart surgery	140	16	11.43%	16	11.43%	14	10.00%
Arrhythmia	83	23	27.71%	22	26.51%	21	25.30%
Heart failure	68	7	10.29%	7	10.29%	4	5.88%
Undiagnosed	501	126	25.15%	117	23.35%	98	19.56%

4. Discussion

Variations in research methods, study populations, and other factors have led to significant differences in reported prevalence rates of depression and/or anxiety symptoms among cardiology patients in domestic studies [9]. A 2014 study by Li *et al.* [10] utilized a self-rated anxiety and depression questionnaire among 2,123 cardiology outpatients from 14 comprehensive tertiary hospitals in major cities. The results indicated a prevalence of depression and/or anxiety disorders of 14.37%, with depression accounting for 10.55% and anxiety disorders for 7.77%. These findings provide a relatively accurate and representative overview of the prevalence of these conditions among cardiology outpatients in tertiary hospitals across China.

This study followed the dual-mind investigation process recommended in the 2020 edition of the "Chinese Expert Consensus on Psychological Prescriptions for Cardiovascular Medicine Patients" [6]. A questionnaire survey was conducted among 1,355 cardiology outpatients from a comprehensive tertiary hospital using Wenjuanxing, an online survey tool. The data collected possesses a degree of regional representativeness. After adjustments, the total prevalence rates for pure depressive states, pure anxiety states, and mixed anxiety and depressive states were approximately 2.88%, 4.87%, and 15.28%, respectively. The findings indicate that mixed anxiety and depressive states were the most prevalent, with mild to moderate severity being predominant. Compared to previous studies [10], this group showed a slightly higher proportion of mixed anxiety and depressive states but a significantly lower proportion of pure anxiety or depressive states.

Two factors may contribute to these discrepancies. First, the self-rated questionnaire assesses the state of anxiety or depression rather than serving as a diagnostic tool, potentially resulting in false-positive or false-negative outcomes. Second, the impact of the COVID-19 pandemic cannot be overlooked. The pandemic caused widespread economic setbacks and life pressures, significantly increasing emotional stress and thereby exacerbating the risk of psychological disorders such as anxiety and depression [3–5].

Anecdotal observations from a tertiary hospital in a provincial capital suggested that over 50% of cardiology outpatients exhibited emotional disorders such as anxiety and depression, a figure substantially higher than reported here. Analysis suggests that repeated, unsuccessful medical visits at primary hospitals may increase emotional stress, leading to higher incidence and severity of anxiety or depression in these patients.

As one of the primary departments for the initial diagnosis of psychological and mental disorders, the

cardiology department plays a critical role in addressing anxiety and depression. This study revealed that over 36% of patients presenting with cardiac symptoms were found to have non-organic heart disease. Among these patients, the prevalence rates for anxiety, depression, and comorbid anxiety and depression were approximately 25.25%, 23.35%, and 19.56%, respectively. These patients, often diagnosed with cardiac neurosis, frequently have symptoms linked to emotional and psychological factors. Young and middle-aged individuals constituted the majority of this group, likely due to socio-economic pressures and heightened post-pandemic anxiety. Increased access to health information and greater health concerns may also contribute to the high prevalence in this demographic, along with a tendency to request coronary angiography during medical visits, which increases the burden on national healthcare resources.

Among patients with organic heart disease, those with arrhythmia exhibited the highest prevalence rates for anxiety (27.71%), depression (26.51%), and comorbid anxiety and depression (25.30%). However, the small sample size for this group could result in significant data deviations. Addressing emotional stressors, including anxiety and depression, is essential in the clinical management of arrhythmia. Similarly, the hypertension group, the largest cohort, exhibited notable rates of anxiety (16.23%), depression (14.06%), and comorbid anxiety and depression (11.90%). Emotional stress and blood pressure fluctuations can mutually influence one another, compounding the challenge of managing primary hypertension.

Low awareness and understanding of hypertension among Chinese patients highlight the need for improved education and promotion of cardiovascular disease prevention and treatment. Developing a dual-hearted medical model that incorporates psychological evaluation and intervention can enhance the quality of life and healthcare experience for patients, improve cardiovascular outcomes, and reduce medical costs and resource wastage.

Despite the rigorous design, subject selection, and standardized survey and analysis methods used in this study, certain limitations should be acknowledged. As a cross-sectional descriptive study, it cannot establish causal relationships between cardiovascular diseases and mental disorders such as anxiety and depression. Moreover, the inclusion of all outpatient cases on the study day ensured a large sample size but did not involve random sampling, which may introduce selection bias. The study population, drawn exclusively from tertiary hospitals in prefecture-level cities, excludes primary and secondary hospitals, thereby limiting its generalizability. Nevertheless, the findings provide valuable data for advancing dual-heart medical practices in the region and serve as a foundation for future analytical research.

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Disclosure statement

The authors declare no conflict of interest.

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