

Research Article

Association between Asthma and Depressive Symptoms: Evidence from The China Health and Retirement Longitudinal Survey (CHARLS)

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Introduction

Asthma is a chronic inflammatory disease of the respiratory system characterized by obstruction of the tracheobronchial system and airway hyperresponsiveness [1-3]. Clinical symptoms include recurrent shortness of breath, wheezing, coughing, excessive mucus secretion, and chest tightness [4,5]. As of 2006, approximately 300 million people worldwide had asthma [6], and in 2015 alone, 397100 people died from asthma, indicating that asthma has become a serious public health problem that poses a threat to human health [7]. At present, asthma is still an incurable disease, and the correct management of symptoms is a key link in the process of asthma treatment [4]. Effective disease management can significantly improve the quality of life, reduce the incidence rate and medical costs [1,8].

Abstract

Background: The association between asthma and depressive symptoms has been confirmed in previous systematic studies, but there is still controversy. The aim of this study is to investigate the association between asthma and depressive symptoms in middle-aged and elderly people in China.

Methods: Data were drawn from the China Health and Retirement Longitudinal Study (CHARLS). The sample includes 13,214 participants aged at least 45 years old. Asthma is defined as the presence of asthma diagnosed by doctors. Depression symptoms were assessed using the 10-item Center for Epidemiologic Studies-Depression (CES-D) scale. Using a logistic regression model to analyze the impact of asthma on depressive symptoms.

Results: Of the 13,426 respondents, the mean (SD) age was 60 (10) years old. The prevalence of asthma and depression symptoms is 6.6% and 51.9%, respectively. After controlling for potential confounding factors (including socioeconomic factors, health behavior variables, and memory-related diseases), logistic regression showed a correlation between asthma and depressive symptoms (OR=1.74, 95%CI: 1.50-3.01; $P < 0.001$).

Conclusions: This cross-sectional study provides evidence for the association between asthma and depressive symptoms. Therefore, preventing or reducing asthma may have a positive impact on the medical care of elderly people with depressive symptoms.

Keywords: Depressive symptoms; Asthma; Aging; Middle-aged and elder adults

It is worth noting that asthma patients often have multiple complications, which exacerbate the severity of asthma. Research on the relationship between mental disorders and asthma suggests that there is a particularly close relationship between depression and asthma patients. For example, the risk of depression in adult asthma patients is 2.09 times higher than in non-asthma patients [9]; Meanwhile, the risk of developing asthma in depressed patients is 1.91 times higher than that in the non-depressed group [10]. The high co incidence of asthma and depression suggests that there may be some common pathogenesis between them. At the same time, the coexistence of the two diseases has also exacerbated its severity, leading to poor asthma control, prolonged hospitalization, prolonged drug use, decreased quality of life, and even suicidal tendencies [2,5].

However, in the past, clinical physicians mainly focused on medication treatment for asthma patients, with little attention paid to their mental health [1,3]. In clinical work, it is particularly important to detect asthma patients with depressive symptoms as early as possible and implement timely and effective interventions to improve the long-term prognosis of asthma [2,5]. This study utilized nationally representative data from the China Health and Retirement Longitudinal Study (CHARLS) to conduct a cross-sectional analysis to explore the relationship between asthma and depressive symptoms in the middle-aged and elderly population in China.

Methods

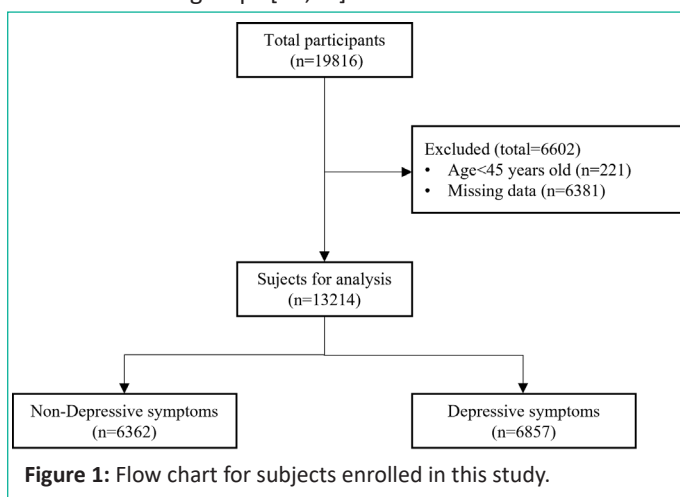
Study Design and Participants

The data for this study comes from the fourth survey of the CHARLS [11] study conducted by the National Institute of Development at Peking University [11]. The details of the sampling design for this survey have been described in previous articles [11]. In short, CHARLS is a nationally representative survey of people aged 45 and above in 450 villages (cities) in 150 counties (districts) of 28 provinces (cities) in Chinese Mainland, providing information on population, geography, health status and lifestyle. This survey was conducted in 2018, with a response rate of 86% [12].

Overall, there were a total of 19,816 subjects in 2018, of which 6,602 were excluded due to incomplete information or age less than 45 years old. Finally, 13,214 subjects were included in the analysis (Figure 1). The Medical Ethics Committee approved the CHARLS survey and required all participants to sign an informed consent form. The data collection by CHARLS has received ethical approval from the Biomedical Ethics Review Committee of Peking University (IRB00001052-11015). The use of CHARLS data has received ethical approval from the Human Research Ethics Committee of the University of Newcastle (H-2015-0290). All patient details were de-identified and the reporting of this study conforms to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Exposure Assessment

The intriguing results were the self-reported doctor-diagnosed asthma using the validated CHARLS baseline questionnaire [13,14]. The inquiry, "Have you ever been diagnosed with asthma by a doctor?" was used to assess them. Individuals who indicated "Yes" were considered to have the illness, and vice versa. Participants were classified into two groups: the asthma and non-asthma groups [13,14].



Outcome Assessment

The 10-item Center for Epidemiological Studies Depression Scale (CES-D-10), which has been validated among senior respondents in China, was utilized to measure depression symptoms in older persons [15,16]. Ten items total, with four possible answers, make up the CES-D-10: 1) infrequently or never (less than one day); 2) occasionally or somewhat frequently (two to four days); and 3) frequently or somewhat frequently (three to four days); and 4) most frequently or entirely (5–7 days). The four options have values that go from 0 to 3, in that order. A lower score denotes a lesser level of depression symptoms [17-19]. The total score runs from 0 to 30. To determine which respondents experienced substantial depression symptoms, a cutoff score of ≥ 10 was employed [16-19].

Covariate Assessment

We adjusted the analysis for any confounding factors based on prior research [20,21]. Socioeconomic factors included age, sex (male, female), residential locations (urban, rural), marital status (married, single), and educational level (illiterate, literate). Health behavior variables included alcohol consumption (yes, no) and current smokers (yes, no). Memory-related diseases (yes, no) was also included in the analysis.

Statistical Analysis

We use a logistic regression model to estimate the correlation between asthma and depressive symptoms, using depressive symptoms as the dependent variable. Also, the 95% CIs for the Odds Ratios (ORs) were given. This study adjusted four models: Model 1 was unadjusted for factors; Model 2 was adjusted for factors in Model 1 plus socioeconomic factors, including age, sex, residential locations, marital status, and educational level; Model 3 was adjusted for factors in Model 2 plus health behavior variables, including alcohol consumption and current smokers; Model 4 was adjusted for factors in Model 3 plus memory-related diseases.

Using the R "lme4" and "lmerTest" packages, all statistical analyses were finished (version 4.0.1). $P < 0.05$ was used to indicate statistical significance in all two-sided statistical tests.

Results

Population Characteristics

As shown in Table 1, out of 13214 subjects, males accounted for 46%; 83% come from rural areas. The mean (SD) age was 60 (10) years old. The prevalence rates of asthma and depression symptoms among participants were 6.6% and 51.9%, respectively. Overall, participants who were female, residing in rural areas, married, drinking, smoking, and memory-related diseases had a higher disease burden for depressive symptoms.

Association Asthma and Depressive Symptoms

We used a logistic regression model to analyze the correlation between asthma and depressive symptoms, and found that asthma and depressive symptoms are closely related (OR=1.77, 95%CI: 1.53-2.04; $P < 0.001$). After controlling for potential confounding factors (including socioeconomic factors, health behavior variables, and memory-related diseases), there is still a correlation between asthma and depression symptoms (OR=1.74, 95%CI: 1.50-3.01; $P < 0.001$).

To verify the robustness of the results, we proposed a gender stratified model and found that there was still a statistically sig-

Table 1: Baseline characteristics of participants.

Variable	Overall	Depressive symptoms		
		No	Yes	p-value
N	13,214	6,362	6,857	
Age (SD), years	60 (10)	60 (10)	60 (10)	0.220
Sex				<0.001
Female (n, %)	7,103 (54%)	3,042 (48%)	4,061 (59%)	
Male (n, %)	6,111 (46%)	3,320 (52%)	2,791 (41%)	
Residential locations				<0.001
Urban (n, %)	2,206 (17%)	832 (13%)	1,374 (20%)	
Rural (n, %)	11,008 (83%)	5,530 (87%)	5,478 (80%)	
Educational level				<0.001
Illiterate (n, %)	4,118 (31%)	2,204 (35%)	1,914 (28%)	
Literate (n, %)	9,096 (69%)	4,158 (65%)	4,938 (72%)	
Marital status				<0.001
Unmarried (n, %)	1,753 (13%)	709 (11%)	1,044 (15%)	
Married (n, %)	11,461 (87%)	5,653 (89%)	5,808 (85%)	
Alcohol consumption				<0.001
No (n, %)	4,227 (32%)	2,282 (36%)	1,945 (28%)	
Yes (n, %)	8,987 (68%)	4,080 (64%)	4,907 (72%)	
Current smokers				<0.001
No (n, %)	5,098 (39%)	2,660 (42%)	2,438 (36%)	
Yes (n, %)	8,116 (61%)	3,702 (58%)	4,414 (64%)	
Memory-related diseases				<0.001
No (n, %)	2,412 (18%)	1,481 (23%)	931 (14%)	
Yes (n, %)	10,802 (82%)	4,881 (77%)	5,921 (86%)	
Asthma				<0.001
No (n, %)	12,341 (93%)	6,054 (95%)	6,287 (92%)	
Yes (n, %)	873 (6.6%)	308 (4.8%)	565 (8.2%)	

Note: Values are means (SDs) or percentages (ns).

significant correlation between asthma and depression symptoms in male (OR=1.75, 95%CI: 1.40-2.18; $P<0.001$) and female (OR=1.72, 95%CI: 1.52-1.96; $P<0.001$) participants, even after controlling for all potential confounding factors.

Discussion

This population-based cross-sectional study indicates that the prevalence of asthma and depression symptoms in middle-aged and elderly people is at a high level. In addition, there is a correlation between asthma and depression symptoms in middle-aged and elderly people, and the correlation between different sex groups is consistent.

This study found that the prevalence of depression symptoms in asthma patients is 40%. Similarly, National Survey on Drug Use and Health data have found that the diagnostic rate of depression in asthma patients is 11.83% higher than those without asthma (5.86%); Compared with non-asthmatic individuals, the incidence of severe depression in patients with life-

long asthma over the past year was 7.84% vs. 4.58%) and the diagnostic rate of depression (10.32% vs. 5.76%) higher [22]. The above studies indicate that the incidence of depression in asthma patients is significantly higher than that in non-asthma populations.

The comorbidity of asthma and depression is very common and has a significant impact on individuals, families, and society [4,5,8]. This study found a close correlation between asthma and depressive symptoms (OR=1.74, 95%CI: 1.50-3.01; $P<0.001$). Research has shown that patients with both asthma and depression have significantly reduced quality of life; Asthma patients with poor asthma control ability and tense lifestyle, as well as patients with parents or interpersonal conflicts, have a higher risk of depression [3,23]. The study jointly suggests that environmental factors such as genetic susceptibility and stress are important pathological mechanisms underlying the comorbidity of asthma and depression. Although specific genetic variations have not yet been found to be associated with the risk of comorbidity between asthma and depression, genes associated with the serotonin pathway and neurogenic growth factors such as BDNF have great advantages in exploring the genetic mechanisms of comorbidity [24,25]. Secondly, the psychological and physiological mechanisms are important factors in the comorbidity of asthma and depression, while the inflammatory pathway links asthma and depressive symptoms more closely [2,23]. Once again, neuropeptides are involved in the comorbidity of asthma and depression by regulating the HPA axis [3,25]. Although we have gained further understanding of the mechanisms underlying the association between asthma and depressive symptoms, the underlying mechanisms remain unclear and further research is needed to clarify them [26,27].

Most studies on medication or non-medication treatment for asthma combined with depressive symptoms have poor quality and inconsistent results [23,25,27]. A Cochrane review included a randomized controlled study of 15 adult asthma patients with depression or anxiety who received psychological intervention therapy (including cognitive behavioral therapy, psychological education, relaxation therapy, and biofeedback therapy) [28]. The study found that the efficacy of anxiety treatment was contradictory, and no study significantly improved the outcomes of depression patients. In addition, a survey from France showed that in a 12 month survey, among 886 patients, 25.6%, 13.7%, and 13% had used anti-anxiety, antidepressants, and hypnotics, respectively, and the dosage of medication was negatively correlated with asthma control [29]. Further large-scale randomized clinical trials are needed to confirm the treatment plans for asthma patients with depressive symptoms.

In conclusion, asthma and depressive symptoms were found to be associated in this nationally representative aging cohort. Our research results indicate that clinical doctors need to pay attention to the mental and psychological health of asthma patients. If necessary, they can screen for depression in asthma

Table 2: The associations between asthma and risk of depressive symptoms.

Characteristic	Model 1		Model 2		Model 3		Model 4	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Total	1.77 (1.53,2.04)	<0.001	1.78 (1.54,2.06)	<0.001	1.81 (1.56,2.09)	<0.001	1.74 (1.50,2.01)	<0.001
Sex								
Male	1.85 (1.49,2.30)	<0.001	1.80 (1.45,2.24)	<0.001	1.79 (1.44,2.23)	<0.001	1.75 (1.40,2.18)	<0.001
Female	1.80 (1.51,2.32)	0.014	1.77 (1.55,2.00)	<0.001	1.77 (1.55,2.01)	<0.001	1.72 (1.52,1.96)	<0.001

Notes: OR = odds ratio; 95% CI = 95% confidence interval.

Model 1: unadjusted;

Model 2: Model 1 + age, residential locations, marital status, and educational level;

Model 3: Model 2 + alcohol consumption and current smokers;

Model 4: Model 3 + memory-related diseases.

patients and provide targeted treatment to alleviate their depressive symptoms, improve their quality of life, reduce asthma incidence, and improve prognosis.

Author Statement

CRedit Authorship Contribution Statement

Yuan He and Ming Yao: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing. Changhui Wang and Dongkai Zhao: Conceptualization, Methodology, Investigation, Writing – original draft, Writing – review & editing.

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