Status and epidemiological characteristics of depression and anxiety among Chinese university students in 2023

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Abstract

Objective This study aims to understand the status of depression and anxiety among Chinese university students through epidemiological investigation of a large sample size and provide a foundation for identifying individuals at risk of psychological crisis and developing targeted intervention strategies.

Methods Survey participants were selected using a multi-stage sampling approach, which incorporated elements of stratification and cluster sampling. The main participants consisted of 49,717 university students from 106 Chinese universities. Self-report questionnaires were used to assess depression and anxiety levels retrospectively.

Results Of the 49,717 questionnaires collected, 41,620 were deemed valid after a rigorous data cleaning process, resulting in a validity rate of 83.7%. Among the respondents, 58.6% were female. The detection rates for depression, anxiety, and comorbidity of depression and anxiety among the students were 9.8%, 15.5%, and 6.5%, respectively. The detection rate of depression varied across different grades (V = 0.119) and locations of universities (V = 0.117). There were great differences in the detection rate of depression and anxiety symptoms among university students in terms of physical health (including self-rated health and vision) and health behaviors (including sleep, smoking and drinking), and physical health and healthy behaviors were important factors in the detection rate of depression and anxiety symptoms among college students.

Conclusion Psychological health issues among Chinese university students are relatively severe, with higher grade students exhibiting particularly concerning signs.

Keywords University students, Depression, Anxiety, Comorbidity, Epidemiological survey, Mental health

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Introduction

In recent years, mental health problems, such as depression and anxiety, have emerged as significant global public health challenges that seriously affecting individuals' quality of life, social functioning, and overall well-being [1–3]. The harmful effects of depression include impaired social relationships, substance abuse, obesity, among others [4]. Prolonged and severe anxiety states can develop into anxiety disorders, including test anxiety, social anxiety, and academic-related anxiety, which permeate various aspects of academic and social life [5]. Depression and anxiety are two common mental health issues that not only affect an individual's emotional state but also significantly impact daily functioning. Depression typically manifests as persistent low mood, loss of interest, and decreased energy, while anxiety primarily presents as excessive worry, tension, and feelings of fear [6]. These two issues are often viewed as important indicators of mental health status as they directly reflect an individual's ability to regulate emotions and psychological adaptation. The relationship between depression and anxiety and overall mental health problems is close [7]. They are not only common manifestations of mental health issues but can also be precursors or comorbidities of other mental health problems. Studies have shown that the presence of depression and anxiety symptoms is often associated with broader mental health issues such as social disorders, sleep problems, and substance abuse [8]. Moreover, the severity of depression and anxiety is frequently used as a key indicator in assessing overall mental health status [9]. In the face of public health emergencies, such as the COVID-19 pandemic, mental health problems have become very critical for various populations. A study published in Lancet in 2022 revealed that without the pandemic's influence, the prevalence of depression would be 3,152.9 per 100,000 population (approximately 3.15%), resulting in a total of 246 million people globally diagnosed with depression. An additional 53 million cases of depression were reported in 2020 due to the pandemic, reflecting a 27.6% increase. The prevalence of anxiety disorders increased to 4,802.4 per 100,000 population (approximately 4.80%), which is equivalent to 374 million individuals worldwide. The pandemic also led to a 25.6% increase or an additional 76 million cases of anxiety disorders in 2020 [10]. Therefore, development of effective interventions and exploring contributing factors to the occurrence of depression and anxiety symptoms should be conducted.

University students are in a critical stage of psychological and social development. They are highly sensitive to their personal growth and shaping their self-identity, values, and career plans [11]. The pressures faced by university students in academic performance, employment prospects, and interpersonal relationships have significantly increased, particularly after the expansion of higher education enrollment [11]. Mental health problems among university students have become increasingly prominent considering that they are under the combined circumstances of sensitive developmental stage and mounting pressures [2]. The proportion of university students who exhibit symptoms of depression and anxiety is significantly higher than that of the general population [12]. A meta-analysis that examined 560 studies found that the detection rates for depression (20.8%) and anxiety (13.7%) ranked second and fourth, respectively, among mental health issues that affect university students [13]. Therefore, gaining a deep understanding of the status and epidemiological characteristics of psychological problems, such as anxiety and depression, among Chinese university students is significant. While mental health issues affect various populations, university students represent a unique and critical demographic for several reasons. Their transitional life stage, heightened vulnerability to mental health challenges, and the potential long-term impact of these issues on their future personal and professional development make them a particularly important group to study and support [14]. China's vast territory encompasses significant differences in economic development levels, cultural backgrounds, and lifestyles across regions. These regional factors may have varying degrees of impact on the mental health of college students [15]. Based on these regional differences, we propose the following research hypothesis:

H1 There are significant differences in the severity of depression and anxiety symptoms among college students from different regions.

Furthermore, visual health has emerged as a significant health concern for modern college students, particularly in the context of increasingly prevalent digital learning and living environments. Factors such as prolonged use of electronic devices, poor eye care habits, and lack of outdoor activities may contribute to an increase in vision problems [16]. Visual health status not only directly affects learning efficiency and quality of life but may also have profound implications for students' mental health. Vision problems can potentially increase academic stress, limit social activities, and affect self-image, thereby possibly triggering or exacerbating symptoms of depression and anxiety [17]. Based on these considerations, we propose the following research hypothesis:

H2 There are significant differences in the severity of depression and anxiety symptoms among college students with different visual health conditions.

Understanding the status of depression and anxiety symptoms as well as related demographic and measurement characteristics is a crucial prerequisite for effective

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intervention and exploration of contributing factors. Despite existing studies that examined the occurrence of anxiety and depression among students [13, 18–26], comprehensive investigation, particularly nationwide epidemiological research using large-scale samples, is lacking with regard to the overall prevalence of anxiety and depression issues among Chinese university students [23]. Therefore, the present study aims to conduct a survey analysis using multi-stage sampling methods on a nationwide sample of university students in China, systematically understand and describe the current situation of anxiety and depression among these students, and elucidate differences among characteristic groups. Although many previous studies have addressed the mental health issues of university students, most have had small sample sizes or were limited to specific regions. This study, by utilizing a large-scale national survey, addresses the gaps in overall prevalence and regional differences identified in existing research, providing more accurate and comprehensive data. These data will aid in developing more precise intervention measures and offer a scientific basis for future policy-making, thus enhancing the mental health levels of university students across the country.

Methods

Participants

This study conducted an epidemiological survey. A total of 49,717 undergraduate students from 106 universities in 31 provinces, autonomous regions, and municipalities in China were surveyed. The sample included students enrolled in regular undergraduate, vocational undergraduate, and junior college programs, excluding adult education, online programs, and graduate studies (master's and doctoral programs). A total of 41,620 valid questionnaires were collected, with female students accounting for 24,408 (58.6%). The survey targeted undergraduate students enrolled in regular higher education institutions in mainland China (excluding Hong Kong, Macau, and Taiwan). The list of regular higher education institutions was referenced from the Ministry of Education's "National List of Regular Higher Education Institutions" (as of June 15, 2023). The multi-stage sampling methods were used to select the participants. The specific sampling steps were as follows:

Selection of sampling sites

Each province (or autonomous region or municipality) was evenly allocated to three sampling sites to ensure the representativeness of the study population. An equal number of participants was sampled from different cities. One city at the provincial capital level was selected as a "Type 1" sampling site. Two additional cities were determined based on geographic locations and socioeconomic development levels of the province or autonomous region, with one city at an average socioeconomic development level as a "Type 2" sampling site and one city with a relatively lower socioeconomic development level as a "Type 3" sampling site. In the case of directly administered municipalities, the sample selection did not strictly adhere to the principles but primarily conducted cluster sampling while considering the principle of quantity distribution among the three sampling sites.

Selection of sampling units

The selection of sampling units considered three factors. First, higher education institutions should be registered with the Ministry of Education and include regular colleges as well as vocational and technical colleges. Second, the units should meet the sampling requirements, including age, number of students, and grade distribution. Third, specific persons should be responsible for distributing the questionnaires, and the units should be willing to participate in long-term monitoring. University students from the selected units should already return to the campus for the fall semester.

Stratification and sample size

$$n = \frac{Z_\alpha^{\,2} * p * (1-p)}{\delta^{\,2}} \tag{A}$$

The population was initially categorized by gender (male and female) and further subdivided into eight groups based on grade distinctions. Each category (e.g., male first-year university students) maintained a minimum sample size of 45 students. The calculation of the minimum sample size is done by Equation A. The confidence level (Z_α) is set at 95%. According to a study on the prevalence of mental disorders in China, the incidence of anxiety disorders and depressive symptoms in Chinese adults was 29.8%, and the incidence of depressive symptoms was 28.8%, and the value of the incidence (***P***) in this formula was estimated to be 38.8%. The permissible margin of error (δ) is set at 5% [27]. The minimum sample size in a university is 364 students. It is divided into 4 grade groups and 2 genders, so that there are 45 students in a single grade band for each gender.

For each province, autonomous region, or municipality, the total sample size reached 1,080 to achieve an estimated nationwide response of 33,480 completed questionnaires (excluding Hong Kong, Macau, and Taiwan). The survey was conducted via Questionnaire Star software and employed electronic questionnaires that were uniformly administered during two teaching weeks in October 2023 (from October 9th to 22nd). A total of 49,717 questionnaires were collected.

Measurement

The content of this survey includes sociological demographic information and physical and mental health behavior scales. The physical health part measures the vision and BMI of university students, and the mental health part mainly conducts a paper-and-pencil test on the depression and anxiety of university students. The average time to complete the whole set of questionnaires is 5 min and 56 s. The maturity scales selected have passed the test for the measurement indicators among Chinese university students. The measurement and analysis indicators are as follows.

Sociological demographic information

Sociodemographic data include gender, grade, age, school attended, and school location (with the provision of a postal code). School location is categorized into three regions: "Eastern," "Central," and "Western," based on China's geographical division. The eastern region comprises Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan provinces; the central region includes Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan provinces; and the western region encompasses Sichuan, Chongqing, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Guangxi, and Inner Mongolia [28].

Depression

The method of mental health flow survey of Chinese residents in the Blue Book of Mental Health: Report on the Development of National Mental Health in China (2019–2020) is generally used [29]. The Center for Epidemiological Studies Depression Scale (CES-D) has been used to screen for depression [30]. He et al. randomly sampled 30,801 individuals from the general population across the country to test the reliability and validity of CES-D. The scale had consistent reliability of 0.85–0.88 and test–retest reliability of 0.49 ($P < 0.001$). The correlation between each item and the total score was greater than 0.5, indicating the satisfactory reliability and validity of CES-D; hence, the scale can be used to measure the level of depression in all age groups [31]. In the present study, the Cronbach's alpha values of CES-D were 0.822 (forward score) and 0.859 (reverse score), and the test–retest reliability correlation coefficient r was 0.619. The scale uses 0–3 to rate the frequency of symptoms in the last week and has a cut-off score of 10; a score of 17 indicates a high risk of depression [30]. Yuan et al. reported that the sensitivity and specificity of depressive disorder detection were 92.6% and 86.8% when CES-D was used to evaluate 16 or more adults, indicating good detection function [32].

Anxiety

The Generalized Anxiety Disorder (GAD-7) is used to assess anxiety levels in the general population [33]. The scale uses the range of 0–3 to rate the frequency of anxiety in the last two weeks. Total score is obtained by adding the scores of the seven items and can be within 0–21 points, of which 0–4 points represent no anxiety, 5–9 points represent mild anxiety, 10–14 points represent moderate anxiety, and 15–21 points represent severe anxiety [29]. Existing studies consider a total score greater than 9 to be a reasonable cut-off point for identifying generalized anxiety [18, 33]. Fu et al. used GAD-7 to investigate the mental health of Chinese university students during the COVID-19 pandemic; the validation of the reliability and validity of GAD-7 showed an internal consistency reliability coefficient of 0.901, indicating that the scale can be used for anxiety risk screening in Chinese university students [34]. In the present study, the internal consistency reliability of GAD-7 was 0.781, and the test–retest reliability correlation coefficient r was 0.803.

Anxiety and depression comorbidities

In this review, "comorbidity" variables were singled out, with depression–anxiety comorbidity defined as conditions that meet both diagnostic criteria for depression and anxiety [35, 36]. The term comorbidity was first proposed by Feinstein and refers to the same patient who has a pre-existing disease in addition to the disease under study or a new disease during the disease [35]. In the present study, university students with a CES-D score greater than 15 and a GAD-7 score greater than 9 were selected as the positive group for comorbidities [37].

Physical health

Physical health indicators include the following. (1) For Self-rated health, The Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) was employed to assess the self-rated health status of university students. For the purpose of this analysis, only the General Health dimension was selected and examined [38]. (2) For visual acuity, the subjects are asked about wearing their eyes in the past month and pathological poor vision. (3) BMI was assessed according to the *National University student Physical Health Standards (2014 Edition)* based on the height and weight test standards for university students [39]; the specific classification standards of BMI are shown in Table 1.

Health behaviors

The health behavior indicators assessed in this study include the following: (1) Sleep Quality: Sleep quality among university students was measured using the Pittsburgh Sleep Quality Index (PSQI) [40]. Based on

Table 1 Body mass index (BMI) scoring sheet (Unit: kg/m2)

Categories	Male	Female
Normal	17.9–23.9	17.2–23.9
Underweight	≤ 17.8	≤ 17.1
Overweight	24.0–27.9	24.0–27.9
Obesity	≥ 28.0	≥ 28.0

the PSQI scores, sleep quality was categorized into four levels: "very good" (total score ≤ 5), "fairly good" (5 < total score ≤ 10), "moderate" (11 ≤ total score < 15), and "poor" (total score ≥ 16) [41]. (2) Physical Activity: Physical activity levels were assessed using the International Physical Activity Questionnaire-Short Form (IPAQ). According to the IPAQ scoring protocol, physical activity behaviors were classified into three categories: "vigorous intensity physical activity (VPA)", "moderate intensity physical activity (MPA)", and "light intensity physical activity (LPA)" [42, 43]. (3) Smoking Behavior: Smoking behavior was evaluated based on the World Health Organization (WHO) definitions related to smoking. Students were categorized into three groups: "Never smoked", "Occasionally smoked", and "Regularly smoked". (4) Alcohol Consumption: Alcohol consumption was assessed using a modified version of the Youth Risk Behavior Surveillance Questionnaire [44]. Based on the number of days students reported drinking alcohol and the number of days they reported being drunk in the past month, alcohol consumption was classified into three categories: " Never had a drink", " Drinking without intoxication", and " Drinking had been drunk". These indicators provide a comprehensive understanding of the health behaviors associated with depression and anxiety among Chinese university students.

Statistical analysis

SPSS25.0 and EXCEL software were used for data processing. Data were preprocessed, and valid questionnaires were selected according to the effective data screening rules. Chi-square test was used to examine differences in depression, anxiety, and comorbidities in demographic indicators, visual acuity, and BMI classification. Cramer's *V* coefficient was used to evaluate the effect under difference analysis, and scoring was as follows: $V = 0.1$–0.3 indicates the existence of difference (small degree of disparity), $V = 0.3$–0.5 indicates the existence of difference (medium degree of disparity), and $V > 0.5$ indicates the existence of difference (high degree of disparity) [45]. Using binomial logistic regression models to examine the relationship between independent variables (gender, grade, region, ethnicity, physical health, and health behaviors) and dependent variables (depression, anxiety, and comorbidities). For each model, R^2 was reported to evaluate the effect of quantitatively

evaluating goodness-of-fit, and the variation of the model was explained using the Hosmer-Lemesho test.

The data cleansing rules of this study are as follows. (1) Questionnaires that cannot identify the "full name" of the school were deleted. (2) Questionnaires with an age of less than 15 years and more than 30 years were deleted. (3) Questionnaires with at least 21 consecutive "all consistent" questionnaire filling codes were deleted. (4) The average time taken to fill in the questionnaire was 5 min and 56 s, and the filling time was deleted in the positions of (0,5%] and [95%,100%). (5) Questionnaire data and BMI data were matched by the "school and student number" code, and duplicate matching questionnaires were deleted.

Results

A total of 49,717 university students participated in the survey, of which 41,620 submitted valid questionnaires, with an effective rate of 83.7%, and 24,408 were female (58.6%). First-year students had the highest response rate (57.4%), while fourth-year students had the lowest response rate (4.0%). This discrepancy in response rates can be attributed to several factors: fourth-year students face significant graduation pressures, such as writing theses, job hunting, or applying for graduate school, which substantially reduce their time and willingness to participate in surveys. Additionally, many fourth-year students engage in part-time jobs or internships, further limiting their availability on campus. The survey was primarily conducted on campus, where fourth-year students spend less time compared to students in other grades, reducing their opportunities to participate. Finally, the timing of the survey may coincide with periods of high academic or personal stress for fourth-year students, decreasing their motivation to complete the survey. University in the central region had the highest response rate (40.0%). Han Chinese students accounted for a large proportion (75.9%). The rate of poor vision among university students was relatively high (75.9%). Among body shape indicators, the overweight and obesity rate of university students accounted for 28.9%, of which 15.5% were obese (Table 2). Overall, the survey had a reasonable sampling, and the response rate met the requirements for statistical analysis and measurement.

The overall detection rate of depressive symptoms among Chinese university students was 9.8%. The rate differed significantly across various factors, including grade ($P < 0.001$, $V = 0.119$), school location ($P < 0.001$, $V = 0.117$), visual acuity ($P < 0.001$, $V = 0.167$), self-rated health ($P < 0.001$, $V = 0.181$), sleep quality ($P < 0.001$, $V = 0.350$), smoking behavior ($P < 0.001$, $V = 0.087$), and alcohol consumption ($P < 0.001$, $V = 0.066$). Specifically, the detection rate of depressive symptoms was higher among senior students compared to their junior

Table 2 Characteristics of depression, anxiety, and comorbidities among Chinese university students

Variable		Overall (41620)		Depression (4060, 9.8%)			Anxiety (4796, 11.5%)			Comorbidity (2720, 6.5%)		
		n	%	n	%	Statistical value	n	%	Statistical value	n	%	Statistical value
Gender	Male	17,212	41.4	1672	9.7	x^2=0.055	1976	11.5	x^2=0.053	1143	6.6	x^2=02.399
	Female	24,408	58.6	2388	9.8	P=0.814	2820	11.6	P=0.818	1577	6.5	P=0.121
						V=0.001			V=0.001			V=0.024
Grade	Freshman	23,878	57.4	2286	9.6	**x^2=155.020**	2733	11.4	x^2=1.897	1535	6.4	x^2=3.913
	Sophomore	10,605	25.5	1057	10.0	P<0.001	1257	11.9	P=0.594	709	6.7	P=0.271
	Junior	5479	13.2	546	10.0	**V=0.119**	613	11.2	V=0.007	368	6.7	V=0.010
	Senior[b]	1658	4.0	171	10.3		193	11.6		108	6.5	
Area	Eastern	14,657	35.2	1535	10.5	**x^2=126.139**	1783	12.2	x^2=9.133	1044	7.1	x^2=1.258
	Westward	10,300	24.7	929	9.0	P<0.001	1151	11.2	P=0.010	613	6.0	P=0.003
	Central	16,663	40.0	1596	9.6	**V=0.117**	1862	11.2	V=0.065	1063	6.4	V=0.098
Ethnicity	Han	38,360	92.2	3727	9.7	x^2=0.849	4404	11.5	x^2=0.872	2495	6.5	x^2=1.258
	Minority	3260	7.8	333	10.2	P=0.357	392	12.0	P=0.351	225	6.9	P=0.533
						V=0.005			V=0.005			V=0.018
Visual acuity	Abnormal	31,599	75.9	2817	8.9	**x^2=152.594**	3404	10.8	**x^2=72.564**	1842	5.8	**x^2=193.54**
	Normal	10,021	24.1	1243	12.4	P<0.001	1392	13.9	P<0.001	878	8.8	P<0.001
						V=0.167			**V=0.142**			**V=0.166**
BMI[a]	Underweight	4608	11.1	454	9.9	x^2=4.340	547	11.9	x^2=2.831	298	6.5	x^2=7.753
	Normal	24,976	60.0	2436	9.8	P=0.827	2894	11.6	P=0.418	1670	6.7	P=0.062
	Overweight	5563	13.4	526	9.5	V=0.005	606	10.9	V=0.008	342	6.1	V=0.043
	Obesity	6433	15.5	640	9.9		745	11.6		407	6.3	
Physical Activity	LPA	29,030	69.8	2870	9.9	x^2=1.887	3375	11.6	x^2=1.206	1915	6.6	x^2=3.121
	MPA	8294	19.9	785	9.5	P=0.389	944	11.4	P=0.547	528	6.4	P=0.523
	VPA	4296	10.3	4.5	9.4	V=0.007	477	11.1	V=0.005	277	6.4	V=0.009
Self-rated Health	Poor	1003	2.4	378	37.7	**x^2=1368.043**	474	47.3	**x^2=2258.858**	308	30.7	**x^2=2686.301**
	Fair	12,886	31.0	1735	13.5	P<0.001	2287	17.7	P<0.001	1121	8.7	P<0.001
	Good	13,608	32.7	968	7.1	**V=0.181**	1121	8.2	**V=0.233**	638	4.7	**V=0.254**
	Very good	9014	21.7	515	5.7		512	5.7		326	3.6	
	Excellent	5109	12.3	464	9.7		402	7.9		327	6.4	
Sleep Quality												

Table 2 (continued)

Variable		Overall (41620)		Depression (4060, 9.8%)			Anxiety (4796, 11.5%)			Comorbidity (2720, 6.5%)		
		n	%	n	%	Statistical value	n	%	Statistical value	n	%	Statistical value
	Very good	18,192	43.7	961	5.3	x^2=5102.034	854	4.7	x^2=6600.326	519	2.9	x^2=8109.516
	Fairly good	15,653	37.6	1090	7.0	$P<0.001$	1297	8.3	$P<0.001$	595	3.8	$P<0.001$
	Fairly bad	5579	13.4	881	15.8	V=0.350	1368	24.5	V=0.398	605	10.8	V=0.441
	Very bad	2196	5.3	1128	51.4		1277	58.2		1001	45.6	
Cigarette Smoking	Never smoked	36,986	88.9	3291	8.9	x^2=316.456	3904	10.6	x^2=339.821	2155	5.8	x^2=417.930
	Occasional smoked	3371	8.1	503	14.9	$P<0.001$	592	17.6	$P<0.001$	366	10.9	$P<0.001$
	Regular smoking	1263	3.0	266	21.1	V=0.087	300	23.8	V=0.090	199	15.8	V=0.100
Drinking wine	Never had a drink	20,337	48.9	1785	8.8	x^2=183.091	2158	10.6	x^2=160.910	1190	5.9	x^2=218.894
	Drinking without intoxication	20,572	49.4	2107	10.2	$P<0.001$	2455	11.9	$P<0.001$	1405	6.8	$P<0.001$
	Drinking had been drunk	711	1.7	168	23.6	V=0.066	183	25.7	V=0.062	125	17.6	V=0.073

V represents Cramer's V coefficient; [a] indicates that the data is missing; [b] Fourth-year students include "fifth-year" students majoring in clinical medicine and other majors

counterparts, with fourth-grade students exhibiting the highest rate (10.3%). In terms of school location, universities in the eastern region had the highest depression detection rate (10.5%). Students with normal vision had a higher prevalence of depression (12.4%) compared to those with poor vision (8.9%). Additionally, students who rated their health more positively had lower depression detection rates. Similarly, better sleep quality was associated with lower depression detection rates. Furthermore, students who reported smoking or alcohol consumption had higher depression detection rates compared to those who had never engaged in these behaviors.

The overall detection rate of anxiety symptoms among Chinese university students was 11.5%. The results showed significant differences in the visual acuity index ($P<0.001$, V = 0.142), self-rated health ($P<0.001$, V = 0.233), sleep quality ($P<0.001$, V = 0.398), smoking behavior ($P<0.001$, V = 0.090), and alcohol consumption ($P<0.001$, V = 0.062) among university students, but no significant differences were observed in sociodemographic indicators or BMI classification. Specifically, similar to the detection of depression, the prevalence of anxiety was higher among students with normal vision (13.9%) compared to those with poor vision (10.8%). Additionally, students who rated their health more positively had lower anxiety detection rates. Better sleep quality was also associated with lower anxiety detection rates. Furthermore, students who reported smoking or alcohol consumption had higher anxiety detection rates compared to those who had never engaged in these behaviors.

The overall detection rate of comorbid symptoms of depression and anxiety among Chinese university students was 6.5%. The rate showed significant differences in the visual acuity index ($P<0.001$, V = 0.166), self-rated health ($P<0.001$, V = 0.254), sleep quality ($P<0.001$, V = 0.441), smoking behavior ($P<0.001$, V = 0.100), and alcohol consumption ($P<0.001$, V = 0.073) among university students, but no significant differences were observed in sociodemographic indicators or BMI classification. Specifically, similar to the detection of depression, the comorbidity detection rate was higher among students with normal vision (8.8%) compared to those with poor vision (5.8%). Additionally, students who rated their health more positively had lower comorbidity detection rates. Better sleep quality was also associated with lower comorbidity detection rates. Furthermore, students who reported smoking or alcohol consumption had higher comorbidity detection rates compared to those who had never engaged in these behaviors.

This Table 3 analysis examines the associations between various independent variables and depression, anxiety, and comorbidities among Chinese university. For depression variables like grade (OR = 0.949, P = 0.009),

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Table 3 Binomial logistic regression model for the predictors of depression, anxiety, and comorbidities

Variable	Depression (4060, 9.8%)						Anxiety (4796, 11.5%)						Comorbidity (2720, 6.5%)					
	B	Wald X²	P	OR	95CI% lower	95CI% upper	B	Wald X²	P	OR	95CI% lower	95CI% upper	B	Wald X²	P	OR	95CI% lower	95CI% upper
Gender	0.033	0.757	0.384	1.034	0.959	1.115	0.038	1.051	0.305	1.039	0.966	1.116	-0.086	3.408	0.065	0.918	0.838	1.005
Grade	-0.053	6.775	0.009	0.949	0.912	0.987	-0.031	2.555	0.110	0.969	0.933	1.007	0.052	4.483	0.034	1.053	1.004	1.105
Area	0.043	4.591	0.032	1.044	1.004	1.087	0.046	5.531	0.019	1.047	1.008	1.087	-0.050	4.211	0.040	0.951	0.906	0.998
Ethnicity	-0.037	0.331	0.565	0.964	0.850	1.093	-0.033	0.277	0.598	0.968	0.857	1.093	0.030	0.153	0.696	1.031	0.885	1.200
Visual acuity	-0.374	92.044	<0.001	**0.688**	0.638	0.743	-0.340	79.743	<0.001	**0.712**	0.661	0.767	0.422	81.891	<0.001	**1.525**	1.392	1.671
BMI	-0.011	0.284	0.594	0.989	0.950	1.030	0.005	0.056	0.814	1.005	0.966	1.044	-0.023	0.860	0.354	0.977	0.930	1.026
Physical Activity	0.044	2.539	0.111	1.045	0.990	1.104	0.038	2.005	0.157	1.038	0.986	1.094	-0.039	1.335	0.248	0.962	0.900	1.027
Self-rated Health	0.154	72.495	<0.001	**1.167**	1.126	1.209	0.321	320.199	<0.001	**1.379**	1.331	1.429	-0.093	18.402	<0.001	**0.911**	0.873	0.951
Sleep Quality	-0.877	2165.012	<0.001	**0.416**	0.401	0.432	-1.025	3089.845	<0.001	**0.359**	0.346	0.372	1.114	2417.184	<0.001	**3.048**	2.915	3.186
Cigarette Smoking	-0.323	83.099	<0.001	**0.724**	0.675	0.776	-0.337	93.743	<0.001	**0.714**	0.667	0.764	0.346	70.178	<0.001	**1.413**	1.303	1.532
Drinking wine	-0.016	0.220	0.639	0.984	0.920	1.053	0.057	3.038	0.081	1.059	0.993	1.130	-0.022	0.283	0.595	0.978	0.901	1.061
Goodness of Fit	R^2=0.088;Hosmer-Lemesho (X^2= 26.154, P=0.187)						R2= 0.124;Hosmer-Lemesho (X^2= 14.342, P=0.143)						R^2=0.089;Hosmer-Lemesho (X^2= 11.744, P=0.163)					

area (OR = 1.044, $P = 0.032$), visual acuity (OR = 0.688, $P < 0.001$), self - rated health (OR = 1.167, $P < 0.001$), sleep quality (OR = 0.416, $P < 0.001$), and cigarette smoking (OR = 0.724, $P < 0.001$) show significant associations. For anxiety, self - rated health (OR = 1.379, $P < 0.001$) and sleep quality (OR = 0.359, $P < 0.001$) are strongly related. For comorbidity, visual acuity (OR = 1.525, $P < 0.001$), self - rated health (OR = 0.911, $P < 0.001$), sleep quality (OR = 3.048, $P < 0.001$), and cigarette smoking (OR = 1.413, $P < 0.001$) are significant. The goodness - of - fit statistics (R^2 and Hosmer - Lemesho test) suggest reasonable model fits for all three outcomes.

Discussion

The results of this study showed that the detection rates of depression, anxiety, and depression and anxiety comorbidities among Chinese university students in 2023 were 9.8%, 115.5% and 6.5%, respectively. According to the data of higher education students in the 2022 National Statistical Communiqué on the Development of Education released by the Ministry of Education of China on July 5, 2023, the number of ordinary undergraduates, vocational undergraduates, and higher vocational (junior college) students was 36,594,100. According to the results of the present study, 3,586,200, 4,208,300 and 2,378,600 Chinese university students had depression, anxiety, and comorbidities, respectively. This finding indicates that the mental health problems of Chinese university students are serious, and further measures should be implemented to improve their mental health level.

In April 2023, the China's Ministry of Education and 17 other departments issued a notice on the issuance of the *Special Action Plan for Comprehensively Strengthening and Improving Student Mental Health in the New Era (2023–2025)*, which emphasizes the need to comprehensively strengthen and improve students' mental health in the new era and improve their mental health literacy. The introduction of the policy will provide all-round support for intervening and improving the mental health of university students. The results of this study can provide data to be used by Chinese government officials to formulate intervention strategies in the future.

Older academics had a higher rate of depression, like previous studies [46–49]. Older students are more stressed than younger students in terms of academics, employment, and interpersonal changes, and a number of previous studies confirmed that the amount of stress and the way to cope with stress are significantly correlated with the degree of depression [50]. This finding suggests that managers and researchers from the psychological work of higher education students should pay attention to the mental health of senior students and to the timely alleviation of the pressure of university students due to employment and study. This study found

that the prevalence of depression among university students in the eastern region was higher than that in the central and western regions. Therefore, hypothesis H1 is supported. The possible reason is that the socio-economic level of eastern China is relatively developed, the pace of production and life is relatively fast, and the consumption level is relatively high. Socioeconomic level is an important factor that influences the degree of depression [20, 51], and low socioeconomic level is the main factor that predisposes depression. University students in the eastern region come from all over the country, and the socioeconomic level of the original family is uneven; a low socioeconomic level of the original family and a high consumption level of school location may lead to an increase in the degree of depression.

This study found that vision health factors were the common variable of depression, anxiety, and comorbidities among university students. Therefore, hypothesis H2 is supported. The detection rate of mental health problems in normal university students was high, which could be attributed to two reasons. First, students with myopia, especially high myopia, have relatively few external stimuli from vision, which allows them to maintain inner peace in some cases. Second, the other senses (such as hearing, touch, etc.) of these university students may be compensated to a certain extent; as such, these students pay more attention to their inner experience without being affected by external visual information. The detection rate of anxiety and depression symptoms in visually impaired university students was not significantly different from that of ordinary university students [52]. Adults with vision loss had a significantly increased risk of depression and anxiety [53]. *Out of sight, **out of mind**?* The causal relationship needs to be discussed in depth in further research.

The binomial logistic regression analysis reveals several significant associations between independent variables and mental health outcomes among Chinese university students in 2023. Notably, sleep quality emerges as a robust predictor across all three outcomes—depression, anxiety, and comorbidities—with OR of 0.416, 0.359, and 3.048, respectively. These findings align with recent studies emphasizing the bidirectional relationship between sleep disturbances and mental health disorders. For instance, a 2022 meta-analysis by Liu et al. demonstrated that poor sleep quality significantly increases the risk of depression and anxiety among university students, with ORs ranging from 1.5 to 2.8 [54]. The current study extends this evidence by highlighting the particularly strong association between sleep quality and comorbid conditions [55], suggesting that sleep interventions could be a critical component of mental health strategies in this population.

Another key finding is the significant role of self-rated health in predicting depression and anxiety. This aligns with recent research underscoring the importance of subjective health perceptions in mental health outcomes. A 2018 study by Hou et al. found that students with poorer self-rated health were twice as likely to report depressive symptoms compared to their peers with better self-rated health [56]. The current study further supports this by demonstrating that self-rated health is a stronger predictor of anxiety than depression [57], potentially reflecting the somatic concerns often associated with anxiety disorders. Additionally, the analysis highlights the protective effect of visual acuity against depression (OR = 0.688, $P < 0.001$) and its risk-enhancing role in comorbidities (OR = 1.525, $P < 0.001$), a finding that warrants further investigation given the limited literature on this association. Overall, these results underscore the multifactorial nature of mental health disorders and the need for comprehensive, targeted interventions addressing both physical and psychological well-being.

Considerable variations exist in the detection rates of depression, anxiety, and comorbidities. The detection rate of depression among Chinese university students is between 8–74% [13, 23, 58–60], and that of anxiety ranged from 5 to 40% [13, 23, 59, 60]. The detection rate of negative emotions varied among university students in different studies, which may be related to the cultural background of their study, the research paradigm adopted by the researchers, the differences in measurement tools, and the different sampling methods [59]. Overall, the present study shows that the mental health problems of Chinese university students are relatively serious. This finding is consistent with previous studies of a sample of Chinese university students [27, 61], suggesting the need for effective management of anxiety symptoms in the treatment of depressive disorders, and vice versa.

This study had accurate sampling and a large sample size but has certain limitations. First, only 4% of the students in this study are seniors, which may increase the probability of type I errors when performing statistical analysis based on grade level. Second, the detection judgment of depression and anxiety in university students only relied on recall self-report, which would limit the external validity of the research conclusions.

Conclusions
Psychological health issues among Chinese university students are relatively severe, with higher grade students exhibiting particularly concerning signs. Further measures are needed to enhance the mental health levels of university students.

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List of Abbreviations

BMI	Body-mass index
CES-D	Center for epidemiological studies depression scale
COVID-19	Corona virus disease 2019
GAD-7	Generalized anxiety disorder
LPA	Light intensity physical activity
MPA	Moderate intensity physical activity
PSQI	Pittsburgh sleep quality index
SF-36	The medical outcomes study 36-item short from health survey
VPA	Vigorous intensity physical activity

Author contributions

SSH，BL，WDZ and CYX contributed to the conceptualization and design of the study, interpretation of the data, and critical drafting and revising of the manuscript; BL，WDZ and SSH conducted the statistical analyses and contributed to the interpretation of the data and critical revision of the manuscript; YPY, YXL, SQM, SF, HL, ZLC, YSZ, YZ, QZ and GXW contributed to the interpretation of the data and critical revision of the manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

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Data availability

The raw data supporting the conclusions of this article will be available from Bo Li (wangqiulibo@163.com) on reasonable requests.

Declarations

Ethics approval and consent to participate

This study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of Nantong University (No 70/2022). Informed consent was obtained from all participants involved in this study.

Consent for publication

No applicable.

Competing interests

The authors declare no competing interests.

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