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Association between a healthy lifestyle and the prevalence of depression in radiology residents in China: findings from a nationwide survey

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ABSTRACT

Objective The relationship between a healthy lifestyle and depression in radiology residents remains poorly understood. This study aims to investigate the relationship between a healthy lifestyle and depressive symptoms in radiology residents in a nationwide survey.

Design Cross-sectional study.

Setting The survey was conducted among radiology residents undergoing training in China between December 2020 and April 2021. This encompassed a total of 215 municipalities and 406 training centres.

Participants 3677 radiology residents in 31 provinces of China.

Primary and secondary outcome measures The primary outcome was Healthy Lifestyle Score (HLS). A multiple logistic regression analysis was performed to evaluate the association between lifestyle factors and depressive symptoms. Additionally, the weighted quantile sum (WQS) index was utilised to identify the lifestyle factor that had the greatest impact on depressive symptoms.

Results The study sample consisted of 3677 participants, among whom the prevalence of depression was 34.7%. Participants were categorised based on their Health Lifestyle Score (HLS) into three groups: low HLS (LHLS), moderate HLS (MHLS) and high HLS (HHLS), with proportions of 8.0%, 79.8% and 12.2%, respectively. Those with LHLS were found to have a significantly higher risk of depression (OR: 5.21, 95% CI: 3.72 to 7.30) and a more severe level of depression (p for trend<0.001) compared with those with HHLS. Furthermore, the Well-being Quality of Life Index (WQS) showed a significant association with depression (OR: 0.34, 95% CI: 0.28 to 0.40), with sleep being identified as the most significant factor contributing to a healthy lifestyle.

Conclusion The study establishes a significant association between an LHLS (long and irregular work hours) and an elevated risk of depressive symptoms among the participants, emphasising the crucial role of sleep in this relationship. These findings underline the importance of promoting a healthy lifestyle, specifically emphasising the need for adequate sleep, among radiology residents.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study represents the inaugural exploration of the relationship between depression and healthy lifestyle among radiology residents in China.
⇒ The sample comprised residents from diverse regions across the country, thereby providing a comprehensive understanding of depression and health conditions within this demographic.
⇒ The cross-sectional design employed in this research only allows for the identification of correlations between observed data and does not infer causality.
⇒ The use of self-report questionnaires for data collection introduces the potential for subjective attitudes or memory bias to impact the findings.

INTRODUCTION

Healthcare researchers are increasingly concerned about the health of doctors.[1] Radiology departments, whose employees are integral to the clinical healthcare workforce, have also expressed concerns regarding occupational hazards and health issues among radiologists. These problems include depression, fatigue, repetitive stress injuries and chronic eye fatigue.[2] Additionally, there is a growing recognition that depression may be a problem among radiology residents.[3 4] The working environment of radiology residents is unique due to prolonged exposure to radiation and the need to perform urgent tasks,[5] leading to heightened levels of psychological stress. Mental disorders can manifest at various stages of a doctor's career,[6] and medical students, residents and physicians are observed to have higher levels of depressive symptoms compared with the general population.[7] Standardised residency training is crucial for qualified radiologists, as it allows them to apply their knowledge and accumulate experience,[8] resulting in an increasing

focus on research on radiologists at this stage of their careers.

Genetic and lifestyle factors have been found to be independently associated with the risk of depression. Regardless of genetic predisposition, adherence to a healthy lifestyle has the potential to alleviate the risk of developing depression.[9] It has been established that there is a strong correlation between a healthy lifestyle and a decreased likelihood of experiencing depression.[10 11] Additional risk factors for depression include smoking, physical inactivity and poor sleep quality.[12–14] In order to quantify the impact of lifestyle choices on depression, the Healthy Lifestyle Score (HLS) was developed based on Life's Essential 8, a publication by the American Heart Association in 2022. Previously, the statistical correlation between the HLS and depression has been analysed.[15]

The potential correlation between healthy lifestyle and depression among radiology residents has not been adequately explored. To address this gap, our study aimed to survey a sample of radiology residents in China to examine this association and assess its impact on their mental well-being. By investigating this relationship, we aim to contribute to the development of specific interventions that can enhance the mental health of radiology residents not only in China but also globally.

MATERIALS AND METHODS

Study design

We conducted a survey among radiology residents (hereafter referred to as 'participants') in 31 provinces of China (excluding Taiwan, Hong Kong and Macao), encompassing 215 municipalities and 406 training centres. The survey took place from December 2020 to April 2021 and was carried out with the support of the Chinese Association of Radiologists. Inclusion criteria were radiology residents actively undergoing training in China during the study period (December 2020 to April 2021). Exclusion criteria included residents who did not complete the questionnaire in its entirety or those with self-reported pre-existing mental health diagnoses. Subsequently, they were invited to complete an anonymous online questionnaire using Wen Juan Xing, a widely utilised survey tool in China.[16]

Patient and public involvement

Our participants were radiology residents who voluntarily took part in the survey. Prior to participation, the participants provided informed consent and were duly informed of their right to withdraw from the study at any point without facing any penalties.

Questionnaire

The questionnaire comprised 54 items covering demographic characteristics, work and life practices, mental health and job-related indicators. The majority of these items were adapted from established and standardised scales.

Depression was assessed using the depression scale in the 21-item Depression Anxiety and Stress Scale (DASS-21). The reliability and validity of the DASS scale enable us to effectively screen for depression initially and assess the severity of depressive symptoms in a large sample.[17] A 4-point Likert scale was implemented to measure the participants' agreement level with a variety of statements pertaining to depression, with the following scale: 0=disagree; 1=somewhat agree; 2=largely agree and 3=completely agree. Scores were combined to determine the degree of depression manifested by the participants according to the prescribed definitions of the total scores: 10=no depressive symptoms; 10–13=mild depressive symptoms; 14–20=moderate depressive symptoms; 21–27=severe depressive symptoms and equal to or greater than 28=extreme depressive symptoms. The depression scale questions are specified in online supplemental table 1.

An HLS was determined for the participants based on three factors: sleep, nicotine exposure and exercise. These factors were assessed using a touchscreen questionnaire, which included linked questions and a 5-point Likert scale. The scores on the Likert scale reflected the participants' level of agreement with statements about the three factors. The content and scoring criteria of Life's Essential 8 were utilised for this assessment, with each factor being assigned a possible score ranging from 0 to 100. To calculate the overall HLS, we obtained the average score for the three factors. HLSs falling within the ranges of 0–49, 50–79 and 80–100 were classified as low HLSs (LHLSs), moderate HLSs (MHLSs) and high HLSs (HHLSs), respectively. For more detailed information about each component of the questionnaire, please refer to online supplemental table 2.

Covariates

We identified several covariates from the collected data, including the participants' age, sex, year of residence (first, second or third year), degree (undergraduate, master's or doctorate), marital status (married or unmarried), whether they had children or not, mean number of hours worked per day (<7, 7–8 or >8), average frequency of night shifts worked (≤once per month, two-to-three times per month, one-to-two times per week or ≥three times per week), mean number of hours of computer screen time per day (<4, 4–<6, 6–<9 or ≥9) and depression status (not depressed or depressed).

Statistical analysis

Descriptive statistics were employed to analyse the characteristics and demographic data of the participants. Continuous variables were presented as means±SD, while categorical variables were reported as frequencies with corresponding percentages. The proportion of participants who experienced depression was determined, and a χ^2 test was utilised to compare the baseline characteristics of participants with different HLSs. Multivariable logistic regression models were constructed to investigate

the relationship between different HLSs and depression. Trends were assessed using p values, and ORs with corresponding 95% CIs were calculated. The reference group in the models was HHLSs, with model 1 representing a crude model. Model 2 was adjusted for age and sex, while model 3 was further adjusted for year of residence, marital status, children status, working hours per day, night shift frequency and computer screen time per day.

The weighted quantile sum (WQS) regression model was employed to quantify the collective influence of three lifestyle factors, namely sleep, nicotine exposure and exercise, on the risk of depression. By integrating logistic regression with a weighted approach, this model combines established methodologies.[18 19] The weight assigned to each factor within the WQS index indicates its respective contribution to the participants' risk of depression.

A significance level of 0.05 was used to determine statistical significance (p<0.05). Statistical analyses and plot generation were conducted using IBM SPSS Statistics V.22.0 and R V.4.3.1.

RESULTS

Characteristics of participants

The survey included a total of 3677 participants from different regions of China: 219 from Northeast China, 743 from Central China, 1486 from East China and 1229 from West China (online supplemental figure 1). Table 1 provides an overview of the participants' demographic characteristics and Health Literacy Scores (HLSs). The results show that 2934 participants (79.8%) had a Moderate Health Literacy Score (MHLS), 294 participants (8.0%) had a Low Health Literacy Score (LHLS) and 449 participants (12.2%) had a High Health Literacy Score (HHLS). The mean age of the participants was 26.54±2.60 years, and there was a statistically significant difference in age between participants with different HLSs. The male-to-female ratio was 0.72:1.00, and the ratio of non-depressed to depressed participants was 1.88:1.00 (table 1).

Healthy Lifestyle Scores

The participants with high Healthy Lifestyle Scores (HHLSs) were found to be younger than those with low Healthy Lifestyle Scores (LHLSs) (χ^2 = 8.114, p<0.001). Among those in residency training, a higher proportion of participants in their first year had HHLSs, whereas the number of participants with LHLSs increased with the number of training years. The majority of participants reported working night shifts once a month or less, with most of them having HHLSs. Over half of the participants (2166, 58.9%) reported working on a computer screen throughout their normal working day. Notably, participants who worked for 9 or more hours per day were more likely to have LHLSs and less likely to have HHLSs. The distribution of HLSs among radiology residents, grouped by sex or depression, is displayed in online supplemental figure 2.

Association between HLSs and depression

The prevalence of LHLSs was highest among participants with depressive symptoms, while the prevalence of HHLSs was highest among participants without depressive symptoms. The prevalence of each level of depression among those with LHLSs, MHLSs and HHLSs is presented in table 2. The results show that the majority of participants did not have depression (2400, 65.3%), while some had mild (383, 10.4%), moderate (645, 17.5%), severe (94, 2.6%) or extreme (155, 4.2%) levels of depression. The distribution of the three HLS levels across different grades of depression was statistically significant (χ^2 = 272.725, p<0.001). Additionally, individuals with LHLSs exhibited more severe depressive symptoms compared with those with MHLSs or HHLSs (p for trend<0.001) (figure 1).

LOGISTIC REGRESSION ANALYSIS

A multivariate logistic regression analysis was conducted to examine the association between depression (the dependent variable) and various independent variables including sex, age and daily computer-usage time. The results are summarised in table 3. Model 1 indicated that individuals with moderate Healthy Lifestyle Scores (MHLS) or low Healthy Lifestyle Scores (LHLS) had a higher risk of depression compared with those with normal hearing (HHLS) (OR: 1.85, 95% CI: 1.46 to 2.34 and OR: 6.53, 95% CI: 4.71 to 9.07, respectively, p<0.001). In model 2, after adjusting for age and sex, and in model 3, after further adjusting for other confounders, the findings remained consistent. Specifically, participants with MHLS or LHLS had an increased risk of depression compared with those with HHLS (model 2: OR: 1.96, 95% CI: 1.55 to 2.50 and OR: 6.35, 95% CI: 4.57 to 8.83, respectively; model 3: OR: 1.83, 95% CI: 1.44 to 2.33 and OR: 5.21, 95% CI: 3.72 to 7.30, respectively).

Subgroup analyses

We conducted stratified analyses considering various demographic and work-related factors. These factors included age, sex, year of residence, marital status, children status, average working time, night shift frequency and time spent per day working on a computer Online supplemental figure 3 presents a forest plot illustrating the relative risk of depression for individuals with moderate-high life stress (MHLS) or low-high life stress (LHLS), with high-high life stress (HHLS) as the reference category. The plot reveals that certain factors were associated with an increased risk of depression in individuals with MHLS or LHLS, but not in those with HHLS. Notably, individuals with LHLS demonstrated the highest risk of depression. Specifically, participants in their first or second year of training exhibited a higher likelihood of depression if they had MHLS compared with those with HHLS (ORs: 2.521 and 1.713, respectively). Furthermore,

Table 1 Baseline characteristics of participants

Characteristic	All participants (n=3677)	Low HLS (n=294)	Moderate HLS (n=2934)	High HLS (n=449)	Statistics	
					F/χ^2	P value
Age, y, mean±SD	26.54±2.60	27.13±2.86	26.49±2.56	26.48±2.66	8.114	<0.001
Sex, n (%)					65.635	<0.001
Men	1539 (41.9)	174 (59.2)	1134 (38.7)	231 (51.4)		
Women	2138 (58.1)	120 (40.8)	1800 (61.3)	218 (48.6)		
Year of residence, n (%)					23.553	<0.001
First year	1293 (35.2)	73 (24.8)	1031 (35.1)	189 (42.1)		
Second year	1184 (32.2)	106 (36.1)	948 (32.3)	130 (29.0)		
Third year	1200 (32.6)	115 (39.1)	955 (32.5)	130 (29.0)		
Degree, n (%)					8.728	0.07
Undergraduate	3387 (92.1)	272 (92.5)	2717 (92.6)	398 (88.6)		
Master	229 (6.2)	18 (6.1)	170 (5.8)	41 (9.1)		
Doctorate	61 (1.7)	4 (1.4)	47 (1.6)	10 (2.2)		
Marriage, n (%)					9.276	0.01
Married	817 (22.2)	86 (29.3)	631 (21.5)	100 (22.3)		
Unmarried or else	2860 (77.8)	208 (70.7)	2303 (78.5)	349 (77.7)		
Child, n (%)					17.080	<0.001
No	3202 (87.1)	234 (79.6)	2567 (87.5)	401 (89.3)		
Yes	475 (12.9)	60 (20.4)	367 (12.5)	48 (10.7)		
Average working time hours/day, n (%)					83.875	<0.001
<7 hours	196 (5.3)	6 (2.0)	167 (5.7)	23 (5.1)		
7–8 hours	2438 (66.3)	147 (50.0)	1945 (66.3)	346 (77.1)		
>8 hours	1043 (28.4)	141 (48.0)	822 (28.0)	80 (17.8)		
Night shift, n (%)					36.201	<0.001
Once a month or less	2276 (61.9)	147 (50.0)	1818 (62.0)	311 (69.3)		
2–3 times a month	617 (16.8)	54 (18.4)	509 (17.3)	54 (12.0)		
1–2 times a week	630 (17.1)	71 (24.1)	489 (16.7)	70 (15.6)		
≥3 times per week	154 (4.2)	22 (7.5)	118 (4.0)	14 (3.1)		
Watching computer screen time, n (%)					119.318	<0.001
<4 hours/day	185 (5.0)	15 (5.1)	153 (5.2)	17 (3.8)		
4–<6 hours/day	573 (15.6)	22 (7.5)	441 (15.0)	110 (24.5)		
6–<9 hours/day	2166 (58.9)	140 (47.6)	1752 (59.7)	274 (61.0)		
≥9 hours/day	753 (20.5)	117 (39.8)	588 (20.0)	48 (10.7)		
Depression, n (%)					148.602	<0.001
Not depressed	2400 (65.3)	105 (35.7)	1943 (66.2)	352 (78.4)		
Depressed	1277 (34.7)	189 (64.3)	991 (33.8)	97 (21.6)		

HLS, Healthy Lifestyle Score.

individuals with MHLS or LHLS who worked an average of 7 or more hours per day and spent more than 5 hours per day working on a computer were more likely to experience depression than those with HHLS. Additionally, individuals with LHLS had a greater likelihood of depression if they worked fewer than three night shifts per week compared with those with HHLS. The p value for interactions was greater than 0.05, indicating the absence of significant interactions between subgroups. Therefore, the aforementioned findings are consistent and reliable.

WQS regression analysis

This analysis examined the combined impact of various lifestyle factors, including sleep quality, physical activity and smoking habits, on depression. The results obtained from both the preliminary and fully adjusted models are

Table 2 Prevalence of depression level among low HLS, middle HLS and high HLS

Depression level	Frequency, n (%)	HLS			Statistics	
		Low HLS	Moderate HLS	High HLS	χ^2	P value
Normal	2400 (65.3)	105 (35.7)	1943 (66.2)	352 (78.4)	272.725	<0.001
Mild	383 (10.4)	34 (11.6)	317 (10.8)	32 (7.1)		
Moderate	645 (17.5)	76 (25.9)	517 (17.6)	52 (11.6)		
Severe	94 (2.6)	28 (9.5)	60 (2.0)	6 (1.3)		
Extremely severe	155 (4.2)	51 (17.3)	97 (3.3)	7 (1.6)		
Total	3677	294	2956	449		

P for trend: <0.001.
HLS, Healthy Lifestyle Score.

presented in table 4. The WQS index in the preliminary model exhibited a strong association with depression (OR: 0.21, 95% CI: 0.16 to 0.27). This finding was further supported by the fully adjusted model (OR: 0.34, 95% CI: 0.28 to 0.40). The p values in both models were less than 0.001, indicating a statistically significant correlation between the aggregated lifestyle factors and the occurrence of depression.

The weights allocated to each component in the WQS index are depicted in figure 2. The sleep score received the highest weight (0.60) in the depression model, indicating its substantial impact on the risk of depression. Following that, the exercise score received the second-highest weight (0.34), while the smoking score had the lowest weight (0.06). This suggests that smoking status had the least influence on the overall risk of depression within this model.

DISCUSSION

This study aimed to examine the relationship between a healthy lifestyle (HLS) and depressive symptoms in a sample of 3677 radiology residents in China. The results revealed significant associations between HLS, encompassing sleep quality, nicotine exposure and exercise levels and the likelihood of experiencing depression. Specifically, participants with lower HLS scores demonstrated a higher propensity for depressive symptoms compared with those with higher HLS scores, with sleep quality emerging as the most influential factor. The implications of these findings are paramount for promoting the mental well-being of radiology residents.

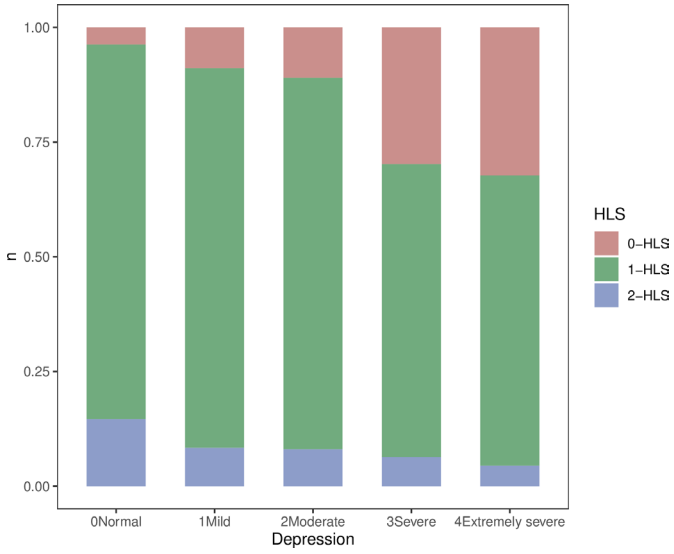

Figure 1 Distribution of HLS in different levels of depression. HLS, Healthy Lifestyle Score.

The prevalence of depressive symptom among the participants was 34.7%, which aligns with the findings of a previous study.[20] However, it is higher than the prevalence reported in another study focusing on medical students (27.2%).[21] This disparity may be attributed to the fact that radiologists experience both academic stress and also clinical practice and work-related stressors. Furthermore, the prevalence of depression among the participants is consistent with that observed in other clinical physicians. For instance, The Lancet reported a 34.6% prevalence of depression among clinical physicians,[22] indicating the need for psychological or psychiatric support among such professionals. Other studies examining healthcare workers have shown varying rates of depression, yet common determinants have been identified, such as sleep problems,[23] being male[6] and experiencing job burnout.[24 25]

In addition to these findings, several studies conducted during the same time frame using the DASS scale also highlight the increased prevalence of depressive symptoms during the COVID-19 pandemic. For instance, a study in Bosnia and Herzegovina reported that oncology staff experienced significant levels of depression, anxiety and stress, with those having comorbidities at greater risk.[26] Similarly, a study in Pakistan found that 72.7% of frontline doctors experienced depressive symptoms, 70.2% reported anxiety and 58.3% experienced stress during the Omicron wave of the pandemic.[27] These results emphasise the heightened stress and psychological burden faced by healthcare workers during the pandemic, particularly in high-stress fields like radiology. The consistency of these findings across different regions suggests

Table 3 Logistics regression analysis of depression with different HLSs (n=3677)

HLS level	N	Cases (%)	Model 1* OR (95% CI)	Model 1* P values	Model 2† OR (95% CI)	Model 2† P values	Model 3‡ OR (95% CI)	Model 3‡ P values
High HLS	449	21.6	1.00 (1.00 to 1.00)	Ref.	1.00 (1.00 to 1.00)	Ref.	1.00 (1.00 to 1.00)	Ref.
Moderate HLS	2934	33.8	1.85 (1.46 to 2.34)	<0.001	1.96 (1.55 to 2.50)	<0.001	1.83 (1.44 to 2.33)	<0.001
Low HLS	294	64.3	6.53 (4.71 to 9.07)	<0.001	6.35 (4.57 to 8.83)	<0.001	5.21 (3.72 to 7.30)	<0.001
P for trend			<0.001		<0.001		<0.001	

*Different HLS as independent variables and depression as the dependent variable (0 for non-depression and 1 for depression).
†Gender and age were adjusted on the basis of model 1 (0 for female, 1 for male, age ≤ 26 for 1 and age > 26 for 2).
‡Adjusted year of residence, marriage, child, working time, night shift, watching computer screen time on the basis of the model 2.
HLS, Healthy Lifestyle Score.

that the pandemic may have amplified the psychological challenges for radiology residents, as they are often involved in both diagnostic and clinical responsibilities.

In addition, low HLS scores may also be a precursor to job burnout, which is characterised by emotional exhaustion, depersonalisation and reduced personal accomplishment. Burnout is particularly prevalent in high-stress medical fields like radiology, where prolonged work hours and high cognitive demands are common. Previous studies have linked factors such as inadequate sleep, lack of physical activity and smoking with increased burnout risk.[24] Implementing lifestyle interventions targeting these areas could both reduce depression also mitigate the early onset of burnout among radiology residents.

As the participants' level of depressive symptoms increased, the proportion of individuals with low healthy lifestyle scores (LHLSs) gradually increased, while the proportion of individuals with high healthy lifestyle scores (HHLSs) gradually decreased. This finding aligns with a previous study that demonstrated a negative correlation between depression and healthy daily habits.[28] Furthermore, our results indicate that sleep, nicotine exposure and exercise are significant factors that influence depression among radiology residents. This observation is consistent with prior research highlighting the increased risk of depression associated with smoking, physical inactivity and poor sleep quality.[12–14] Based on these findings, we recommend that healthcare institutions and policymakers implement targeted interventions to promote healthy lifestyles among radiology residents. Examples of such interventions include smoking cessation programmes, initiatives to encourage physical activity, and education on sleep hygiene.

Radiology residents face unique occupational challenges that can exacerbate mental health issues, including long periods of screen exposure, working in dimly lit environments and a sedentary work style. These factors are associated with disrupted circadian rhythms, reduced sleep quality and increased depressive symptoms.[29] The sedentary nature of radiology work further limits opportunities for physical activity, compounding the risk of depression. Interventions that address these specific environmental factors could be crucial in improving the overall well-being of this population.

The Whole-Body Quality of Life Scale (WQS) regression model was utilised to assess the overall burden of Health-Related Lifestyle Factors (HLSs) on depression, incorporating weights determined through bootstrap sampling. This approach provides a more refined analysis of how multiple, correlated lifestyle factors collectively impact mental health. In our study, sleep and exercise were identified as the most heavily weighted factors, highlighting their critical role in mitigating depressive symptoms. A key strength of the WQS model is its ability to account for the complex interplay between different behaviours, offering a holistic perspective that single-factor analyses may overlook. However, one notable limitation is its difficulty in capturing interactions between factors with opposite effects. For instance, if one factor exerts a protective influence while another increases risk, the model may underestimate the protective factor's impact. Additionally, the WQS model assumes linear relationships and fixed weights across populations, which may not fully capture the variability inherent in real-world settings. This can lead to potential biases, especially if certain HLSs are misclassified or if the sample lacks diversity.[19] Despite these limitations, the WQS model remains a robust tool for prioritising key lifestyle interventions, particularly in contexts like radiology residency, where optimising sleep and physical activity can significantly reduce the risk of depression.

Table 4 The association between WQS Regression Index and depression

Outcomes	OR	95% CI* of OR	P value
Depression			
Model 1	0.21	0.16 to 0.27	<0.001
Model 2	0.34	0.28 to 0.40	<0.001

*OR estimates represent the ORs of depression when the WQS index was increased by one quartile. Model 1: adjusted for sex, age. Model 2: adjusted for sex, age, degree, marriage, year of residence, child, night shift, average working time and watching computer screen time.
WQS, weighted quantile sum.

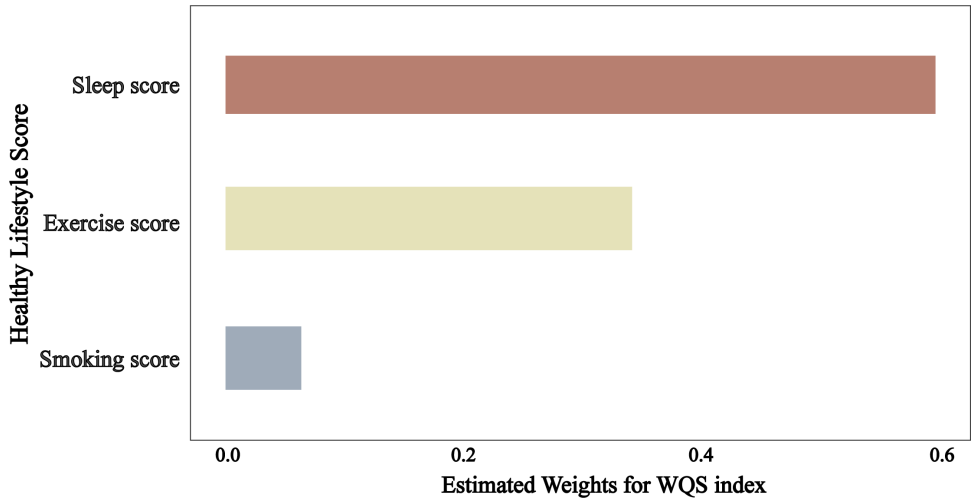

Figure 2 WQS model regression index weights for depression. WQS, weighted quantile sum.

Research on the influence of sleep on depression is currently a focal point in the field. In contrast to the American Heart Association's Life's Simple 7, which emphasises seven key factors, their Life's Essential 8 includes the consideration of sleep.[15] The relationship between sleep and depression is complex and bidirectional, with changes in brain dynamics and structure related to sleep impacting various symptoms and cognitive abilities.[30] Radiology residents often experience irregular work schedules, including night shifts, which further disrupt their sleep-wake cycles. This disruption is strongly associated with the onset and worsening of depressive symptoms.[31] Addressing these sleep disturbances through strategies like sleep hygiene education and optimised shift scheduling could play a critical role in reducing depression rates and enhancing the mental health of radiology residents. Furthermore, insomnia may serve as an initial stage leading to the onset of a psychopathological episode,[29] making it crucial to monitor the occurrence of insomnia in radiologists. Additionally, there exists a close correlation between sleep quality, duration and depression. Insomnia, as a modifiable risk factor for depression, suggests that addressing insomnia through treatment can help prevent depression. Notably, the long hours spent working on a computer can disrupt sleep patterns and adversely affect sleep quality. Consequently, due to the profound effect of sleep on mental health, job performance and overall quality of life, it is imperative to determine ways to enhance the sleep quality of radiologists. For instance, providing education to radiologists on how to create a conducive sleep environment could assist in optimising their sleep and reducing the risk of depression.

Depression is a multifaceted disorder. It has been observed that physical activity has an antidepressant impact.[32] Our study showed that the number of people categorised as having low physical activity was significantly higher in the depressed population than in the non-depressed population. Some scholars have endeavoured to comprehend the psychological and biological mechanisms through which physical activity exerts its antidepressant effects on the mental well-being of young people. To illustrate, Kandola[33] demonstrated that exercise induces various interconnected changes in the brain, thereby creating an environment that can combat depression. In comparison to other medical professionals, radiology residents spend a greater amount of their work time seated in front of computer screens and reviewing reports, a circumstance that can readily result in decreased physical activity.

Numerous studies have consistently demonstrated the detrimental effects of smoking on mental health. Furthermore, a Mendelian randomisation study has found that smoking may be a contributing factor to the development of depression.[34] Additionally, individuals who smoke often resort to this habit as a means of stress relief when they are in a negative emotional state. Paradoxically, smoking actually amplifies the risk of depression, trapping individuals in a vicious cycle. Conversely, quitting smoking can significantly decrease the likelihood of developing depression, with the risk continuing to decrease as the duration of abstinence lengthens.[12] Therefore, promoting long-term smoking cessation is an essential approach for preserving the mental well-being of radiology residents and preventing the onset of depression. To this end, offering appropriate support and resources to assist radiology residents in adopting positive and effective strategies to reduce or quit smoking is of utmost importance. By doing so, a conducive and healthy work environment can be fostered both on an individual and professional level.

To the best of our knowledge, this study represents the first investigation on the correlation between depression and healthy lifestyle among radiology residents in China. The participants consisted of radiology residents from various regions across the nation, facilitating a comprehensive grasp of the depression and health conditions among this population. Our findings demonstrate a

persistent association between a healthy lifestyle and depression even after controlling for covariates in the logistic model, thereby highlighting the stability of our results. Furthermore, employing the WQS method during data analysis revealed that sleep exerted the greatest impact on depression.

Several limitations of this study should be acknowledged. First, the cross-sectional design employed in this study only allows for the determination of correlations between observed data and does not establish causality. Therefore, it remains uncertain whether an inadequately healthy lifestyle directly contributes to the development of depression. Additionally, given the study was conducted during the COVID-19 pandemic, the psychological burden induced by the pandemic, such as lockdowns and disruptions to daily life, may have influenced the prevalence and severity of depressive symptoms in our study.[35] Studies have shown that healthcare workers experienced higher levels of stress and depressive symptoms during the pandemic due to increased workload and uncertainty, which may have skewed the mental health data of the participants in this study.[36] Thus, it is essential to interpret our findings within the context of the pandemic and recognise the need for ongoing mental health monitoring as conditions evolve postpandemic. Second, the use of self-report questionnaires for data collection introduces the possibility of subjective attitudes or memory bias influencing the results. Third, the sample of this study consisted solely of radiology residents, which raises concerns about the generalisability of the findings to other populations. It is important to exercise caution when interpreting and applying our findings, and future research should consider employing longitudinal or alternative study designs to further enrich the understanding and validation of our results. Moreover, further in-depth research is warranted to achieve a comprehensive and multidimensional comprehension of mental health issues among radiology residents.

In this study, we conducted a survey among radiology residents undergoing training in various departments across China. The results revealed a significant association between long working hours and stress-induced depression, with inadequate sleep being identified as the primary contributing factor. These findings emphasise the crucial need to prioritise and promote a healthy lifestyle among radiology residents, ultimately aiming to enhance their mental health and overall well-being. Specifically, it is imperative to emphasise the importance of sufficient sleep in order to reduce the risk of depression. Furthermore, future investigations should delve into other potential factors that may impact the mental health of radiology residents, thus enabling the development of comprehensive and personalised mental health management programmes.

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