

ORIGINAL ARTICLE

Abnormal PHQ-9 score for Depressive Symptoms and its Associated Factors among Medical Students of a Local University

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ABSTRACT

Introduction: Depression is a prevalent mental health concern among medical students due to academic pressures and personal challenges. Understanding its prevalence and identifying key associated factors are crucial for targeted interventions aimed at reducing its impact on students' well-being. **Materials and methods:** This study assessed the prevalence of depressive symptoms and examined associated factors among 498 medical students at a public university using the Patient Health Questionnaire-9 (PHQ-9). Sociodemographic and lifestyle data, including social support, family history, and involvement in physical and social activities, were analyzed through multiple logistic regression. **Results:** 60.2% of students exhibited depressive symptoms, with 33.5% reporting mild symptoms, 15.3% moderate, 7.4% moderately severe, and 4.0% severe depression. Key factors significantly associated with severe depressive symptoms included lack of social support (Adjusted Odd Ratio (AOR)=5.75), family history of depression (Adjusted Odd Ratio (AOR)=22.02), history of being bullied (AOR=4.06), unwillingness to pursue medicine (AOR=19.08), absence of close friends (AOR=3.42), no participation in sports (AOR=3.14), and no involvement in societal or community activities (AOR=7.19). **Conclusion:** These findings highlight the urgent need for targeted interventions to address modifiable factors contributing to depression. Strengthening social support networks, promoting extracurricular and community involvement, and providing accessible mental health services can mitigate the impact of depression on medical students, enhancing their well-being and academic performance.

Malaysian Journal of Medicine and Health Sciences (2026) 22(2): 1-10.doi:10.47836/mjmh.v22.i2.1547

Keywords: Depression, Medical students, PHQ-9, Prevalence, Mental health

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INTRODUCTION

Medical education is widely recognized as a demanding and stressful pursuit, often placing significant psychological burdens on students. The rigorous academic requirements, intense competition, sleep deprivation, and exposure to human suffering create an environment conducive to the development of mental health issues, particularly depression (1). As future healthcare providers, the well-being of medical students is crucial not only for their personal health but also for the quality of patient care they will eventually provide (2).

Depression is defined as a feeling of low mood, loss of interest, avolition, worthlessness, and hopelessness. It may be accompanied by cognitive and neurovegetative

symptoms such as difficulty concentrating, memory impairment, loss of appetite, and sleep disturbances (3). The prevalence of depression among medical students has become a growing concern in recent years, with studies suggesting rates higher than those in the general population (4,5). However, the exact prevalence and severity of depressive symptoms, as well as the factors contributing to their development, vary across different cultural and educational contexts. This indicates that students from diverse backgrounds may require tailored interventions to address their unique conditions (6).

The prevalence of major depressive disorder (MDD) among university students in Malaysia has been a subject of increasing concern, with several studies conducted to assess its severity and associated factors. Gan et al. conducted a comprehensive cross-sectional study involving 1,022 undergraduate students from six Malaysian universities (7). Their findings revealed a significant prevalence of depressive symptoms, with 29.4% of students experiencing some level of depression. Notably, 3.4% of the students reported

severe depression, highlighting a substantial burden of mental health issues among the general university student population. The level of depression is expected to vary and may be influenced by factors such as students' age, years of training, family history of depression or medical illness, enjoyment of their studies, involvement in sports and society, as well as smoking status (8–17).

The Patient Health Questionnaire-9 (PHQ-9) remains a widely validated screening tool for detecting and assessing the severity of depression (3,16). Its brevity and reliability make it particularly suitable for use in busy academic settings. By focusing on abnormal PHQ-9 scores, this study aims to provide a clear picture of the prevalence of clinically significant depressive symptoms among medical students. Specifically, it seeks to examine the prevalence of abnormal PHQ-9 scores and the associated factors among medical students at a local university. This knowledge is essential for developing evidence-based strategies to promote mental health and well-being in medical education, ultimately contributing to the cultivation of resilient and mentally healthy future physicians (18). Furthermore, there have been changes in the assessment methods and curriculum of the medical faculty over the past two years, highlighting the need to assess the mental health of students at this local university.

METHODS

This cross-sectional study was conducted at the medical faculty of a local university, involving 498 medical students. The study aimed to describe the background of medical students at the International Islamic University of Malaysia (IIUM), find out how common abnormal PHQ-9 scores for depression are, and identify the factors linked to those scores. The minimum required sample size, calculated based on a 95% confidence interval, a precision of 0.05, and a depression prevalence of 11% among medical students, was 150 participants (19). The study was conducted from 26 March to 25 October 2024. Convenience sampling was employed, where all medical students from Year 1 to Year 5 were approached in a lecture hall. The questionnaire was distributed via Google Forms links to those who agreed to participate. The validated PHQ-9 was used as the primary assessment tool, and sociodemographic data were collected, including social factors such as social support, involvement in sports, and participation in societal activities (2,16). Abnormal PHQ-9 scores were categorized into mild, moderate, moderately severe, and severe depressive symptoms (2,16). The sociodemographic characteristics of participants were summarized descriptively. Categorical variables were presented as frequencies and percentages, while numerical variables were analyzed using the mean and standard deviation for normally distributed data and the median and interquartile range for non-normally

distributed data. The significant factors associated with depression were identified using ordinal logistic regression. The strength of association was evaluated using adjusted odds ratios (AORs) with a 95% confidence interval. Findings with a p-value <0.05 were considered statistically significant, and all reported p-values were two-sided.

Participation in this research was strictly voluntary, and legitimate informed consent was obtained prior to data collection. The study was approved by the Kulliyah of Medicine Research Committee (KRC) (ID: IIUM/305/13/26/1) and the National Medical Research Register (ID: RSCH ID-24-05515-N7N). Additionally, respondents who exhibited severe depressive symptoms during the study were contacted and advised to seek treatment at the IIUM Family Health Clinic.

To minimize potential confounders, the academic calendars for each academic year were reviewed to ensure that students were approached outside of revision weeks and exam periods. We also informed the medical students' WhatsApp group in advance and invited them to suggest a suitable week to conduct the study. A day was then selected when all students from a specific academic year were scheduled to attend a compulsory common lecture held in a large hall, in order to minimize absentees. Since our outcome variable is binary, multiple logistic regression was used to control for other possible confounding variables.

RESULTS

Out of 722 medical students in the current academic session, 498 agreed to participate in this study. The sociodemographic characteristics of the participants are summarized in Table 1. The median age was 22 years (2.3%). The highest number of responses came from Year 1 students (24.5%), followed by Year 4 (24.1%), Year 2 (19.5%), Year 5 (17.5%), and Year 3 (14.5%). The majority of participants were female (67.1%), Malaysian Malay (97.4%), and had married parents (88.0%). Approximately two-fifths of respondents came from middle 40% of income earners (M40) families (42.6%), followed by top 20% income earners (T20) (32.5%) and bottom 40% income earners (B40) (24.9%).

More than half of the respondents had a normal body mass index (BMI) (57.0%), and almost all were non-smokers (98.6%). Most participants were living with family members (92.6%) and did not have a family history of depression (93.0%). About one-third of respondents reported a history of being bullied (31.3%). The study also found that the majority of students were motivated to study medicine (91.4%) and had close friends (89.8%). Additionally, around two-thirds of participants were involved in sports (69.5%) and societal or community engagement (65.5%).

Table 1: Sociodemographic characteristics of the respondents (n=498)

Characteristics	n	%
Age(years) (median, IQR)	22.0	2.3
Year of study		
Year 1	122	24.5
Year 2	97	19.5
Year 3	72	14.5
Year 4	120	24.1
Year 5	87	17.5
Gender		
Male	164	32.9
Female	334	67.1
Ethnicity		
Malaysian- Malay	485	97.4
Malaysian- Others	11	2.2
Non- malaysian	2	0.4
Parents Marital Status		
Divorced	23	4.6
Married	438	88.0
Single parents due to partner death	37	7.4
Family Financial Income*		
B40 (RM5,250 and below)	124	24.9
M40 (RM5,251 to RM11,819)	212	42.6
T20 (RM11,820 and above)	162	32.5
Body Mass Index (BMI)*		
Underweight (<18.5 kg/m ²)	59	11.8
Normal (18.5-22.9 kg/m ²)	284	57.0
Overweight (23-27.4 kg/m ²)	122	24.5
Obese (>27.4 kg/m ²)	33	6.6
Smoking Status		
Daily smoker	2	0.4
Ex-smoker	5	1.0
Non-smoker	491	98.6
Social Support		
Stay alone	37	7.4
Stay with family members	461	92.6
Family History of Depression		
Yes	35	7.0
No	463	93.0

CONTINUE

Table 1: Sociodemographic characteristics of the respondents (n=498). (CONT.)

Characteristics	n	%
History of Been Bullied		
Yes	156	31.3
No	342	68.7
Willingness To Do Medicine		
Yes	455	91.4
No	43	8.6
Any Close Friends		
Yes	447	89.8
No	51	10.2
Involved in Any Sports		
Yes	346	69.5
No	152	30.5
Involved in Society or Community Engagement		
Yes	326	65.5
No	172	34.5

*Based on Household Income Survey Report 2022

**Based on CPG Management of Obesity Second Edition

Table 2 presents the total prevalence and severity of depressive symptoms among medical students. The classification of severity was based on the Mental Health Professional reinterview criterion standard for the PHQ-9, in which scores of 5, 10, 15, and 20 correspond to mild, moderate, moderately severe, and severe depression, respectively (20). This study found that two-fifths of participants (39.8%) had a normal level of depressive symptoms. However, 60.2% of the medical students exhibited some level of depressive symptoms. Specifically, the prevalence of respondents with mild depressive symptoms was 33.5%, while 15.3% of students had moderate depressive symptoms. Additionally, 7.4% of participants experienced moderately severe depressive symptoms, and 4.0% reported severe depressive symptoms.

Table II: Severity of depressive symptoms (n=498)

Severity*	n	%
Normal	198	39.8
Mild	167	33.5
Moderate	76	15.3
Moderate severe	37	7.4
Severe	20	4.0

*Based on MHP Reinterview Criterion Standard of PHQ-9

Table 3 shows the association between sociodemographic factors and the severity of depressive symptoms, based on responses from the Sociodemographic and PHQ-9 questionnaires. The analysis revealed a significant association between eight sociodemographic factors and the severity of depressive symptoms. Firstly, smoking status was significantly associated with depressive symptom severity ($p < 0.005$), with daily smokers

experiencing more severe symptoms. Social support was also strongly linked to depressive symptom severity ($p = 0.023$), with students living alone being more susceptible to severe depressive symptoms compared to those living with family members. Additionally, having a family history of depression ($p < 0.001$) and a history of being bullied ($p < 0.001$) were closely associated with greater depressive symptom severity. Willingness to study medicine was another key factor ($p < 0.001$); students who were forced to pursue medicine were more likely to experience severe depressive symptoms than those who willingly chose the field. Having close friends was also significantly associated with depressive symptom severity ($p = 0.025$), with students lacking close friendships more prone to severe symptoms. Furthermore, involvement in sports ($p < 0.001$) and participation in societal or community engagement activities ($p < 0.001$) were strongly linked to less severe depressive symptoms.

Table III: Association between sociodemographic and severity of depressive symptoms (n=498)

Characteristic	Severity of Depression										χ ²	df	p value	Cramer's V
	Normal		Mild		Moderate		Moderate severe		Severe					
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)				
Smoking Status														
Daily smoker	0	(0.0)	0	(0.0)	1	(1.3)	0	(0.0)	1	(5.0)	21.953	8	*0.005	0.15
Ex-smoker	4	(2.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(5.0)				
Non-smoker	194	(98.0)	167	(100.0)	75	(98.7)	37	(100.0)	18	(90.0)				
Social Support														
Stay alone	8	(4.0)	17	(10.2)	7	(9.2)	1	(2.7)	4	(20.0)	11.291	4	*0.023	0.15
Stay with family members	190	(96.0)	150	(89.8)	69	(90.8)	36	(97.3)	16	(80.0)				
Family History of Depression														
Yes	7	(3.5)	13	(7.8)	5	(6.6)	4	(10.8)	6	(30.0)	20.829	4	*<0.001	0.21
No	191	(96.5)	154	(92.2)	71	(93.4)	33	(89.2)	14	(70.0)				
History of Been Bullied														
Yes	47	(23.7)	48	(28.7)	34	(44.7)	14	(37.8)	13	(65.0)	23.444	4	*<0.001	0.22
No	151	(76.3)	119	(71.3)	42	(55.3)	23	(62.2)	7	(35.0)				
Willingness To Do Medicine														
Yes	187	(94.4)	158	(94.6)	68	(89.5)	29	(78.4)	13	(65.0)	30.487	4	*<0.001	0.25
No	11	(5.6)	9	(5.4)	8	(10.5)	8	(21.6)	7	(35.0)				
Any Close Friends														
Yes	184	(93.0)	149	(89.2)	68	(89.5)	32	(86.5)	14	(70.0)	11.150	4	*0.025	0.15
No	14	(7.1)	18	(10.8)	8	(10.5)	5	(13.5)	6	(30.0)				

CONTINUE

Table III: Association between sociodemographic and severity of depressive symptoms (n=498). (CONT.)

Characteristic	Severity of Depression										χ ²	df	p value	Cramer's V
	Normal		Mild		Moderate		Moderate severe		Severe					
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)				
Involved in Any Sports														
Yes	154	(77.8)	126	(75.4)	43	(56.6)	15	(40.5)	8	(40.0)	38.008	4	*<0.001	0.28
No	44	(22.2)	41	(24.6)	33	(43.4)	22	(59.5)	12	(60.0)				
Involved in Society or Community Engagement														
Yes	151	(76.3)	114	(68.3)	38	(50.0)	19	(51.4)	4	(20.0)	40.373	4	*<0.001	0.29
No	47	(23.7)	53	(31.7)	38	(50.0)	18	(48.6)	16	(80.0)				

* P significant at < 0.05

 χ^2 = chi-square value, df = degree of freedom

Table 4 presents the multiple logistic regression analysis used to determine the significant associations between sociodemographic factors and the severity of depressive symptoms identified in Table 3. The absence of social support, such as staying alone, was significantly associated with higher odds of severe depressive symptoms (AOR = 5.75; 95% Confidence Interval (CI): 1.57–21.13, $p = 0.008$) compared to respondents who lived with family members. Similarly, students with a family history of depression had substantially higher odds (AOR = 22.02; 95% CI: 5.94–81.64, $p < 0.001$) of severe depressive symptoms compared to those without such a history. A history of being bullied was also significantly associated with higher odds of both moderate (AOR = 2.63; 95% CI: 1.45–4.79, $p = 0.002$) and severe depressive symptoms (AOR = 4.06; 95% CI: 1.76–9.38, $p = 0.001$) compared to students without such a history. Furthermore, unwillingness to study medicine was significantly associated with higher odds of moderately severe (AOR = 6.45; 95% CI: 2.10–19.81, $p = 0.001$) and severe depressive symptoms (AOR = 19.08; 95% CI:

6.03–60.37, $p < 0.001$) compared to students who were willing to pursue medicine. Additionally, not having close friends was significantly associated with higher odds of severe depressive symptoms (AOR = 3.42; 95% CI: 1.13–10.39, $p = 0.030$) compared to students with close friends. Lack of involvement in sports was associated with increased odds of moderate (AOR = 2.12; 95% CI: 1.14–3.94, $p = 0.017$), moderately severe (AOR = 4.36; 95% CI: 2.01–9.43, $p < 0.001$), and severe depressive symptoms (AOR = 3.14; 95% CI: 1.31–7.49, $p = 0.010$) compared to students who participated in sports. Finally, no involvement in societal or community engagement activities was significantly associated with higher odds of moderate (AOR = 2.60; 95% CI: 1.41–4.78, $p = 0.002$) and severe depressive symptoms (AOR = 7.19; 95% CI: 2.90–17.82, $p < 0.001$) compared to students who engaged in such activities. Notably, smoking status, which was significant in the univariate analysis, did not remain significant in the multivariate analysis after accounting for confounding factors.

Table IV: Multiple logistic regression analysis of factors associated with severity of depressive symptoms

Associated factors	Severity of Depression											
	Mild				Moderate				Severe			
	AOR	95% CI Lower	95% CI Upper	p-value	AOR	95% CI Lower	95% CI Upper	p-value	AOR	95% CI Lower	95% CI Upper	p-value
Smoking status												
Ex smoker	0.110	0.001	11.186	0.349	0.119	7.090	199.984	0.574	0.089	1.238	6470.489	0.672
Daily smoker	0.263	0.263	0.263	-	1.562	1.562	1.562	-	0.473	0.473	0.473	-
Non-smoker	Ref	-	-	-	-	-	-	-	-	-	-	-
Social support												
Stay alone	2.245	0.900	5.600	0.083	1.938	0.591	6.358	0.275	0.781	0.100	6.124	0.814
Stay with family members	Ref	-	-	-	-	-	-	-	-	-	-	-
Family History of Depression												
Yes	1.919	0.670	5.497	0.225	1.025	0.219	4.809	0.975	2.468	0.544	11.186	0.241
No	Ref	-	-	-	-	-	-	-	-	-	-	-
Willingness To Do Medicine												
Yes	Ref	-	-	-	-	-	-	-	-	-	-	-
No	0.954	0.323	2.813	0.932	1.703	0.502	5.779	0.393	6.450	2.100	19.811	*0.001
Any Close Friends												
Yes	Ref	-	-	-	-	-	-	-	-	-	-	-
No	1.501	0.680	3.313	0.315	0.900	0.314	2.585	0.845	1.272	0.380	4.264	0.697
Involved in Any Sports												
Yes	Ref	-	-	-	-	-	-	-	-	-	-	-
No	0.956	0.562	1.626	0.869	2.123	1.144	3.942	*0.017	4.356	2.013	9.426	*<0.01
Involved in Society or Community Engagement												
Yes	Ref	-	-	-	-	-	-	-	-	-	-	-
No	1.434	0.867	2.373	0.160	2.599	1.413	4.778	*0.002	1.915	0.877	4.180	0.103

* P significant at < 0.05

Abbreviations: AOR = Adjusted Odd Ratio, CI = Confidence Interval.

DISCUSSION

Depression is a significant concern among medical students worldwide, with various studies consistently documenting higher prevalence rates compared to the general population. The demanding nature of medical education, combined with factors such as long study hours, emotional strain, and high expectations, contributes to increased stress levels, which can ultimately lead to depressive symptoms. In our study, it was found that two-fifths (39.8%) of the participants had normal levels of depressive symptoms. However, a significant portion (60.2%) of the students reported some level of depressive symptoms. Specifically, 33.5% of respondents experienced mild depressive symptoms, 15.3% reported moderate symptoms, 7.4% exhibited moderately severe depressive symptoms, and 4.0% had severe depressive symptoms. Our results showed a higher trend compared to previous literature (15,18-21). In many studies, the prevalence of depression among medical students ranges from 27% to as high as 48%, depending on the region and the specific stressors present in their training environment (19,21). For instance, one study found that 39% of medical students at the same university had depressive symptoms before major curriculum changes were implemented five years ago (15). These changes, along with more intensive assessments, might have contributed to the difference; however, we cannot verify this as the study populations were from different cohorts. Similarly, research conducted in Malaysia revealed that 29.4% of students experienced depressive symptoms, with 3.4% reporting severe depression (19). These findings highlight the significant mental health challenges faced by medical students during their education, emphasizing the need for mental health support systems to help manage these symptoms and prevent them from worsening throughout their academic journey.

Social support is a well-established protective factor against depression, particularly in high-stress environments such as medical school. In this study, a lack of social support, such as living alone, was significantly associated with severe depressive symptoms. Students who lived alone had 5.75 times higher odds of experiencing severe depression (AOR = 5.751, 95% CI: 1.565–21.133, $p = 0.008$). Conversely, students with stronger support systems from family members were less likely to develop depressive symptoms. These findings align with a study conducted in Malaysia, which found that students with higher perceived social support had significantly lower levels of depressive symptoms (8,19,21). That study revealed that students with strong social support had a 40% lower risk of experiencing depression compared to those with poor support systems ($p < 0.001$) (8). Similarly, a 2022 study in China reported that medical students with family and social support were 25% less likely to develop severe depressive symptoms, highlighting the critical role of emotional support in managing mental health (9). Research from

Saudi Arabia also confirmed the protective impact of social networks on depression. It was found that 18% of students with strong peer and familial support reported depression compared to 42% of those lacking adequate support ($p < 0.05$) (10). Collectively, these studies emphasize the importance of fostering a supportive environment within medical institutions to help mitigate depressive symptoms and improve mental well-being among students.

A family history of depression is another significant risk factor for developing depressive symptoms, influenced by both genetic susceptibility and environmental factors. In this study, students with a family history of depression were 22.02 times more likely to develop severe depressive symptoms (AOR = 22.02, 95% CI: 5.939–81.643, $p < 0.001$), underscoring the critical role of genetic predisposition in mental health outcomes. This finding aligns with a study conducted in Germany, which reported that medical students with a family history of depression were significantly more likely to experience recurrent depressive episodes throughout their academic careers (11). The study revealed that students with a family history were 30% more likely to report depressive symptoms, even after accounting for other factors such as academic pressure (11). Similarly, research by Ibrahim et al. in Egypt found that medical students with a family history of depression had a two-fold increased risk of developing depressive symptoms. This reinforces the importance of early intervention and support for at-risk students to prevent the progression of depressive symptoms (12).

There is a significant association between a history of being bullied and the severity of depression, particularly for moderate (AOR = 2.634, 95% CI: 1.448–4.791, $p = 0.002$) and severe depression (AOR = 4.063, 95% CI: 1.760–9.375, $p < 0.001$). This aligns with findings from Romo-Nava et al., who reported that a history of emotional abuse during childhood or adolescence was associated with Major Depressive Disorder (MDD) in medical students (22). Our findings further highlight the strong connection between past bullying experiences and the current severity of depression. These results are consistent with previous research, which emphasized the long-term psychological impact of emotional abuse on mental health in medical education settings (22). This suggests that the effects of bullying may persist well into adulthood, potentially influencing mental health during medical training. Future research could explore the specific mechanisms through which past bullying experiences contribute to depression in medical students, such as altered stress responses or decreased self-esteem.

Additionally, our study reveals an interesting relationship between willingness to pursue medicine and depression severity among medical students. Students who were unwilling to pursue medicine had significantly higher

odds of experiencing severe forms of depression compared to those who were willing. Specifically, unwillingness to pursue medicine was associated with 6.450 times higher odds of moderate-severe depression (95% CI: 2.100–19.811, $p < 0.001$) and 19.080 times higher odds of severe depression (95% CI: 6.030–60.372, $p < 0.001$). These findings align with research conducted by Pham et al. on medical students in Ho Chi Minh City, Vietnam (13). Their study found that students whose career choice was influenced by family had a 1.17 and 1.36 times greater relative probability of experiencing “moderately severe depression” and “severe depression,” respectively, compared to those without depression (13). While our study focused on willingness rather than family influence, both findings underscore the significant impact that career motivation and choice can have on mental health outcomes among medical students. The markedly higher odds of severe depression among students unwilling to pursue medicine suggest that the alignment between personal career aspirations and their actual educational path may play a crucial role in determining students’ mental well-being.

Our study found that medical students who reported having no close friends had higher odds of experiencing more severe forms of depression compared to those with close friends. Specifically, students without close friends had 1.3 times higher odds of moderate-severe depression (95% CI: 0.380–4.264, $p = 0.697$) and 3.4 times higher odds of severe depression (95% CI: 1.125–10.389, $p = 0.030$) compared to students who reported having close friends. These findings align with research conducted by Mahroon et al. on medical students in Bahrain (14). Their study identified a significant association between depressive symptoms and relationships with peers ($p < 0.001$). Our results provide further evidence of this relationship, specifically highlighting the protective role of close friendships against severe depression. Additionally, our findings are consistent with research by Diehl et al. on loneliness among university students (23). Their study reported that social loneliness scores increased with the degree of depression and anxiety, as measured by the PHQ-4 ($p < 0.001$). While our study did not directly measure loneliness, the absence of close friends can serve as a proxy for social isolation, aligning with the concept of social loneliness described in Diehl et al.’s work. The significant association between a lack of close friends and severe depression (AOR = 3.419, 95% CI: 1.125–10.389, $p = 0.030$) in our study underscores the critical importance of social connections in maintaining mental health among medical students. This relationship becomes particularly pronounced at higher levels of depression severity, suggesting that close friendships may act as a buffer against the most severe depressive symptoms. These findings highlight the need for initiatives aimed at fostering social connections and *ukhuwah* among medical students. Creating opportunities for students to socialize and collaborate

may help reduce their risk of depression and promote overall mental well-being.

This study demonstrated that a lack of involvement in sports activities is a significant risk factor for depressive symptoms. Students who did not participate in sports activities were more susceptible to developing moderate (AOR = 2.123, 95% CI: 1.144–3.942, $p = 0.017$), moderately severe (AOR = 4.356, 95% CI: 2.013–9.426, $p < 0.001$), and severe depressive symptoms (AOR = 3.135, 95% CI: 1.313–7.485, $p = 0.010$). These findings correspond to previous research among medical students, which identified regular physical activity (AOR = 0.64, 95% CI: 0.42–0.98) as one of the two significant protective factors against depression (15). Similarly, a study conducted on new students at Shandong College of Economics and Business revealed that those actively engaged in team sports exhibited lower levels of anxiety and depression compared to those who were not (16). Furthermore, the number of hours spent participating in team sports per week was negatively associated with anxiety and depression levels, underscoring the importance of regular team sports participation. Regular exercise provides numerous benefits for mental health, which may be attributed to both physical and psychological processes. Physically, exercise can induce changes in brain neurotransmitters and improve sleep patterns. Some research suggests that exercise supports brain development and cognitive functions linked to the prefrontal cortex, reduces inflammation, and positively influences brain structure (24). Additionally, exercise may impact epigenetics, counteracting stress-related changes in DNA and gene expression (25). Psychologically, regular exercise can improve physical health, thereby boosting self-confidence and overall well-being (26). These findings highlight the importance of promoting physical activity, particularly team sports, as a preventive strategy for depressive symptoms in students.

A lack of involvement in society and community engagement programs is also proven to be a significant risk factor for depression among medical students. Students who are not involved in such activities have a 2.6 times higher risk of developing moderate depressive symptoms (AOR = 2.599, 95% CI: 1.413–4.778, $p = 0.002$) and about a seven times higher risk of developing severe depressive symptoms (AOR = 7.185, 95% CI: 2.897–17.822, $p < 0.001$). This finding aligns with a study conducted in Northern Thailand by Phomprasith et al., which found that final-year medical students with poor or average social relationships had more than five times higher odds of experiencing moderate to severe depressive symptoms (AOR = 5.34, $p = 0.022$) (21). Another study conducted in China revealed a bidirectional association between social participation and depressive symptoms (27). Poor social participation was associated with depressive symptoms, and conversely, depressive symptoms strongly influenced

reduced social and offline participation. Hu highlighted that social participation can increase individuals' trust in others, contributing to better mental health outcomes (28). Additionally, engaging in activities that maintain or replace one's social role can enhance a person's sense of meaning and identity, helping to alleviate negative emotions and depressive symptoms resulting from the disruption of their original role (29,30).

LIMITATION

This study had several limitations. Certain factors, such as religiosity, presence of anxiety, pregnancy status, and chronic illness, were not examined, despite being proven significant in previous studies. Academic performance itself warrants deeper exploration, as it may serve both as a potential contributor to, and a consequence of, depressive symptoms. Including these factors in future research could yield more precise and comprehensive results. Additionally, the study was conducted solely among medical students at a single university, limiting its generalizability to medical students in other universities or countries. Future research should consider involving participants from multiple universities across Malaysia, including Sabah and Sarawak, to ensure the findings can be more reliably generalized. This study was also prone to the "healthy worker effect" phenomenon, a type of selection bias, as responses were collected only from students attending classes. Consequently, the perspectives of students who were unwell or absent may have been underrepresented. Moreover, the study included a relatively small sample size of non-Malay and non-Malaysian participants, and the ethnic composition did not reflect Malaysia's overall population. As a result, the findings cannot be generalized to the general population. To address this limitation, future research should expand the sampling localities and apply appropriate weightings for each ethnicity to ensure a representative sample. This approach would enhance the study's applicability to Malaysia's diverse population.

CONCLUSION AND RECOMMENDATIONS

This study demonstrated a high prevalence of depression among medical students that is consistent with the previous literature. The factors that were found to have significant association with severe depressive symptoms were mainly modifiable risk factors including lack of social support, close friends, involvement in sports and social activities within the university. It is important for the university to empower all students to be involved in sports and extracurricular activities such as organising a health screening programme that involves the students as committees, or even faculty level sports day that involves the interaction between lecturers, students and staff. In addition, the university can focus on providing social support resources to help them adapt to university life. We recommend offering convenient access to

counsellors so individuals can share their issues and learn effective coping strategies. Furthermore, we believed that empowering the established mentor mentee system could improve depressive and anxiety symptoms among the students. The mentor can share their tips and tricks on surviving medical school and medical career. This will reduce their uncertainties about the future that might lead to depression and anxiety if not being tackled earlier. Overall, systematic measures should be taken in order to prevent a higher incidence of depression among medical students in the future.

ACKNOWLEDGEMENT

We would like to thank Kulliyah of Medicine, IIUM Kuantan campus for facilitating this study.

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