Determinants of Depression among University Students in Malaysia; A National Cross-Sectional Study

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A B S T R A C T

Aims Depression in Malaysia represents a significant and growing public health concern. With the current challenges in academic and university life, university students have become particularly vulnerable to depression and are unable to cope with stress. Accordingly, this study aimed to identify associative factors for depression among Malaysian students.
Materials & Methods A cross-sectional study was conducted at public and private universities in Malaysia. A convenience sample of 1821 out of 1860 cases were approached and completed self-administered questionnaires, regarding depression (Patient Health Questionnaire-9) and their socio-demographic, academic, and psychosocial characteristics. A Chi-square test was conducted to find the relationship between the variables and depression, followed by multivariate logistic regression analysis to identify the predictors.
Findings More than one-third (33.8%) of students scored clinical levels of depression. Financial support for the study, alcohol consumption, poor sleep quality, body mass index, and the global score for psychosocial characteristics were predictors of depression.
Conclusion A high rate of depression in Malaysian students may be mitigated by addressing the influencing factors. Interventions, such as lifestyle change can reduce depression in this group.

Keywords Depression; Students; Psychology; Psychosocial Functioning; Sleep Quality; Malaysia

C I T A T I O N   L I N K S

[1] Cross-national variations in reported ... [2] The prevalence and impact ... [3] Effects of early life stress on depression, ... [4] Suicide and youth: ... [5] Epidemiology of alcohol use in late adolescence in Greece ... [6] Escalating progression of mental health disorders ... [7] Influence of globalisation on ... [8] Paying out and crowding out? The ... [9] Correlates of depression, anxiety and stress ... [10] Prevalence, associated factors and predictors of depression among adults ... [11] Diagnostic and statistical manual of ... [12] Predicting self-compassion in UK nursing ... [13] Cross-cultural comparison of mental health ... [14] Suicidal behaviours and associated factors ... [15] Depression and anxiety in the Malaysian urban population ... [16] Depression level and coping responses toward the ... [17] Prevalence of depression, depressive symptoms, ... [18] The prevalence and socio-demographic correlates of depressive ... [19] Demographic and psychosocial predictors of ... [20] Anxiety prevalence and affecting factors ... [21] Psychosocial factors predicting first-year college ... [22] The PHQ-9: Validity of a brief depression ... [23] Criterion validity of the PHQ-9 (Malay ... [24] Quality of life, burnout, educational debt, and ... [25] Association of depression and anxiety disorder with ... [26] Accelerated aging in breast cancer survivors and its ... [27] Prevalence of depression among ... [28] Prevalence of depression among health sciences students: ... [29] Depression, acculturative stress, and social connectedness ... [30] Factors associated with depression among university ... [31] Medical students' experience of and reaction to ... [32] Prevalence and determinants of depressive ... [33] Alcohol and ... [34] Sleep disturbances and mental strain in university ... [35] Associations of physical activity, screen time with depression, ... [36] Sleep quality and psychological distress among undergraduate ... [37] Sleep quality and its psychological correlates ... [38] The relationship between the BMI and the ... [39] Relationship among obesity, depression, ... [40] Prevalence of overweight and underweight ... [41] Weight, gender, and depressive symptoms ... [42] Prevalence of mental distress and associated factors ... [43] Social support moderates stress ... [44] What are the factors that influence physical ... [45] The roles of academic procrastination tendency ... [46] How social support influences university students' ... [47] A longitudinal study of the relations among university students' ...

Introduction

Depression or major depressive disorder is a severe medical illness, regarded as a global disability and burden [1]. It has been reported to occur more in a woman than a man and can affect every aspect of life, including performance, productivity, well-being, and even social interaction [2, 3]. Depression increases the proneness of the smoking habit, alcohol abuse, drug addiction, and suicidal behavior [4, 5]. A recent study measured the mental health of the Malaysian public aged 18 years and above, approximately two months after the COVID-19 pandemic's onset, and reported increased depressive, anxiety, and stress symptoms throughout the study period (12th May to 5th September 2020), with the depression rates showing the greatest increase. Moreover, young people, particularly students, females, and people with poor financial conditions, were more vulnerable to mental health symptoms [6].

Due to rapid globalization and lifestyle changes in Malaysia, the mental health of citizens has been negatively affected, in particular university students [7, 8]. A previous study conducted on students at four public universities in Klang Valley, Malaysia reported that the prevalence rate of depression among the students was 27.5% for moderate depression and 9.7% for severe to extremely severe depression [9]. Students who have depression may exhibit various emotional and physical signs, such as feeling sad, poor concentration, and losing interest in doing any activities for at least two weeks [10, 11]. A common concern is students who have symptoms of depression but refuse to seek help because of the stigma of depression [12]. The stigmatization and discrimination toward mental illnesses can make help-seeking harder [13]. The prevalence of depression among university students keeps growing with suicidal ideation of 11.7%, as reported among university students in six ASEAN (the Association of Southeast Asian Nations) member states [14].

Many studies have revealed that students' performance in school, college, and university are affected by symptoms of depression, which may impair their academic achievement, lead to deterioration in relationships, difficulties in solving interpersonal conflicts, sleeping disorder, marital problems, and affect future employment [9-11].

From the public health perspective, early detection and prevention of mental health problems among young adults in the universities is essential. Understanding their psychological distress, such as depression as well as its correlates, would allow appropriate screening and intervention programs to prevent mental health problems in this population. This is vital for their educational achievement and success in their future career development and for the nation, as the youth of today are the leaders of tomorrow [9]. Whilst many studies have been done to investigate the prevalence of depression in the community setting [15, 16], less is known about university students, specifically throughout Malaysia. Investigating the associative factors contributing to depression is crucial as there is a consensus that depression is linked to suicidal behavior among university students worldwide [17]. This study sought to determine the prevalence of depression and its predictors among university students in Malaysia. Therefore, the results of this study help to develop and implement intervention programs to help students adapt and face challenging situations.

Materials and Methods

Study design

This study was conducted between June and December 2019 using a complete set of questionnaires consisting of several items, including a self-administered Patient Health Questionnaire (PHQ-9) to measure the presence of depression. To participate in this study, eligibility criteria included being Malaysian students aged 18 years old and above and undertaking their tertiary education at selected public or private universities for this study in Malaysia.

Survey instruments

The questionnaires were developed in dual languages, English and Bahasa Malaysia (the national language of Malaysia) based on an extensive review of the literature [18-21]. The content validity was evaluated by five experts from the Community Health and Psychiatry Department at Universiti Putra Malaysia to examine each item for congruence. The reliability of the questionnaire was determined by a pre-test among 80 university students who were not included in the study (r=0.82). The questionnaire consisted of four sections: socio-demographic, academic, psychosocial, and psychological domains.

1- Socio-demographic characteristics

The socio-demographic sections collected general information on gender, age, ethnicity, marital status, family monthly income, residency, smoking status (yes/no), alcohol consumption (yes/no), poor sleep quality (yes/no), the number of people in the household, parents with tertiary education background (yes/no), and body mass index (BMI). BMI was calculated from height and weight. The WHO (2000) criteria were used to classify the BMI of the participants as underweight (< 18.5 kg/m²), normal (18.5-24.9 kg/m²), overweight (25.0-29.9 kg/m²) and obese (≥30.0 kg/m²).

2- Academic characteristics

The academic variables contained level of education (diploma, master's degree, and PhD), academic year, the field of study, cumulative grade point average (CGPA), financial support for study (yes/no), and current living arrangements.

3- Psycho-social characteristics

The psychosocial section was developed based on the previous literature and comprised of five items

related to having a good friend in university (yes/no), doubting the future (yes/no), actively involved in societies (yes/no), having problems with other students (yes/no), and having problems with lecturers (yes/no) [18-21]. The following operational definitions were used for certain terms "Good relationships with other students" reflected generally on the quality of the participants' relationships with their peers, and "good friend(s)" was defined as someone the participants could confide in.

4- Patient Health Questionnaire (PHQ-9)

The psychological section was assessed using nine items of the PHQ-9 to measure the present symptoms of depression in the past two weeks of one's daily life. The original version of the instrument was first published and validated by Kroenke *et al.* [22], which was subsequently validated in the Malay language by Sherina *et al.* [23]. The Malay version also contains nine items that range from zero (not at all) to three (nearly every day), with an overall range score of 0-27. A threshold score of ten or above on PHQ-9 was considered as the presence of depression among participants.

Sample size

This study used the cluster sampling method to calculate the sample size. The calculation was done using the formula for testing the difference in proportions [24]. Considering the possible dropouts of 25%, the final sample size was calculated at 1860. Incomplete questionnaires and students who did not meet the criteria were omitted from the analysis. After the screening, out of 1860 students who participated in this study, 1821 students met the criteria and completed the questionnaires accordingly (97.9% response rate).

Sampling and data collection

The first step in the procedures involved attaining the list of the universities in Malaysia from the Ministry of Higher Education. A multistage cluster random sampling was employed to select the universities. The selection was made for public universities based on their ranking in QS University Rankings Asia 2017/2018, while the Rating System for Malaysian Higher Education 2017 (SETARA) and Times Higher World University Rankings 2018 were used to screen the private universities. All universities were then sorted according to their state. We divided Malaysia into six parts; Northern region (Perlis, Kedah, Penang, and Perak), East Coast region (Kelantan, Pahang, and Perak), Central region (Selangor, Federal Territories of Kuala Lumpur, and Putrajaya), Southern region (Negeri Sembilan, Melaka, and Johor), Sabah, and Sarawak. Using a random sampling method, we chose one state from each part. Based on the screening list, we contacted the universities located in the selected state and sent them an invitation letter with a brief explanation of the study. Upon agreement, we received the confirmation letter from the respected universities with the schedule for us to conduct the survey. Out of the 22 universities

listed, sixteen universities agreed to participate. On a particular day, the data collection was done either in the hall, classroom, or in the designated hallway provided by the organizing committee members from each of the universities. The students were handed out the information sheet related to the study, and the written consent form was obtained from each student before answering the questionnaires. The study materials were handed out and collected by staff at each university: None of the researchers were involved to avoid possible biases. A maximum of 45 minutes was given to the students to complete the questionnaires.

Statistical analysis

Data analysis was done using the IBM Statistical Package for the Social Sciences (SPSS) software version 25, where data at $p<0.05$ were significant. The presence of depression was measured using PHQ-9 at a cut-off point of ten and above. Descriptive analysis was done to determine the mean, standard division, frequency, and percentage, while the Chi-square test was conducted to measure the association between the variables and depression followed by multivariate logistic regression to determine the predictors of depression. In the multivariate regression, coding was used on the dependent variable, where '0' indicated the absence of depression, and '1' indicated the presence of depression. The lowest prevalence group or sub-group from the categorical variable was taken as a reference category (RC).

Findings

Descriptive analysis

The prevalence rate of depression at a cut-off point of ≥10 was recorded at 33.8%, with 615 students having a risk of depression. The majority of the students were female (n=1138; 62%), aged 18-22 years old (n=1530), and Malays (n=922). Our sample was similar to the general Malaysian student population (60% female students in the general sample stated by Statista, 2019). Most students were single (n=1799). We also noticed that only a few students were involved in cigarette smoking and alcohol consumption (n=54 and n=158, respectively). More than half of the students had a normal BMI (n=1068), and only 145 students were obese. Besides, 1151 students came from a small family with a maximum of five members in the household. Despite many of them living in urban areas (n=1367), more than half of the students came from low-income families with a total income of less than RM3900 (about 940 USD) per month. In terms of academic characteristics, a higher number of students who participated were doing their bachelor's degree and took engineering and manufacturing (n=433), medicine (n=362), and health science (n=322) courses. On the other hand, the students showed excellent academic performance, where 1405 students had a cumulative

grade point average (CGPA) above 3.00, and 277 had first-class CGPA (3.75-4.00). More than half of the students (n=998) received financial support for their studies, and 1092 students were living in college dormitories. Psychosocial characteristics revealed that out of 1821 students, 1704 students had good friends, and among them, only 32.7% had depression. On the other hand, 36.5% out of 1396 students who doubted their future had depression, while a lower percentage of depression was noted in students who were actively involved in societies. Meanwhile, students who were having problems with other students and lecturers showed a higher percentage of depression than the students who were not having any problems with other students and lecturers.

Factors associated with depression
Socio-demographic characteristics
Table 1 shows the relationship between socio-demographic characteristics and depression. Among all the factors, current smoking (p=0.04), alcohol consumption (p<0.01), poor sleep quality (p<0.01), and BMI (p<0.01) were significantly associated with depression. Students who were currently smoking exhibited a higher prevalence of depression, where 46.3% of students who smoked had depression while only 33.4% of students who were not smoking had depression. Similarly, 48.1% of students who consumed alcohol had depression, while a lower prevalence of depression was observed in students who were not taking alcohol (32.4%). On the other hand, more than half of the students who had poor sleep quality had depression compared to those who had good sleep quality, and students who were obese had a significantly higher rate of depression than those who were underweight, normal, and overweight.

Table 1. Prevalence and relationship of depression based on the sociodemographic characteristics of participants (n=1821)

Socio-demographic Characteristic	Total number	Depression		Statistics		
	No. (%)	Yes (PHQ-9≥10) No. (%)	No (PHQ-9<10) No. (%)	χ^2	df	p-value
Gender					1	0.16
Male	683(37.5)	217(31.8)	466(68.2)	1.95		
Female	1138(62.5)	398(35.0)	740(65.0)			
Age (year)				t=0.39		0.69
Mean±SD	20.95±2.01	20.92±1.73	20.96± 2.14			
Ethnicity					3	0.08
Malay	922(50.6)	295(32.0)	627(68.0)			
Chinese	553(30.4)	185(33.5)	368(66.5)	6.57		
Indian	165(9.1)	60(36.4)	105(63.6)			
Others	181(9.9)	75(41.4)	106(58.6)			
Marital status					2	0.08
Single	1799(98.8)	611(34.0)	1188(66.0)	2.42		
Married, divorced, or widow	22(1.2)	4(18.0)	18(82.0)			
Monthly family income (MYR)¥					3	0.24
≤950	330(18.1)	124(37.6)	206(62.4)			
951-RM3,900 MYR	722(39.6)	248(34.3)	474(65.7)	4.13		
3,901-RM8,400 MYR	504(27.7)	158(31.0)	348(69.0)			
≥8,401	265(14.6)	87(32.8)	178(67.2)			
Residency					1	0.19
Rural	454(24.9)	142(31.3)	312(68.7)	1.68		
Urban	1367(75.1)	473(34.6)	894(65.4%)			
Current smoking					1	0.04*
Yes	54(3.0)	25(46.3)	29(53.7)	3.90		
No	1767(97.0)	590(33.4%)	1177(66.6)			
Alcohol consumption					1	<0.01*
Yes	158(8.7)	76(48.1)	82(51.9)	15.88		
No	1663(91.3)	539(32.4)	1124(67.6)			
Poor sleep quality					1	0.01*
Yes	779(42.8)	393(50.4)	386(49.6)	169.27		
No	1042(57.2)	222(21.3)	820(78.7%)			
Body mass index (kg/m²)					3	<0.01*
Underweight (< 18.5)	290(15.9)	115(39.7)	175(60.3)			
Normal (18.5-24.9)	1068(58.6)	339(31.7)	729(68.3)	11.68		
Overweight (25.0-29.9)	318(17.5)	100(31.4)	218(68.6)			
Obese (≥30.0)	145(8.0)	61(42.1)	84(57.9)			
Number of people in the household 1-5					2	0.29
6-10	1151(63.2)	377(32.8)	774(67.2)	2.45		
≥11	648(35.6)	228(35.2)	420(64.8)			
	22(1.2)	10(45.5)	12(54.5)			
Parents with tertiary education background					1	0.58
Yes	786(43.2)	260(33.1)	526(66.9)	0.29		
No	1035(56.8)	355(34.3)	680(65.7)			

*Significant at p<0.05; ¥1 MYR= 4.40 US Dollar. PHQ-9: Patient Health Questionnaire.

Table 2. Prevalence and relationship of depression based on the academic characteristics of participants (n=1821)

Academic Characteristic	Total number No. (%)	Depression Yes (PHQ-9≥10) No. (%)	No (PHQ-9<10) No. (%)	χ^2	Statistics df	p-value
Level of education					3	0.18
Diploma	357(19.6)	132(37.0)	225(63.0)			
Degree	1433(78.7)	477(33.3)	956(66.7)	4.82		
Master	23(1.3)	4(17.4)	19(82.6)			
PhD	8(0.4)	2(25.0)	6(75.0)			
Academic year					4	0.02*
1st year	334(18.3)	223(66.8)	111(33.2)			
2nd year	786(43.2)	534(67.9)	252(32.1)			
3rd year	336(18.5)	203(60.4)	133(39.6)	11.55		
4th year	294(16.1)	190(64.6)	104(35.4)			
5th year & above	71(3.9)	56(78.9)	15(21.1)			
Field of Study					6	<0.01*
Education	28(1.5)	10(35.7)	18(64.3)			
Social Science, business & law	201(11.0)	85(42.3)	116(57.7)			
Science, mathematics & computer	161(8.8)	49(30.4)	112(69.6)			
Medicine	362(19.9)	83(22.9)	279(77.1)	34.64		
Health Science	322(17.7)	111(34.5)	211(65.5)			
Engineering and manufacturing	433(23.8)	147(33.9)	286(66.1)			
Others	314(17.2)	130(41.1)	184(58.6)			
CGPA¥					3	0.03*
3.75-4.00	277(15.2)	89(32.1)	188(67.9)			
3.0-3.74	1128(61.9)	376(33.3)	752(66.7)	8.50		
2.25-2.99	376(20.7)	128(34.0)	248(66.0)			
2.0-2.24	40(2.2)	22(55.0)	18(45.0)			
Financial support for education					1	0.01*
Yes	998(54.8)	298(29.9)	700(70.1)	15.11		
No	823(45.2)	317(38.5)	506(61.5)			
Current living arrangements					3	0.60
Parent's home	439(24.1)	152(34.6)	287(65.4)			
College dormitory	1092(60.0)	359(32.9)	733(67.1)	1.83		
Off-campus	282(15.5)	100(35.5)	182(64.5)			
Others	8(0.4)	4(50.0)	4(50.0)			

*Significant at p<0.05; ¥ Cumulative grade point average. PHQ-9: Patient Health Questionnaire.

Table 3. Prevalence and relationship of depression based on the psychosocial characteristics of participants (n=1821)

Psychosocial characteristic	Total number No. (%)	Depression Yes (PHQ-9≥10) No. (%)	No (PHQ-9<10) No. (%)	χ^2	Statistics df	p-value
Having a good friend at university					1	<0.01*
Yes	1704(93.6)	558(32.7)	1146(67.3)	12.48		
No	117(6.4)	57(48.7)	60(51.3)			
Having doubts regarding the future					1	<0.01*
Yes	1396(76.7)	510(36.5)	886(63.5)	20.37		
No	425(23.3)	105(24.7)	320(75.3)			
Actively involved in societies					1	0.02*
Yes	922(50.6)	288(31.2)	634(68.8)	5.37		
No	899(49.4)	327(36.4)	572(63.6)			
Having problems with other students					1	<0.01*
Yes	385(21.1%)	186(48.3%)	199(51.7)	46.14		
No	1436(78.9%)	429(29.9%)	1007(70.1)			
Having problems with any lecturer(s)					1	<0.01*
Yes	165(9.1%)	91(55.2%)	74(44.8)	37.07p		
No	1656(90.9%)	524(31.6%)	1132(68.4)			

*Significant at p<0.05.

Academic characteristics

According to Table 2, the academic year (p<0.01), the field of study (p<0.01), CGPA (p=0.03), and financial support for the study (p<0.01) demonstrated a significant correlation with depression. Students in year five and above of their academic year showed a significantly lower depression rate than other students. Surprisingly, in terms of the field of study, medicine students exhibited the lowest prevalence rate. On the other hand, students who had the lowest

CGPA (2.00-2.24) showed a higher prevalence rate of depression than students who had a CGPA of 2.25 and above. Similarly, a higher depression rate was recorded in students who did not receive financial support for study than in those who received financial support.

Psychosocial characteristics

Table 3 shows the relationship between depression and the psychosocial characteristics of the students. Based on the PHQ-9 scores, five psychosocial characteristics tested showed a significant correlation with depression.

Our data revealed that 48.7% of students who did not have a good friend in university had depression, while a lower percentage was observed in a group of students who had good friends and still had depression (p<0.01).

Similarly, students who doubted their future (p<0.01), students who had problems with other students (p<0.01), and students who had problems with the lecturers (p<0.01) showed significantly higher depression rates compared to the students who did not doubt their future and students who had no problems with other students and lecturers. Meanwhile, students who were not actively involved in societies had a slightly higher percentage of depression than students who were actively involved in societies.

Table 4. Predictors of depression based on multivariate logistic regression analysis

Characteristics	Crude Weighted OR (95% CI)	p-value	Adjusted* Weighted AOR (95% CI)	p-value
Financial support for education				
Yes				
No (Ref)	0.79 (0.63-0.99) 1	0.04*	0.79 (0.63-0.99) 1	0.04*
Alcohol consumption				
Yes (Ref)	1		1	
No	0.67 (0.47-0.98)	0.04*	0.66 (0.45-0.96)	*0.03
Poor sleep quality				
Yes (Ref)	1		1	0.001*
No	0.28 (0.23-0.35)	0.001*	0.26 (0.21-0.32)	
Body mass index (BMI)				
Underweight (< 18.5)	0.72(0.46-1.13)	0.15	0.70 (0.45-1.09)	0.12
Normal (18.5-24.9)	0.54 (0.37-0.80)	0.02*	0.55 (0.38-0.82)	0.03*
Overweight (25.0-29.9)	0.55 (0.35-0.85)	0.08	0.57 (0.37-0.89)	0.01*
Obese (≥30.0) (Ref)	1		1	
Having a good friend at university		0.001*		0.001*
Yes	0.55 (0.36-0.83)		0.54 (0.36-0.81)	
No (Ref)	1		1	
Having doubts regarding your future				
Yes				
No (Ref)	1.63 (1.24-2.14) 1	0.001*	1.59 (1.22-2.07) 1	0.001*
Actively involved in societies				
Yes	0.70 (0.56-0.87)	0.00*	0.69 (0.56-0.86)	0.01*
No (Ref)	1		1	
Having problems with other students				
Yes (Ref)				0.001*
No	1 0.57 (0.44-0.74)	0.001*	1 0.52(0.40-0.66)	
Having problems with any lecturer(s)				
Yes (Ref)				0.001*
No	1 0.53 (0.36-0.77)	0.001*	1 0.53 (0.37-0.78)	
CGPA¥				
3.75-4.00	0.61(0.29-1.28)	0.19	0.62(0.30-1.29)	0.21
3.0-3.74	0.55(0.27-1.11)	0.09	0.57(0.29-1.13)	0.10
2.25-2.99	0.57(0.28-1.17)	0.12	0.59(0.28-1.17)	0.13
2.0-2.24 (Ref)	1		1	
Current smoking				
Yes (Ref)	1		1	
No	0.81 (0.44-1.48)	0.50	0.80 (0.43-1.46)	0.52
Field of Study				
Education (Ref)	1		1	
Social Science, business, and law	1.68(0.68-4.12)	0.04*	1.77(0.74-4.22)	0.19
Science, mathematics, and & computer	0.95(0.38-2.39)		0.99(0.41-2.42)	0.99
Medicine	0.84(0.34-2.06)		0.65(0.27-1.53)	0.33
Health science	1.45(0.60-3.49)		1.44(0.62-3.37)	0.39
Engineering and manufacturing	1.05(0.44-2.53)		1.10(0.47-2.55)	0.81
Others	1.29(0.53-3.15)		1.22(0.52-2.85)	0.64
Academic year				
1st year	1.90(0.92-3.91)	0.08	1.91(0.91-3.93)	0.08
2nd year	1.73(0.88-3.39)	0.10	1.74(0.87-3.39)	0.10
3rd year	1.99(0.98-4.07)	0.06	1.99(0.98-4.07)	0.06
4th year	2.00(0.95-4.22)	0.06	2.00(0.95-4.22)	0.06
5th year & above (Ref)	1		1	

* Significant at p<0.05; Odd Ratio (OR); Adjusted Odd Ratio (AOR); Confidence Interval (CI); Reference Group (Ref); ¥ Cumulative Grade Point Average.
*Adjusted for other variables in the table.

Predictors of depression
Multivariate logistic regression analysis was done to determine the predictors of depression (Table 4). The assumption of linearity, homoscedasticity, and normality of residuals was met, and the model was fit (χ^2=299, df=22, and p<0.01).

Nine variables were found to be the predictors of depression (financial support for the study, alcohol consumption, sleep quality, BMI, having a good friend in university, having doubts regarding the future, being actively involved in societies, having problems with other students, and having problems with any lecturer(s)). The strongest predictor of depression was having doubts regarding the future. Data exhibited that students who doubted their future had 1.61 times more depression (OR=1.61; 95% CI=123-2.12) than those who had no doubts about their future. The results also indicated that students who received financial support (OR=0.79; 95% CI=0.63-0.99), who were actively involved in societies (OR=0.70; 95% CI= 0.56-0.87), who did not drink alcohol (OR=0.67; 95% CI=0.46-1.13), who had good relationships with other student(s) (OR=0.57; 95% CI=0.44-0.74) and lecturer(s) (OR=0.53; 95% CI=0.36-0.77), who had a good friend(s) in the university (OR=0.55; 95% CI=0.36-0.83) and who had quality sleep (OR=0.29; 95% CI=0.23-0.35) were at less risk of having depression.

Discussion
Depression results in diverse negative health outcomes, including mental disability, suicide, and increased death risk from chronic diseases, such as cancer [25, 26]. University is a place where students are exposed to academic, financial, socio-cultural, and interpersonal pressures, leading to the risk of depression [27]. We used the PHQ-9 to measure the risk of depression among university students in Malaysia. PHQ-9 is a reliable and valid instrument for measuring depression levels in a non-clinical population, and it has been widely used in studies conducted among university students in many countries, including Malaysia [28, 29]. In this study, the prevalence rate of depression among university students in Malaysia was 33.8%, which is similar to a study conducted using the PHQ-9 among students in a public university in Malaysia, where the prevalence rate of depression in the study was 36.4% [28]. Moreover, the rates of depression were reported at 29.3%, 30%, and 34.9% in other studies conducted among Malaysian university students despite using instruments other than PHQ-9 for their studies [30, 31]. Among the students' sociodemographic characteristics, alcohol consumption, poor sleep quality, and BMI were the predictors of depression. Our data revealed that half of the students who consumed alcohol had depression. In line with previous studies, our data exhibited that students who consumed alcohol had a higher prevalence rate

of depression than students who did not consume alcohol [32]. Another study found an association between depression and alcohol use, with more epidemiological evidence pointing to depression increasing the risk of alcohol use disorder, rather than the other way around [33]. The plausible explanation for this is that the misuse of alcohol will not only cause the neuropsychological and metabolic changes of the individual, but also affect their behavior, and social and economic life, which then leads to increased risk of depression. Alcohol use needs to be closely monitored in Malaysian universities to mitigate the rates of depression.

On the other hand, sleep quality showed a significant correlation in the multivariate analysis with depression. Previous studies revealed a bidirectional relationship between depression and sleep quality [34, 35]. High levels of stress and depression can cause sleep disturbance, while poor sleep quality can hurt mental health. This is consistent with our study, where half of the students who had poor sleep quality had depression, and the ratio was much higher than the students who had good sleep quality. This finding was similar to an earlier study conducted among students in a Nigerian university, where a significant association was reported between poor sleep quality and depression [36]. In a study conducted in Germany and Luxembourg [34], there was an increase of 25.5% in the prevalence of depression among students who had poor sleep quality. Further, another study also showed that poor sleep quality was linked to poor academic performance [37]. Similar to depression, sleep quality is also associated with various health and educational outcomes. University staff needs to educate students about the importance of sleep in relation to mental health.

Additionally, data showed that students who had depression over students who had no depression were higher in the underweight and obese group than the normal and overweight groups. A similar trend was exhibited by a study conducted among Alexandria University students in Egypt, although no significant association was found with depression [38]. Emotional states influence the individual's eating habits, thus having a significant impact on BMI and the body weight condition led by emotional eating has been associated with depression [39]. A study conducted among Thailand university students revealed that obese and overweight students who were trying to lose weight showed symptoms of depression [40]. On the other hand, a study conducted in South Korea demonstrated that those who were underweight were significantly more depressed compared to those who were in other weight categories [41].

In terms of the academic characteristics of the students, only financial support for studies was a predictor for depression in this study. The financial aspect is an essential parameter in determining the risk of depression among university students. Our

study revealed that students without financial support had higher depression levels than those who received financial assistance, which is similar to a study conducted in Northwest Ethiopia [42].

All the five items of psychosocial characteristics tested in our study showed a significant correlation as predictors of depression. The transition from secondary education to tertiary education requires students to be mentally and emotionally prepared. However, students who cannot cope with challenges in university life will face many psychosocial issues and may fall into a depression state [43]. Our findings showed that students who had depression were more likely to not have good friends at university, were not active in any community, had doubts about their future, and had problems with other students and professors. A meta-analysis by Vancampfort *et al.* [44] revealed that a higher level of depression was negatively associated with participation in university activities. Besides, students who have self-doubts regarding their future usually have low self-esteem and tend to delay their coursework. Academic procrastination was shown to have an impact on the academic achievements of students, and there was a significant relationship between academic procrastination and depression [45]. Perceived good relationships with other students and lecturers, and having good friends are part of the social support a student can get when they are in the university [46]. Higher depression was recorded in students with low social support than in students with high social support [43]. Similarly, in university students in Australia, there was a negative association between social contact with university friends and depression [47].

Strengths and limitations
This study involved a relatively large sample, which contributed to the generalizability of our findings. As the questionnaires were developed in dual languages, it helped the students with poor English to understand better using their native language (Bahasa Malaysia). However, several limitations should be noted. First, other than PHQ-9, depression can also be measured using other tools, and different screening tools may cause variation in the data. Second, we could not conduct the study in every state in Malaysia, only six states were chosen due to the time and budget constraints. This could have led to the possibility of data variation too. Third, heterogeneity in some of the variables, such as field and year of study may also influence the data's accuracy. Lastly, as a cross-sectional design was utilized, we could not identify causal directions of the study variables.

Implication to practice
This study highlights the importance of identifying the prevalence risk of depression and its predictors among university students in Malaysia. Given the limitations of the available data, disparate findings on the depression prevalence data, particularly among university students in Malaysia, are essential for developing specific interventions in the future.

Conclusions
The prevalence of depression among university students warrants further attention and effective intervention. Reliable estimates of depression among university students are essential for preventing, treating, and identifying emotional distress causes. This study's results can be used as evidence-based data for future studies and responsible bodies (e.g., university staff, local education committees, and the government) to investigate other factors contributing to the prevalence risk of depression among university students in Malaysia and identify appropriate interventions to minimize the issue.

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