

Prevalence of Depression and its Associated Factors Among Adults during Third Wave of COVID-19 Pandemic in Malaysia, 2021

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Abstract - Malaysia recently entered third-wave of COVID-19 pandemic starting from October 2020 to end of January 2021. Therefore, objective of our study was to identify the prevalence of depression and its associated factors among adults during third wave of COVID-19 pandemic in Malaysia. A total of 1468 Malaysian adults participated in this cross-sectional web-based survey. A standardized questionnaire was generated using the Google Form, and the link was shared through social media such as Facebook, Twitter, Instagram and WhatsApp. Patient Health Questionnaires (PHQ-9) was used to assess the levels of depression. Among 1468 participants, 320 (22 %) and 358 (24.6 %) indicated to have moderate to severe depression during third-wave of COVID-19 in Malaysia. Multiple predictors were identified that contributed to depression. These included female gender, family's source income affected by the pandemic, do not perform exercise, victim of abuse and those with family and/or friends infected with COVID-19 virus. COVID-19 pandemic had caused the implementation of lockdown and physical distancing in Malaysia and nations across the globe. The pandemic had brought serious negative impacts on mental health of the adults especially depression especially during third wave of pandemic. The findings of our study suggested that new interventions or strategies are needed to be developed to address the severity of depression among Malaysian adults.

Keywords: prevalence; depression; third wave of COVID-19 pandemic; Malaysian adults; cross-sectional study

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Introduction

The new COVID-19 pandemic had made huge global impacts including high rates of mortality and morbidity, and loss of income and sustained social isolation for billions of people [1]. As of 19th January 2021, there had been around 97 million confirmed cases of COVID-19, with a confirmed fatality of

around over 2 million worldwide [2]. Following the detection of the first COVID-19 case on the 25th of January 2020, Malaysia like many other countries had a lockdown strategy [3]. On 18 March 2020, a nationwide “Movement Control Order” (MCO; i.e., lockdown) was declared, aimed at controlling the viral outbreak [4]. In October 2020, Malaysian Health director-general Tan Sri Dr Noor Hisham Abdullah reported that Malaysia was entering the third wave of COVID-19 Pandemic [5]. With four digits of cases reported every day since the end of November 2020, the Prime Minister of Malaysia announced a second MCO to be imposed on 13th January 2021 in selected 6 states in Malaysia [6]. This was to ensure there was social distancing through home quarantine to help curb the spread of the virus among its population. There were clear reasons to expect that these government policies and physical distancing measures aimed at limiting disease spread will impact the mental health of the community.

However, there was inadequate attention paid to understanding and studying the associated factors and prevalence of depression and anxiety during the third wave of COVID-19 pandemic in Malaysia. Most of the recent studies done in Malaysia were studies done on university students and the studies period were during the initial stage of pandemic [7,8]. The lack of knowledge implied that Malaysia is not fully capable of aiding and supporting Malaysians as they encounter the unprecedented COVID-19 pandemic. Research had been done to link the relation of mental health and COVID-19 pandemic but have failed to show positive correlation between these variables [1,9]. The reasons could be due to the time of survey was before the peak of the pandemic in those countries and the number of cases reported was not significant enough to cause an impact on mental health. There was minimal evidence about the acute phase mental health

impacts of large-scale epidemics across communities.

Hence, our research was aimed to study the prevalence of depression its associated factors among Malaysian adults during third wave of COVID-19 pandemic in Malaysia. We hypothesized that the prevalence of depression among Malaysian adults was high during third wave of pandemic, sociodemographic variables, financial struggle, hobby, lack of privacy, lack physical activity, physical or mental abuse, having family member with mental illness recent, recent or past COVID-19 infection, and having family and friends infected with COVID-19 have association to depression among Malaysian adults during the pandemic.

Subjects and Methods

A cross-sectional study design was used to assess the mental health status of Malaysian adult population in terms of depression level during COVID-19 pandemic using Patient Health Questionnaires (PHQ-9). The target population was Malaysian citizens who were residing in Malaysia during the time of the survey and those who were 18 years old and above. An online survey was distributed through social media platforms such as WhatsApp, Instagram, Twitter and Facebook to recruit participants. A sample size estimation of 385 was calculated by using the Raosoft (sample size calculator) with the population size of 21.82 million adults of the age 18 and above in Malaysia as per 2019 [10,11].

A standardized questionnaire was used to obtain information about participants’ socio-demographics including age; gender; residency; race; marital status; occupational status; family income and educational status; presumed risk factors of depression including family income affected by COVID-19; new hobby during pandemic; privacy at home; physical activity; abuse during pandemic; current and past COVID-19 infection; presence or history of family and friends with COVID-19 infection; and depression [1-3].

PHQ-9 was used in this study to measure and screen the overall presence and level of depression. It comprised 9 questions and participants were asked to select a score on each question from the survey, which scores as “0” for “not at all”; “1” for “several days”; “2” for “more than half the days” and “3” for “nearly every day”. The scores were summed up and categorized into different categories whereby score 0 - 4 was said to have minimal depression, score 5 - 9 was deemed to have mild depression. Meanwhile, score 10 - 14 was moderate depression and score 15 - 19 was moderately severe depression and score more than 20 was said to be severe depression. The diagnostic validity of the PHQ-9 was shown in studies that involved multiple primary care and obstetrical clinics. PHQ-9 had sensitivity of 0.80 and specificity of 0.92 for major depressive disorder [12]. A research done in 2019 had shown that the Cronbach alpha of PHQ-9 had a great satisfactory result of 0.87 and convergent validity with the BDI-II scale [Pearson’s correlation of 0.88, ($p < 0.01$)] [11]. This tool had also shown to be reliable as it was included into research [13-15].

Twenty-two participants were included in pilot testing, PHQ-9 obtained Cronbach’ alpha of 0.885, indicating that this questionnaire had good validity and internal consistency.

The research was approved by the Research Ethics Committee of Asia Metropolitan University under report AMU/MREC/FOM/NF/03/2021. The sample was recruited through a non-probability purposive sampling technique. Prior to the survey, the respondents were informed about details of the objectives, backgrounds, introduction and nature of the study. The participants were asked for written consent before administration of the questionnaire. Participation was fully voluntary and participants were not compensated. Participants’ confidentiality was maintained as no identifying information was collected.

In total, 1468 adults participated in this research. However, 11 participants did not grant consent. Therefore, a total of eligible 1457 samples were collected for analysis. The collected data were analyzed using Statistical Package for

Social Sciences-version 26. Categorical data (e.g., gender) associations were evaluated using the χ^2 test to compare data among participants with and without depression. Binary logistic regression and ‘multiple logistic regression’ MLogR (backward method) based on the previous literatures were used to analyze the factors associated significantly with depression. Data were presented as the crude and adjusted odds ratio (OR) with the 95 % confidence interval (CI) and their corresponding p values. We deemed p-value less than 0.05 as statistically significant.

Results

Table 1 shows the descriptive information of different selected variables of the Malaysian adults during the third wave of COVID-19 pandemic. Results show about 90 % of the individuals were aged between 18 to 35 years old (90.1 %). More than 70 % of the individuals were females (73.6 %) and the rest were males. Majority of the individuals live in urban areas, 1232 (84.6 %). More than half the individuals are Malay (55.5 %). About 80 % of the individuals were single (85.6 %) and more than half of them are unemployed or are homemakers, 829 (56.9 %). Table 2 showed the prevalence of depression based on the levels among Malaysian adults during COVID-19 pandemic. Results showed that 358 (24.6 %) of the individuals were found to have severe depression symptoms while only 187 (12.8 %) had no depression symptoms.

The results from the chi-square analyses for the tests of associations between participants’ demographic variables and depression are presented in Table 3. Among the tested variables, age group, gender, race, marital status, occupational status, family income, educational status, family’s source of income affected, privacy in home, do not perform exercise, victims of abuse, family members infected/affected with virus and friends infected with virus were significant at a level ($p < 0.05$).

Table 1. Socio-demographic characteristic of participants (N = 1457)

Socio-demographic characteristics	Frequency (%)
Age	
18 - 35 years old	1313 (90.1)
36 - 55 years old	113 (7.8)
> 55 years old	31 (2.1)
Gender	
Male	385 (26.4)
Female	1072 (73.6)
Residency	
Urban	1232 (84.6)
Rural	225 (15.4)
Race	
Malay	808 (55.5)
Chinese	184 (12.6)
Indian	378 (25.9)
Other	87 (6.0)
Marital status	
Married	175 (12.0)
Single	1247 (85.6)
Divorced	12 (0.8)
Widowed	5 (0.3)
Other	18 (1.2)
Occupational status	
Full-time	448 (30.7)
Part-time	58 (4.0)
Student	122 (8.4)
Unemployed/Homemaker	829 (56.9)
Family income	
Less than RM 4,849	784 (53.8)
Between RM 4,850 and RM 10,959	474 (32.5)
More than RM 10,960	199 (13.7)
Educational status	
No formal education	7 (0.5)
Primary	7 (0.4)
Secondary	87 (6.0)
Post-secondary education	442 (30.3)
Tertiary	915 (62.8)

Binary logistic regression (Simple Logistic Regression SLogR) was performed to as-

Table 2. Prevalence of depression among Malaysian adults (N = 1457)

Depression level	Frequency (%)
Normal	187 (12.8)
Mild	275 (18.9)
Moderate	317 (21.8)
Moderately severe	320 (22.0)
Severe	358 (24.6)

certain the associations of variables that were significant from Chi-square analysis on the likelihood that participants have depression symptoms, results were tabulated in Table 4. Respondents of the age 18 - 35 years old were 3.74 (95 % CI: 1.32 - 10.63) times more likely to have depression compared to the age group of above 55 ($p < 0.05$). Males were 44.3 % (95 % CI: 0.39 - 0.79) less likely to have depression compared to females ($p < 0.05$). Family income of less than RM 4,849 were 1.98 times (95 % CI: 1.24 - 3.15) more likely to have depression compared to the family income of more than RM 10,960 while family income of between RM 4,849 - RM 10,959 are 1.64 times (95 % CI: 1.03 - 2.61) more likely to have depression compared to the family income of more than RM 10,960 ($p < 0.05$). For those who had no affect in family's sources of income, there were 43.2 % (95 % CI: 0.39 - 0.81) less likely to have depression compared to those whose family's sources of income affected ($p < 0.05$). Participants who had no privacy at home had 1.98 times (95 % CI: 1.32 - 2.99) more likely to have depression compared to those who had privacy at home ($p < 0.05$). Furthermore, individuals who were not the victims of abuse had 7.4 % (95 % CI: 0.08 - 0.74) less likely to have depression compared to those who were victims of abuse ($p < 0.05$). Moreover, individuals whose friends were not infected with COVID-19 were 38.7 % (95 %

Table 3. Associations between sociodemographic characteristics and depression levels among participants using Chi-square test (N = 1457)

Variables	Normal n (%)	Mild depression n (%)	Moderate depression n (%)	Moderately severe depression n (%)	Severe depression n (%)	X ² (df)	p value
Age group						81.525 (8)	0.000*
18-35 years	147 (11.2)	224 (17.1)	292 (22.2)	305 (23.2)	345 (26.3)		
36-55 years	29 (25.7)	42 (37.2)	18 (15.9)	12 (10.6)	12 (10.6)		
>55 years	11 (35.5)	9 (29.0)	7 (22.6)	3 (9.7)	1 (3.2)		
Gender						63.526 (4)	0.000*
Male	78 (20.3)	95 (24.7)	85 (22.1)	79 (20.5)	48 (12.5)		
Female	109 (10.2)	180 (16.8)	232 (21.6)	241 (22.5)	310 (28.9)		
Residency						5.663 (4)	0.226
Urban	163 (13.2)	222 (18.0)	276 (22.4)	270 (21.9)	301 (24.4)		
Rural	24 (10.7)	53 (23.6)	41 (18.2)	50 (22.2)	57 (25.3)		
Race						102.545 (12)	0.000*
Malay	62 (7.7)	132 (16.3)	170 (21.0)	199 (24.6)	245 (30.3)		
Chinese	31 (16.8)	48 (26.1)	55 (29.9)	37 (20.1)	13 (7.1)		
Indian	83 (22.0)	76 (20.1)	77 (20.4)	65 (17.2)	77 (20.4)		
Others	11 (12.6)	19 (21.8)	15 (17.2)	19 (21.8)	23 (26.4)		
Marital status						75.249 (16)	0.000*
Married	42 (24.0)	58 (33.1)	35 (20.0)	17 (9.7)	23 (13.1)		
Single	138 (11.1)	211 (16.9)	277 (22.2)	294 (23.6)	327 (26.2)		
Divorced	3 (25.0)	4 (33.3)	2 (16.7)	2 (16.7)	1 (8.3)		
Widowed	1 (20.0)	1 (20.0)	-	1 (20.0)	2 (40.0)		
Others	3 (16.7)	1 (5.6)	3 (16.7)	6 (33.3)	5 (27.8)		

Table 3. (continued)

Variables	Normal n (%)	Mild depression n (%)	Moderate depression n (%)	Moderately severe depression n (%)	Severe depression n (%)	X ² (df)	p value
Occupational status						40.902 (12)	0.000*
Full-time	70 (15.6)	117 (26.1)	92 (20.5)	80 (17.9)	89 (19.9)		
Part-time	7 (12.1)	10 (17.2)	16 (27.6)	11 (9.0)	14 (24.1)		
Unemployed/Homemaker	11 (9.0)	20 (16.4)	20 (16.4)	29 (23.8)	42 (34.4)		
Student	99 (11.9)	128 (15.4)	189 (22.8)	200 (24.1)	213 (25.7)		
Family income						44.353 (8)	0.000*
Less than 4,849 RM	74 (9.4)	136 (17.3)	174 (22.2)	180 (23.0)	220 (28.1)		
Between 4,849 and 10,959 RM	67 (14.1)	108 (22.8)	92 (19.4)	107 (22.6)	100 (21.1)		
More than 10,960 RM	46 (23.1)	31 (15.6)	51 (25.6)	33 (16.6)	38 (19.1)		
Educational status						27.882 (16)	0.033*
No formal education	-	2 (28.6)	-	2 (28.6)	3 (42.9)		
Primary	-	1 (16.7)	-	1 (16.7)	4 (66.7)		
Secondary	11 (12.6)	15 (17.2)	20 (23.0)	21 (24.1)	20 (23.0)		
Post-secondary	46 (10.4)	75 (17.0)	93 (21.0)	91 (20.6)	137 (31.0)		
Tertiary	130 (14.2)	182 (19.9)	204 (22.3)	205 (22.4)	194 (1.2)		
Family's source of income affected						20.442 (4)	0.000*
No	109 (16.1)	123 (18.1)	162 (23.9)	141 (20.8)	143 (21.1)		
Yes	78 (10.0)	152 (19.5)	155 (19.9)	179 (23.0)	215 (27.6)		
New hobby						9.100 (4)	0.059
No	51 (9.8)	100 (19.2)	108 (20.7)	120 (23.0)	142 (27.3)		
Yes	136 (14.5)	175 (18.7)	209 (22.3)	200 (21.4)	216 (23.1)		
Privacy in home						66.342 (4)	0.000*
No	38 (7.8)	69 (14.1)	87 (17.8)	124 (25.3)	172 (35.1)		
Yes	149 (15.4)	206 (21.3)	230 (23.8)	196 (20.3)	186 (19.2)		

Table 3. (continued)

Variables	Normal n (%)	Mild depression n (%)	Moderate depression n (%)	Moderately severe depression n (%)	Severe depression n (%)	X ² (df)	p value
Do not perform exercise						29.618 (1)	0.000*
No	132 (15.0)	181 (20.6)	202 (23.0)	183 (20.8)	180 (20.5)		
Yes	55 (9.5)	94 (16.2)	115 (19.9)	137 (23.7)	178 (30.7)		
Victim of abuse						50.058 (4)	0.000*
No	183 (13.7)	263 (19.6)	301 (22.5)	293 (21.9)	300 (22.4)		
Yes	4 (3.4)	12 (10.3)	16 (13.7)	27 (23.1)	58 (49.6)		
Currently infected with virus						4.048 (4)	0.400
No	181 (12.9)	268 (19.1)	305 (21.7)	310 (22.1)	339 (24.2)		
Yes	6 (11.1)	7 (13.0)	12 (22.2)	10 (18.5)	19 (35.2)		
Infected with virus in the past						6.371 (4)	0.173
No	186 (13.2)	264 (18.7)	305 (21.6)	312 (22.1)	344 (24.4)		
Yes	1 (2.2)	11 (23.9)	12 (26.1)	8 (17.4)	14 (30.4)		
Family member infected with virus						11.076 (4)	0.026*
No	175 (13.7)	246 (19.2)	267 (20.9)	282 (22.0)	309 (24.2)		
Yes	12 (6.7)	29 (16.3)	50 (28.1)	38 (21.3)	49 (27.5)		
Friends infected with virus						12.698 (4)	0.013*
No	139 (15.0)	181 (19.5)	192 (20.7)	198 (21.3)	218 (23.5)		
Yes	48 (9.1)	94 (17.8)	125 (23.6)	122 (23.1)	140 (26.5)		

*X² = chi – square value, df = degree of freedom

Table 4. Associations between sociodemographic characteristics and depression among participants using simple logistic regression (SLogR) (N = 1457)

Variables	B	Wald	df	Crude OR	95 % CI		p-value
					Lower	Upper	
Age							
> 55 years old							
18-35 yr	1.319	6.132	1	3.740	1.317	10.625	0.013
36-55 yr	0.826	2.435	1	2.284	0.809	6.444	0.119
Gender							
Male							
Female	-0.585	10.180	1	0.557	0.389	0.798	0.001
Residency							
Urban							
Rural	0.241	0.827	1	1.272	0.757	2.137	0.363
Race							
Others							
Malay	0.649	3.037	1	1.914	0.922	3.970	0.081
Chinese	-0.087	0.044	1	0.917	0.409	2.055	0.833
Indian	-0.407	1.162	1	0.666	0.318	1.395	0.281
Marital status							
Married							
Single	0.221	0.087	1	1.248	0.287	5.417	0.768
Divorced	0.818	1.341	1	2.266	0.568	9.049	0.247
Widowed	-0.376	0.113	1	0.687	0.076	6.173	0.737
Others	-0.505	0.118	1	0.604	0.034	10.797	0.732
Occupational Status							
Full-time							
Part-time	0.108	0.231	1	1.115	0.716	1.734	0.631
Unemployed/Homemaker	-0.053	0.013	1	0.948	0.379	2.372	0.910
Student	0.449	1.248	1	1.566	0.713	3.440	0.264
Family Income							
More than RM 10,960							
Less than RM 4,849	0.683	8.304	1	1.980	1.244	3.151	0.004
Between RM 4,849 and RM 10,959	0.494	4.341	1	1.638	1.030	2.607	0.037
Educational Status							
No formal education							
Primary	19.954	0.000	1	463433149.192	0.000	.	0.999
Secondary	19.140	0.000	1	205381752.627	0.000	.	0.999
Post-secondary	0.419	1.231	1	1.521	0.725	3.191	0.267
Tertiary	0.174	0.744	1	1.191	0.801	1.770	0.388
Family's source of income affected							
No							
Yes	-0.565	9.833	1	0.568	0.399	0.809	0.002

Table 4. (continued)

Variables	B	Wald	df	Crude OR	95 % CI		p-value
					Lower	Upper	
New hobby							
No							
Yes	0.318	2.582	1	1.375	0.932	2.028	0.108
Privacy at home							
No	0.685	10.670	1	1.984	1.315	2.993	0.001
Yes							
Performing exercise							
No	0.297	2.429	1	1.346	0.926	1.957	0.119
Yes							
Victim of abuse							
No	-1.394	6.322	1	0.248	0.084	0.735	0.012
Yes							
Currently infected with COVID-19							
No	0.586	1.042	1	0.797	0.583	5.534	0.307
Yes							
Infected with COVID-19 in the past							
No	-1.660	2.224	1	0.190	0.021	1.685	0.136
Yes							
Family infected with COVID-19							
No	-0.455	1.789	1	0.634	0.325	1.236	0.181
Yes							
Friends infected with COVID-19							
No	-0.490	6.363	1	0.613	0.419	0.896	0.012
Yes							

CI: 0.42 - 0.89) less likely to have depression compared to those who have friends with COVID-19 infection.

The final model presented in Table 5 we used multiple logistic regression (MLogR-backward LR method) to measure the adjusted Odd Ratio (OR) to show the factors associated with depression based on the previous literatures. We found eight variables were significantly associated with depression among Malaysian adults during COVID-19 pandemic in Malaysia ($p < 0.05$) as shown in Table 5. Three for more likely and five for less likely.

The variables associated with more likely to have depression consist of: (1) Participants with family income less than RM 4,849 had 2.7 times more likely to have depression (AOR: 2.69, 95 % CI: 1.68 - 4.32), (2) while participants whose family income between RM 4,849 - RM 10,959 were 2.1 times more likely to have depression (AOR: 2.08, 95 % CI: 1.27 - 3.40) (3). Participants who had no privacy at home got 6.97 times more likely to have depression compared to those who had privacy at home (AOR: 6.97, 95 % CI: 1.94 - 25.05), $p < 0.05$. The variables with less likely associations with

Table 5. Associations between sociodemographic characteristics and depression among participants using Multiple logistic regression (MLogR) (N = 1457)

Variables	B	Wald	df	Adjusted	95 % CI		p-value
				OR	Lower	Upper	
>55 years old	-0.669	13.840	1	0.512	0.360	0.729	0.001***
Family income							
More than RM 10,960 ^{ref}							
Less than RM 4,849	0.991	17.000	1	2.695	1.682	4.318	0.001***
Between RM 4,849 and RM 10,959	0.730	8.381	1	2.075	1.266	3.401	0.004
Privacy at home							
No	1.942	8.863	1	6.974	1.942	25.048	0.003
Yes ^{ref}							
>55 years old by Family's source of income not affected	-0.422	10.244	1	0.656	0.506	0.849	0.001
Female by not victim of abuse	-0.840	23.214	1	0.432	0.307	0.608	0.001***
Less than RM 4,849 by Privacy at home	-1.207	2.831	1	0.299	0.073	1.220	0.092
Between RM 4,849 and RM 10,959 by Privacy at home	-1.653	5.282	1	0.191	0.047	0.784	0.022
Friends not infected with COVID-19 by not victim of abuse	-0.711	15.177	1	0.491	0.343	0.702	0.001***

*B = beta coefficient, OR = odds ratio, df = degree of freedom, 95 % CI = 95 % confidence interval

depression consist of: (1) Those whose ages were more than 55 years old had 50.2 % less likely to have depression compared to other age groups (AOR 0.512, 95 % CI: 0.36 - 0.73) with $p < 0.05$. Compared to those whose family income more than RM 10,960 ($p < 0.05$) [1,2]. (2) Participants with age 55 years old by Family's source of income not affected had 64.6 % less likely to have depression compared to those whose age are not over 55 years old by family's source of income were affected (AOR: 6.56, 95 %CI: 0.51- 0.85) $p < 0.05$ (3). Moreover, female participants who were not victims of abuse had 56.8 % less likely to have depression compared to male who were victims of abuse (AOR: 0.43, 95 % CI: 0.31 -0.61) $p < 0.05$ (4). However, participants whose family incomes were between RM 4,849 and

RM 10,959 by privacy at home had 80.9 % less likely to had depression compared to those whose incomes were not between RM 4,849 and RM 10,959 by who did not have privacy at home (AOR: 0.19:95 % CI: 0.05 - 0.78) $p < 0.05$ (5). For those participants whose friends did not infect with COVID-19 by not victim of abuse had 50.9 % less likely to had depression compared to those whose friends infected with COVID-19 by victim of abuse (AOR: 0.491, 95 % CI: 0.34 - 0.70) $p < 0.05$.

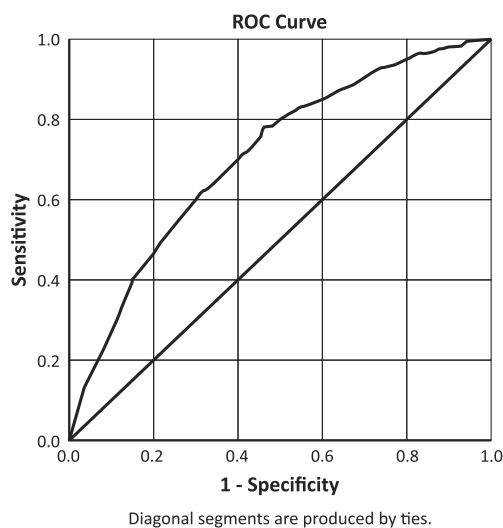
According to Table 6. Omnibus tests of model coefficients gave us a chi-square of 102.04 on 10 degrees of freedom and significant beyond $p < 0.001$. Therefore, by adding age > 55 years old, Family income, Privacy at home and interactions (> 55 years old by Family's source of income not affected, Female by

Table 6. Omnibus tests of Model coefficients

Omnibus Tests of Model Coefficients		Chi-square	Degrees of freedom	Significance
Step 1	Step	102.042	10	0.000
	Block	102.042	10	0.000
	Model	102.042	10	0.000

not victim of abuse, Less than RM 4,849 by Privacy at home, Income between RM 4,849 and RM 10,959 by Privacy at home and Friends not infected with COVID-19 by not victim of abuse) variables into the model improves the model. Next step was checking the assumptions and outliers. Hosmer-Lemeshow good-

ness of fit showed a chi-square 1.17 with 7 df and p-value was 0.992 which was more than 0.05 (not significant) which meant that the model fits well. In this study, we can conclude that 6.8 % of the depression was explained by the significant independent variables stated in Table 5 based on the Cox & Snell R square

**Figure 1.** Receiver Operator Characteristic (ROC) for distinguishing probability among participants with depression and without depression

Area Under the Curve:

Test Result Variable(s): Predicted probability

Area	Std. Error ^a	Asymptotic Sig. ^b	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.709	0.021	0.000	0.668	0.749

The test result variable(s): Predicted probability has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

(0.068) in MLogR analysis. The sensitivity of 99.7 % meant that we can predict that if the participant was age not above 55 years old, family income less than RM 4,849 or between RM 4,849 and RM 10,959, who had privacy at home, participants not over 55 years old by Family's source of income affected, male by Victim of abuse, family income between RM 4,849 and RM 10,959 by Privacy at home and participants whose friends infected with COVID-19 by Victim of abuse, had 99.7 % chance of getting depression. However, specificity of 4.3 % meant that if the participants was above 55 years old, family income more than RM 10,960, who did not have privacy at home, participants over 55 years old by not affecting family's source of income, female by not a victim of abuse, family income not between RM 4,849 and RM 10,959 by those who did not have privacy at home, and participants whose friends were not getting infected with COVID-19 by not being a victim of abuse, had 4.3 % chance of not getting depression. Overall, our predictions were correct with 87.4 % success rate.

According to ROC curve, as shown in Figure 1., the model discriminated 70.9 % (95 % CI: 66.8 % - 74.9 %) of the predicted of having depression. We checked for outliers by using cook's influential statistics shown that none was more than 1.0 in the data therefore, there were no influential outliers.

Discussion

This research studied depression and anxiety among Malaysian adults during the third-wave of this COVID-19 pandemic in Malaysia. The findings of this study focused on the effect of the COVID-19 pandemic related transitions on the mental health of Malaysian adults. Based on the findings, alarmingly more than three-quarter of Malaysian adults were suffering from mild to severe depression (87.2 %). These findings were in line with re-

cent COVID-19 surveys done in Bangladesh for depression and a multi-country study for anxiety [9,13].

In this study, young adults aging from 18 to 35 years old were more depressed than other older age groups, similar to a recent study in Malaysia [8]. The lower prevalence of depression in the older age group can be hypothesized as age-related changes in brain neurotransmitter function, age-related psychological or social changes, disorder-associated mortality, and a cohort effect [17]. Another hypothesis was that younger adults spend more time on social media and the information shared regarding COVID-19 on the internet could exacerbate the depression level of younger adults.

About 73.6 % of our research participants were female, this could be due to the fact that females in our sample are more prone to stay at home males. Long duration of stay at home could have led to more time spent with family members and more time to relax, which may have reduced the level of depression. The results also suggested that family income affected during COVID-19 pandemic was a critical factor in understanding the increased prevalence of depression among Malaysian adults (AOR: 6.56, 95 % CI: 0.51 - 0.85) $p < 0.05$. Movement Control Order (MCO) in Malaysia had caused disruption to the economic source of income and also increased the rate of unemployment [11]. The financial insecurities caused by the pandemic contributed as a stressor to high prevalence of depression among Malaysian adults, similar to a study which identified financial disruptions induced by the acute phase of the COVID-19 pandemic was associated with considerable impairments in community mental health in Australia adults (OR: 2.41, 95 % CI: 0.34 - 2.70) $p < 0.05$ [11].

Our study also found that not performing exercise had significant association with depression (OR: 1.98, 95 % CI: 1.315 - 2.99) with $p < 0.05$. However, study in Bangladesh found that not performing exercise had no associa-

tion with depression and anxiety which was conflicting with present study (OR: 0.56, 95 % CI: 0.02 - 0.85) $p > 0.05$ [19]. Physical activities had been known to be mood boosters by elevating endorphins levels which could induce feelings of happiness and euphoria. Alarmingly, 8.0 % of our study participants were victims of abuse. Being not victim of abuse was found to be the predictors which less likely to cause depression in our study (OR: 0.25, 95 % CI: 0.08 - 0.74) with p value 0.012. According to recent study done in the United States, the rate of domestic violence increased by 5 % during the pandemic due to the increased efforts to stay at home [20]. This may suggest that abusers spend more time with their victims at home, generating more violence opportunities and hence creating more psychological distress towards the victims [19].

The risk of getting COVID-19 infection such as having friends not infected with COVID-19 revealed less likely to cause depression (AOR: 0.61, 95 % CI: 0.42 - 0.89) with p value 0.012. This finding was supported by previous research studies [20]. COVID-19 was labelled as a severe pulmonary disease depending on the co-morbidities of the infected individual. Fearing for the long-lasting side effects of COVID-19 on themselves and also their loved ones could inflict depression and anxiety. With the new practice of this pandemic such as social distancing and lockdown, the healthcare officials should revise the methods to screen, prevent and manage patient for mental illness [20].

Firstly, the distribution of surveys via online platforms could create some issues in terms of recruiting participants who had access to internet and electronic gadgets only. Our study also did not assess the psychological condition of participants before COVID-19 pandemic. Hence the results could be a pre-existing condition before COVID-19 pandemic. Another limitation to this current study was that depression symptoms were self-assessed using validated standardized questionnaire via

online survey since, research methodology could not clinically examine depression symptoms among the participants.

Our study addressed the levels of depression and its associated factors among Malaysian adults during third-wave of COVID-19 pandemic in Malaysia. This was a study to collect data from Malaysian adults using a standardized questionnaire and one of the very few studies to investigate the prevalence of depression using PHQ-9 questionnaire. Our study gave empirical evidence that a large percentage of Malaysians have been suffering from depression. In addition to age, race and gender, marital status along with occupational and educational status were found to be associated to the rise of depression levels among Malaysian during the third wave of this COVID-19 pandemic. Individuals who were victims of abuse and those who have family or friends infected with the COVID-19 virus also contributed to the rise of depression among Malaysian adults. To minimize the growing numbers of mental health problems especially depression in Malaysia, the government should provide psychological supports through campaigns and more mental health hotlines. Financial disruption by COVID-19 was found to be the stressor of depression and anxiety, hence the government should address the high unemployment rate especially during this pandemic as many people have lost their jobs due to lockdown.

Acknowledgements

None.

Conflict of interest

None to declare.

Funding Sources

None.

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