



Depression and anxiety in the Malaysian urban population and their association with demographic characteristics, quality of life, and the emergence of the COVID-19 pandemic

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Accepted: 11 February 2021 / Published online: 19 February 2021

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Abstract

The prevalence of depression and anxiety has been shown to be higher in the urban population compared with the rural population. The present study investigated the prevalence of depression symptoms, anxiety symptoms, and depression with comorbid anxiety symptoms and their associated factors in a random sample drawn from several urban communities in Malaysia. This study also determined the association between the emergence of the COVID-19 pandemic and depression symptoms, anxiety symptoms, and depression with comorbid anxiety symptoms. We recruited 326 participants, who were administered a sociodemographic characteristics questionnaire; the 21-item Depression, Anxiety, and Stress Scale (DASS-21) to assess the presence or absence of depression symptoms, anxiety symptoms, and depression with comorbid anxiety symptoms; and the World Health Organization Quality of Life-BREF (WHOQoL-BREF) to assess their QoL. The following prevalence values were obtained among the participants: depression symptoms, 23.9%; anxiety symptoms, 41.7%; and depression with comorbid anxiety symptoms, 19.9%. Those assessed after the declaration of COVID-19 as a global pandemic showed increased odds of depressive symptoms (adjusted OR = 2.99, 95% CI = 1.41–6.35, $p = 0.006$) and depressive with comorbid anxiety symptoms (adjusted OR = 3.19, 95% CI = 1.37–7.45, $p = 0.005$), while the presence of comorbid stress increased the odds of depressive symptoms (adjusted OR = 16.00, 95% CI = 7.84–32.63, $p < 0.001$), anxiety symptoms (adjusted OR = 19.72, 95% CI = 9.75–39.89, $p < 0.001$), and depressive with comorbid anxiety symptoms (adjusted OR = 40.44, 95% CI = 15.90–102.87, $p < 0.001$). Higher psychological QoL reduced the odds of depressive symptoms (adjusted OR = 0.83, 95% CI = 0.69–0.99, $p = 0.032$) and depressive with comorbid anxiety symptoms (adjusted OR = 0.82, 95% CI = 0.68–0.98, $p = 0.041$), whereas higher physical health QoL (adjusted OR = 0.85, 95% CI = 0.75–0.97, $p = 0.021$) and social relationship QoL (adjusted OR = 0.70, 95% CI = 0.55–0.90, $p = 0.009$) reduced the odds of anxiety symptoms. Based on our findings, we recommended several measures to curb psychological complications among the urban population, particularly as the battle to contain COVID-19 is ongoing.

Keywords Depression · Anxiety · Depression with comorbid anxiety · Urban population · COVID-19 · Malaysia

Introduction

In Malaysia, a developing country in Southeast Asia that is moving forward rapidly in becoming a developed country,

76.04% of the population was living in urban areas in 2018, representing a threefold increase in urbanization compared with 1960 (United Nations Department of Economic and Social Affairs, 2018). One of the major concerns associated with urbanization is the negative effect that it imposes on the mental health status of the urban population. Various factors, such as low socioeconomic status, low social capital, higher rates of pollution, and physical threats (e.g., violence and higher crime rates), may increase the risk of developing psychological complications among the urban population compared with the rural population (Gruebner et al., 2017). Hence, it is of pivotal importance to investigate the mental health status of the urban population in a rapidly developing country like Malaysia.

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Among the common psychological complications related to urbanization, depression and anxiety are exhibiting a rising trend, not only in the global context but also specifically in Malaysia. Comparing urban with rural settings, the odds of mood disorder and anxiety disorder are almost 1.4-fold and 1.2-fold higher in the urban population (Gruebner et al., 2017). In a previous study, a national mental health survey of 9656 Colombian respondents in the community showed that the prevalence of depression with comorbid anxiety was 9.6% in urban respondents compared with only 6.9% in rural respondents (de Vries et al., 2018). In the Malaysian context, data on the prevalence and associated factors of depression and anxiety in the urban population are still lacking. A study of 301 Malaysian respondents from an urban poor community indicated that the prevalence of depression was 12.3%, and the demographic factors associated with depression included young age (<25 years old), male gender, and living in the community for < 4 years (Tan & Yadav, 2012). Another study investigating the mental health status of 1556 participants sampled from communities in the state of Selangor reported that the prevalence rates of depression and anxiety were 10.3% and 8.2%, respectively. The demographic factors associated with depression were ethnicity and marital status, while the only demographic factor associated with anxiety was marital status (Kader Maideen, Mohd. Sidik, Rampal, & Mukhtar, 2014; Kader Maideen, Mohd Sidik, Rampal, & Mukhtar, 2015). Recently, Cheah, Azahadi, Phang, and Abd Manaf (2020) extracted data from a survey conducted on a nationally representative sample of Malaysian adults and revealed that the demographic variables associated with depression and generalized anxiety disorder included younger age, female gender, Indian ethnic group, lower level of education, and being unmarried.

To the best of our knowledge, no study has investigated the quality of life (QoL) of the urban population in Malaysia. In the wake of the emergence of the COVID-19 pandemic, there has been a significant effect on the mental health status of the general population around the world. A systematic review of 19 studies on the psychological consequences of COVID-19 for the general population found that the rates of depressive symptoms (14.6%–48.3%), anxiety symptoms (6.33%–50.9%), and stress symptoms (8.1%–81.9%) were alarming in the general population (Xiong et al., 2020). Nevertheless, data on the comparison of the prevalence of these psychological symptoms among the urban population before and after the emergence of COVID-19 as a global pandemic are not available. To fill this research gap, this study investigated the following issues: (1) the prevalence of depression symptoms, anxiety symptoms, and depression with comorbid anxiety symptoms and (2) the association between various demographic factors, QoL, and the psychological complications mentioned above among participants sampled from several urban communities in Malaysia. In addition, this study

evaluated the association between the emergence of the COVID-19 pandemic and depression symptoms, anxiety symptoms, and depression with comorbid anxiety symptoms.

Methods

Study Participants

This cross-sectional study was carried out from July 2019 to August 2020 and recruited people living in six urban communities in the state of Penang in northern Peninsular Malaysia. Subject recruitment and data collection were temporarily halted from mid-March to early June 2020 due to a movement control order (MCO) imposed by the Malaysian government to curb the increasing spread of COVID-19 in the country. During the MCO, the country was under complete lockdown, where any travel, social, religious, or work-related activities outside the home were prohibited by the government. The research project was resumed from mid-June 2020 and ended in August 2020, which was between 1 week and 2 months after the MCO was lifted. This study was initially intended to investigate the prevalence of psychological complications and their associated factors in the urban population. As the COVID-19 pandemic emerged, we included the comparison of the odds of psychological complications before and after the emergence of the COVID-19 pandemic as one of the objectives of the study. This study received approval from the Human Research Ethics Committee of Universiti Sains Malaysia (code: USM/JEPeM/19030190). The sampling frame for this study was based on the Department of Statistics 2015, in which the district of Seberang Perai Tengah in the state of Pulau Pinang was selected because it was the most highly populated district in the mainland part of Pulau Pinang (population: 395,100 people). Six communities that were considered urban areas in the district of Seberang Perai Tengah were selected: Seberang Jaya, Juru, Bukit Mertajam, Permatang Pauh, Alma, and Perai. The summation of the estimated total population in these urban communities was at 174,886 people. Maps and Enumeration Blocks of the six selected cities were obtained. Simple random sampling by computer-generated random numbers was utilized to select the Enumeration Blocks and then the living quarters and households. Then, a psychiatrist and a research assistant on the research team traveled to the selected communities and searched for each selected living quarters and household. The research assistant alerted the people living in the household by knocking on the door. One inhabitant from each selected household who fulfilled the eligibility criteria of the study was briefed by the research assistant regarding the objectives of the study, duration of involvement, risks and benefits of the study, responsibilities and rights of the participants, and steps taken to maintain the confidentiality of the

information disclosed. Written informed consent for study participation was provided by each participant before enrolment. The inclusion criteria to participate in the study were as follows: age of at least 18 years, Malaysian citizen, living in the selected households, and literacy in Bahasa Malaysia (the official language of Malaysia). Participants were excluded if they presented with psychotic disorders or bipolar mood disorder, or if they had a history of illicit drug use. (Participants were screened with Diagnostic and Statistical Manual for Mental Disorders 5th Edition [DSM-5] diagnostic criteria by the psychiatrist in the research team).

Data Collection

The participants completed the demographic characteristics questionnaire, the Malay version of the 21-item Depression, Anxiety, and Stress Scale (DASS-21), and the Malay version of the 26-item World Health Organization QoL-BREF (WHOQoL-BREF) under the supervision of the research team. Demographic data collected include the following: gender, age, employment status, ethnicity, marital status, the time of assessment in relation to the declaration of COVID-19 as a global pandemic, and cigarette smoking. The height and weight of the participants were also measured to compute the body mass index (BMI). The age of the participants was coded into the three following groups: age of 18–30 years was coded as 0, 31–60 years as 1, and > 60 years as 2. The gender of the participants was coded as follows: male as 0 and female as 1. The ethnicity of the participants was coded into two groups as follows: non-Malay as 0 and Malay as 1. The employment status of the participants was also coded into the two following groups: employed as 0 and unemployed or student as 1. Marital status was coded into two groups, where married was coded as 0 and unmarried, divorced, or widowed as 1. The time of assessment in relation to the declaration of coronavirus disease 2019 as a pandemic was coded into two groups, that is, before COVID-19 was declared as a global pandemic, coded as 0, and after COVID-19 was declared as a global pandemic, coded as 1. Finally, cigarette smoking status was coded into the two following groups: non-smokers were coded as 0 and smokers as 1.

The DASS-21 is a self-reported instrument to assess the severity levels of anxiety, depression, and stress symptoms experienced by respondents. It consists of 21 items, which are categorized into three subscales, that is, the anxiety, depression, and stress subscales. Participants are asked to score each item on a Likert scale ranging from 0 to 3. Sum scores are computed for each subscale by adding the score of each item per subscale and multiplying the sum score with a factor of 2. Hence, the total score for each subscale ranges from 0 to 42. The total sum score for the DASS-21 ranges from 0 to 126. The cut-off scores for case findings in DASS-21 are as follows: 9 for the depression subscale, 7 for the anxiety subscale,

and 14 for the stress subscale (Lovibond & Lovibond, 1995). The Malay version of the DASS-21 has acceptable internal consistency, with Cronbach's alpha values ranging from 0.74 to 0.84 for its subscales. The three-factor model of the Malay version of the DASS-21 has also been confirmed, and most of its items have acceptable factor loading (0.39 to 0.73; Musa, Fadzil, & Zain, 2007).

The WHOQoL-BREF is a self-reported instrument to assess the QoL of respondents. It comprises 26 items, with items 1 and 2 assessing the perceived QoL and health status of the respondents, and the other items grouped into four domains (environmental, psychological, physical health, and social relationship domains). Participants were asked to score each item on a Likert scale from a range of 1 to 5. The sum of the scores in each domain can be transformed into a 0- to 100-point scale (WHOQoL, 1998). The WHOQoL-BREF has acceptable psychometric properties and can be substituted for the WHOQoL-100 to measure QoL without significant loss of information. The Malay version of the WHOQoL-BREF was validated in the Malaysian population and shown to have good psychometric properties. It has good internal consistency, with Cronbach's $\alpha = 0.89$ (Hasanah, Naing, & Rahman, 2003).

Statistical Analysis

All data were analyzed using the Statistical Package for Social Sciences version 26 (SPSS 26; SPSS Inc., Chicago, Illinois, USA). To achieve objective 1 of the study, the descriptive statistics for the demographic characteristics of the participants, the DASS-21 subscale scores, and the WHOQoL-BREF domain scores were computed. All the categorical variables were reported as frequency and percentage, while all the continuous variables were reported as mean and standard deviation (SD). To achieve objective 2 of the study, initially, simple logistic regression was performed to assess the crude odds ratios (crude ORs) of individual demographic characteristics and the WHOQoL-BREF domain scores, and stress symptoms (no stress coded as 0 and presence of stress coded as 1) in predicting the outcome of depression symptoms (no depression coded as 0 and presence of depression coded as 1), anxiety symptoms (no anxiety coded as 0 and presence of anxiety coded as 1), and depression with comorbid anxiety symptoms (no depression with comorbid anxiety coded as 0 and presence of depression with comorbid anxiety coded as 1). The variables with $p < 0.1$ were entered into multiple logistic regression models to assess their association with depression symptoms, anxiety symptoms, and depression with comorbid anxiety symptoms. The Hosmer–Lemeshow goodness-of-fit test was referred to as the indicator of the goodness-of-fit of the regression models (test finding with $p > 0.05$ denoted good model fit). A p value < 0.05 was

considered statistically significant. All the p -values were two-tailed. There were no missing values.

Results

Characteristics of the Study Participants

The demographic characteristics, QoL scores, and psychological complications of the participants are summarized in Table 1. Initially, 376 eligible subjects were invited to participate in this study, but 50 declined, stating that they were not interested in enrolling in the study and wished not to be disturbed. The final sample size was 326 participants, representing a response rate of 86.7%. Most participants fell within the age group of 31–60 years ($n = 259$, 79.4%), and approximately three-quarters of them were female. Most participants were Malays ($n = 305$, 93.6%), and most were married ($n = 283$, 86.8%). Most participants had a stable job ($n = 261$, 80.1%), and more than half participated in the study prior to the declaration of COVID-19 as a global pandemic ($n = 199$, 61.0%). Most participants did not smoke ($n = 308$, 94.5%), and the mean BMI was 26.87 (SD = 5.52).

The prevalence values of psychological complications were as follows: depression symptoms, 23.9% ($n = 78$); anxiety symptoms, 41.7% ($n = 136$); depression with comorbid anxiety symptoms, 19.9% ($n = 65$); and stress symptoms, 31.6% ($n = 103$). The mean QoL domain scores were as follows: physical health QoL, 69.44 (SD = 12.82); psychological QoL, 71.06 (SD = 12.78); social relationship QoL, 72.40 (SD = 12.82); and environmental QoL, 68.44 (SD = 12.52).

Predictors of Depression among the Participants

The association between various demographic characteristics, QoL, and depression symptoms among the participants are presented in Table 2. Simple logistic regression analyses indicated that the individual variables significantly associated with depression symptoms ($p < 0.1$) included being single, divorced, or widowed (crude OR = 1.87, 95% CI = 0.94–3.72, $p = 0.074$), those who were assessed after COVID-19 was declared as a global pandemic (crude OR = 1.49, 95% CI = 1.28–1.86, $p = 0.013$), those with stress symptoms (crude OR = 17.60, 95% CI = 9.36–33.10, $p < 0.001$), higher physical health QoL score (crude OR = 0.93, 95% CI = 0.91–0.96, $p < 0.001$), higher psychological QoL score (crude OR = 0.93, 95% CI = 0.91–0.95, $p < 0.001$), higher social relationship QoL score (crude OR = 0.95, 95% CI = 0.93–0.97, $p < 0.001$), and higher environmental QoL score (crude OR = 0.94, 95% CI = 0.92–0.97, $p < 0.001$).

Multiple logistic regression analysis revealed that there were only two variables that predicted higher odds of depression symptoms, that is, assessment after COVID-19

Table 1 Sociodemographic characteristics, the quality of life scores, and prevalence of depression, anxiety, and depression with comorbid anxiety among the participants

Variables	<i>n</i>	%
Age:		
18–30 years old	26	8.0
31–60 years old	259	79.4
> 60 years old	41	12.6
Gender:		
Male	88	27.0
Female	238	73.0
Ethnicity:		
Malay	305	93.6
Chinese	8	2.4
Indian	13	4.0
Employment status:		
Employed	261	80.1
Unemployed/students	65	19.9
Marital status:		
Married	283	86.8
Single	32	9.8
Divorced/widowed	11	3.4
Participation time:		
Before declaration of COVID-19 pandemic	199	61.0
After declaration of COVID-19 pandemic	127	39.0
Cigarette smoking:		
Smokers	18	5.5
Non-smokers	308	94.5
BMI	26.87 ^a	5.52 ^b
Depression:		
No	248	76.1
Yes	78	23.9
Anxiety:		
No	190	58.3
Yes	136	41.7
Stress:		
No	223	68.4
Yes	103	31.6
Depression with comorbid anxiety:		
No	261	80.1
Yes	65	19.9
WHOQoL-BREF scores:		
Physical health QoL subscale mean score	69.44 ^a	12.82 ^b
Psychological QoL subscale mean score	71.06 ^a	12.78 ^b
Social QoL subscale mean score	72.40 ^a	12.82 ^b
Environment QoL subscale mean score	68.44 ^a	12.52 ^b

^a mean, ^b standard deviation

was declared as a global pandemic (adjusted OR = 2.99, 95% CI = 1.41–6.35, $p = 0.006$) and those with stress symptoms (adjusted OR = 16.00, 95% CI = 7.84–32.63,

Table 2 Association between sociodemographic characteristics, quality of life, and depression among the participants

Variables	Crude OR ^a (95% CI)	Adjusted OR ^b (95% CI)
Age:		
18–30 years	1	–
31–60 years	0.75 (0.30–1.87)	
> 60 years old	1.57 (0.54–4.57)	
Gender:		
Male	1	–
Female	1.31 (0.72–2.38)	
Ethnicity:		
Non-Malay	1	–
Malay	0.48 (0.19–1.22)	
Employment status:		
Employed	1	–
Unemployed/students	1.05 (0.56–1.97)	
Marital status:		
Married	1	1
Single/divorcee/widow/widower	1.87 (0.94–3.72)*	1.00 (0.39–2.60)
Participation time:		
Before declaration of COVID-19 pandemic	1	1
After declaration of COVID-19 pandemic	1.49 (1.28–1.86)*	2.99 (1.41–6.35)**
Cigarette smoking:		
Smokers	1	–
Non-smokers	1.61 (0.45–5.71)	
BMI	0.99 (0.95–1.04)	–
Stress:		
No	1	1
Yes	17.60 (9.36–33.10)*	16.00 (7.84–32.63)**
WHOQoL-BREF scores:		
Physical health QoL subscale mean score	0.93 (0.91–0.96)*	0.92 (0.80–1.06)
Psychological QoL subscale mean score	0.93 (0.91–0.95)*	0.83 (0.69–0.99)**
Social QoL subscale mean score	0.95 (0.93–0.97)*	0.83 (0.65–1.05)
Environment QoL subscale mean score	0.94 (0.92–0.97)*	1.12 (0.96–1.29)

* statistical significance at $p < 0.1$; ** statistical significance at $p < 0.05$; ^a = absence of depression coded 0 (reference), presence of depression coded 1; ^b = absence of depression coded 0 (reference), presence of depression coded 1, multiple logistic regression model reported Cox and Snell $R^2 = 0.332$, $p < 0.001$, Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 12.43$, $p = 0.133$)

$p < 0.001$). There was only one variable that was protective against depression—that is, higher psychological QoL score (adjusted OR = 0.83, 95% CI = 0.69–0.99, $p = 0.032$). The Cox and Snell R^2 of the multiple logistic regression model was 0.332 ($p < 0.001$), and the Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 12.43$, $p = 0.133$) indicated acceptable fit of the model.

Predictors of Anxiety among the Participants

The association between various demographic characteristics, QoL, and anxiety symptoms among the participants are

illustrated in Table 3. Simple logistic regression analyses demonstrated that those within the age group of 31–60 years (crude OR = 0.48, 95% CI = 0.21–1.08, $p = 0.075$); those who were single, divorced, or widowed (crude OR = 2.69, 95% CI = 1.34–5.23, $p = 0.003$); those who were experiencing stress symptoms (crude OR = 23.81, 95% CI = 12.44–45.55, $p < 0.001$); higher physical health QoL score (crude OR = 0.79, 95% CI = 0.73–0.85, $p < 0.001$); higher psychological QoL score (crude OR = 0.82, 95% CI = 0.75–0.89, $p < 0.001$); higher social relationship QoL score (crude OR = 0.65, 95% CI = 0.56–0.75, $p < 0.001$); and higher environmental QoL score (crude OR = 0.86, 95% CI = 0.80–0.91,

Table 3 Association between sociodemographic characteristics, quality of life, and anxiety among the participants

Variables	Crude OR ^a (95% CI)	Adjusted OR ^b (95% CI)
Age:		
18–30 years	1	1
31–60 years	0.48 (0.21–1.08)*	0.38 (0.12–1.28)
> 60 years old	0.63 (0.24–1.71)	0.45 (0.11–1.85)
Gender:		
Male	1	–
Female	1.27 (0.77–2.10)	–
Ethnicity:		
Non-Malay	1	–
Malay	0.51 (0.21–1.26)	–
Employment status:		
Employed	1	–
Unemployed/students	0.78 (0.45–1.36)	–
Marital status:		
Married	1	1
Single/divorcee/widow/widower	2.69 (1.34–5.23)*	1.27 (0.49–3.32)
Participation time:		
Before declaration of COVID-19 pandemic	1	–
After declaration of COVID-19 pandemic	0.81 (0.51–1.27)	–
Cigarette smoking:		
Smokers	1	–
Non-smokers	1.92 (0.67–5.53)	–
BMI	1.00 (0.97–1.05)	–
Stress:		
No	1	1
Yes	23.81 (12.44–45.55)*	19.72 (9.75–39.89)**
WHOQoL-BREF scores:		
Physical health QoL subscale mean score	0.79 (0.73–0.85)*	0.85 (0.75–0.97)**
Psychological QoL subscale mean score	0.82 (0.75–0.89)*	1.13 (0.95–1.35)
Social QoL subscale mean score	0.65 (0.56–0.75)*	0.70 (0.55–0.90)**
Environment QoL subscale mean score	0.86 (0.80–0.91)*	1.02 (0.89–1.16)

* statistical significance at $p < 0.1$; ** statistical significance at $p < 0.05$; ^a = absence of anxiety coded 0 (reference), presence of anxiety coded 1; ^b = absence of anxiety coded 0 (reference), presence of anxiety coded 1, multiple logistic regression model reported Cox and Snell $R^2 = 0.389$, $p = 0.003$, Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 5.29$, $p = 0.726$)

$p < 0.001$) were significantly likely to have anxiety symptoms ($p < 0.1$).

The multiple logistic regression analysis illustrated that participants with stress symptoms (adjusted OR = 19.72, 95% CI = 9.75–39.89, $p < 0.001$) represented the only variable that significantly predicted higher odds of anxiety symptoms. Higher physical health QoL score (adjusted OR = 0.85, 95% CI = 0.75–0.97, $p = 0.021$) and higher social relationship QoL score (adjusted OR = 0.70, 95% CI = 0.55–0.90, $p = 0.009$) were protective against anxiety. The Cox and Snell R^2 of the multiple logistic regression model was 0.389 ($p = 0.003$), and the Hosmer–Lemeshow

goodness-of-fit test ($\chi^2 = 5.29$, $p = 0.726$) indicated acceptable fit of the model.

Predictors of Depression with Comorbid Anxiety among the Participants

The association between various demographic characteristics, QoL, and depression with comorbid anxiety symptoms among the participants are illustrated in Table 4. Simple logistic regression analyses revealed that there were several variables significantly associated with depression with comorbid anxiety symptoms ($p < 0.1$). These variables included those

Table 4 Association between socio-demographic characteristics, quality of life, and depression with comorbid anxiety among the participants

Variables	Crude OR ^a (95% CI)	Adjusted OR ^b (95% CI)
Age:		
18–30 years old	1	–
31–60 years old	0.74 (0.28–1.94)	
> 60 years old	1.38 (0.44–4.29)	
Gender:		
Male	1	–
Female	1.29 (0.68–2.45)	
Ethnicity:		
Non-Malay	1	1
Malay	0.37 (0.15–0.94)*	0.67 (0.15–2.95)
Employment status:		
Employed	1	–
Unemployed/students	0.72 (0.39–1.33)	
Marital status:		
Married	1	1
Single/divorcee/widow/widower	2.61 (1.36–5.01)*	0.59 (0.20–1.71)
Participation time:		
Before declaration of COVID-19 pandemic	1	1
After declaration of COVID-19 pandemic	2.06 (1.12–3.77)*	3.19 (1.37–7.45)**
Cigarette smoking:		
Smokers	1	–
Non-smokers	2.06 (0.46–9.18)	
BMI	0.99 (0.94–1.04)	–
Stress:		
No	1	1
Yes	39.77 (17.04–92.81)*	40.44 (15.90–102.87)**
WHOQoL-BREF scores:		
Physical health QoL subscale mean score	0.77 (0.70–0.85)*	0.93 (0.79–1.10)
Psychological QoL subscale mean score	0.73 (0.65–0.81)*	0.82 (0.68–0.98)**
Social QoL subscale mean score	0.66 (0.57–0.78)*	0.89 (0.69–1.16)
Environment QoL subscale mean score	0.83 (0.76–0.89)*	1.07 (0.91–1.26)

* statistical significance at $p < 0.1$; ** statistical significance at $p < 0.05$; ^a = absence of depression with comorbid anxiety coded 0 (reference), presence of depression with comorbid anxiety coded 1; ^b = absence of depression with comorbid anxiety coded 0 (reference), presence of depression with comorbid anxiety coded 1, multiple logistic regression model reported Cox and Snell $R^2 = 0.366$, $p < 0.001$, Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 9.37$, $p = 0.312$)

who were of Malay ethnicity (crude OR = 0.37, 95% CI = 0.15–0.94, $p = 0.089$); being single, divorced, or widowed (crude OR = 2.61, 95% CI = 1.36–5.01, $p = 0.037$); assessment after COVID-19 was declared as a global pandemic (crude OR = 2.06, 95% CI = 1.12–3.77, $p = 0.020$); and stress symptoms (crude OR = 39.77, 95% CI = 17.04–92.81, $p < 0.001$). In addition, all the domains of QoL were significantly associated with depression with comorbid anxiety symptoms ($p < 0.1$), such as physical health QoL score (crude OR = 0.77, 95% CI = 0.70–0.85, $p < 0.001$), psychological QoL score (crude OR = 0.73, 95% CI = 0.65–0.81, $p < 0.001$), social

relationship QoL score (crude OR = 0.66, 95% CI = 0.57–0.78, $p < 0.001$), and environmental QoL score (crude OR = 0.83, 95% CI = 0.76–0.89, $p < 0.001$).

The multiple logistic regression analysis pinpointed that there were only two variables that significantly predicted higher odds of depression with comorbid anxiety symptoms, which were assessment after COVID-19 was declared as a global pandemic (adjusted OR = 3.19, 95% CI = 1.37–7.45, $p = 0.005$) and stress symptoms (adjusted OR = 40.44, 95% CI = 15.90–102.87, $p < 0.001$). The only variable that was protective against depression with comorbid anxiety among

the participants was a higher psychological QoL score (adjusted OR = 0.82, 95% CI = 0.68–0.98, $p = 0.041$). The Cox and Snell R^2 of the multiple logistic regression model was 0.366 ($p < 0.001$), and the Hosmer–Lemeshow goodness-of-fit test ($\chi^2 = 9.37$, $p = 0.312$) indicated acceptable fit of the model.

Discussion

This study determined the prevalence of depression symptoms, anxiety symptoms, and depression with comorbid anxiety symptoms, as well as the association between various demographic factors, QoL, and the mentioned psychological complications among participants from urban communities. We found that 23.9% of the participants had depression symptoms, 41.7% had anxiety symptoms, and 19.9% had depression with comorbid anxiety symptoms. Our findings showed a relatively high prevalence of depression compared with the results of a few studies on the Malaysian urban population, which reported the prevalence of depression in the range of 10.30%–13.98% (Cheah et al., 2020; Kader Maideen et al., 2014; Tan & Yadav, 2012). Nevertheless, our study revealed a lower prevalence of depression compared with the prevalence reported in other Asian countries, such as India and China, where the range was reported as 33%–35% (Firdaus & Ahmad, 2014; Li et al., 2019). Again, the prevalence of anxiety reported in our study was much higher than that reported in another study on the prevalence of anxiety in Malaysian communities (in which it was 8.2%; Kader Maideen et al., 2015). In comparison with other Asian countries, the prevalence of anxiety found in our study was comparable to that reported in the Chinese community (reported as 41.12%; Guo et al., 2016). In contrast, the prevalence of depression with comorbid anxiety found in our study was relatively lower than that of another study of comorbidity of depression and anxiety in the Malaysian community (reported as 67.2%; Kader Maideen et al., 2014). The discrepancy in the prevalence of anxiety, depression, and comorbid depression and anxiety between our study and other studies in the Malaysian community may be attributed to the different screening tools used. In addition, the emergence of the COVID-19 pandemic may have elevated the prevalence of depression symptoms, anxiety symptoms, and depression with comorbid anxiety symptoms in our study. When we compared the prevalence of depression and anxiety in our study to that of a study of depression and anxiety in 576 Malaysian urban dwellers who attended primary healthcare clinics, which also used the DASS-21 as a screening instrument (anxiety: 44.5%; depression: 20.5%; Abd Rahman, Idris, & Ibrahim, 2020), similar prevalence values were noted.

There were only two factors that registered a significant association with higher odds of depression symptoms, which were as follows: comorbid stress, which increased the odds of

acquiring depression symptoms by more than 17-fold compared with an absence of comorbid stress, and undergoing assessment after the declaration of COVID-19 as a global pandemic, which increased the odds of depression symptoms by almost threefold compared with undergoing assessment before the declaration of COVID-19 as a global pandemic. In contrast, a higher level of perceived psychological QoL was protective against depression, reducing the odds of depression by 1.25-fold, as indicated by our findings. Psychosocial stressors may lead to increased activity of the amygdala, which enhances the release of dopamine from the mesocortical dopaminergic pathway; this induces exaggerated responses to mild negative stressors and results in negative bias in cognitive processing, increasing the risk of depression. In addition, unavoidable stressors may also lead to dysregulation of the noradrenaline system in the locus coeruleus, which may result in features of depression, such as altered attention and memory. Psychosocial stressors may also induce increased levels of serum proinflammatory cytokines (e.g., interleukin-1, interleukin-6, and tumor necrosis factor- α), which may be associated with an increased risk of developing depression. Moreover, increased reactivity of the amygdala because of stress exposure may be associated with altered mood regulation (Tafet & Nemeroff, 2016). These factors could explain the presence of comorbid stress and higher odds of depression symptoms in our study. The association of COVID-19 with the development of depression symptoms in our study is consistent with the findings of several studies of the effect of COVID-19 on the general populations in China, Italy, and Turkey, indicating that the odds of depression increased after the emergence of the COVID-19 pandemic (Ahmed et al., 2020; Gao et al., 2020; Mazza et al., 2020; Özdin & Özdin, 2020; Wang et al., 2020a; Wang et al., 2020b). Interestingly, the participants who enrolled in our study after the declaration of COVID-19 as a global pandemic underwent assessment after the MCO had been lifted for 3 weeks (after the study recommenced from July 2020 to August 2020). Hence, our study pinpointed that the increased odds of depression symptoms may persist even after the movement lockdown imposed by the government had been lifted, indicating that the negative psychological impact associated with the COVID-19 pandemic may be independent of the effect of the movement lockdown on mental health. The inverse relationship between psychological QoL and depression is well documented: Lower psychological QoL was reported in depressive patients, while improvement of psychological QoL occurred in treated major affective disorder patients who had just been discharged from inpatient wards (Olusina & Ohaeri, 2003; Shumye, Belayneh, & Mengistu, 2019). Hence, it is not surprising that higher perceived psychological QoL reduced the odds of depression symptoms, as reported by this study.

Our study reported that the presence of comorbid stress was the only factor significantly associated with increased odds of

anxiety symptoms, while social relationship QoL and physical health QoL reduced the odds of anxiety among the participants. Again, persistence of stress may induce an increase in amygdala reactivity, which may be associated with anxiety. The presence of psychosocial stressors may cause dysregulation of the noradrenaline system, resulting in an altered state of arousal; this process may induce anxiety disorder (Tafet & Nemeroff, 2016). This may explain the association between the presence of comorbid stress and higher odds of anxiety symptoms in our study. The protective effect of higher physical QoL against the occurrence of anxiety can be explained by the inverse relationship between physical health and anxiety. Poor and moderate self-rated health is predictive of higher odds of acquiring anxiety by 4-fold and 1.7-fold, respectively (Hossain et al., 2020). Conversely, a meta-analysis of 14 cohorts of 13 prospective studies reported that high self-reported physical activity reduced the odds of developing anxiety by 1.35-fold, and high self-reported physical activity was protective against development of agoraphobia and posttraumatic stress disorder; these results were evident in Asian and European populations, as well as across different age groups, from children/adolescents to adults (Schuch et al., 2019). As with the association between social relationships and anxiety, cross-sectional data from the assessment of spouse or partner relationships of 4988 Irish adults identified that positive partner interaction was significantly associated with a reduced likelihood of anxiety (Santini, Koyanagi, Tyrovolas, & Haro, 2015). Nevertheless, social disconnectedness predicted a higher occurrence of anxiety symptoms (Santini et al., 2020). These findings support the association between high social relationship QoL and lower odds of anxiety found in this study. Surprisingly, our study did not find that the emergence of the COVID-19 pandemic increased the odds of anxiety. This may be explained by the high employment rate (80.1%) and the high marital rate (86.8%) among the participants. Studies on the psychological impact of COVID-19 on the general population have found that those who are working, married, and have stable income report lower anxiety symptoms (Wang, Di, Ye, & Wei, 2020; Zhang, Wang, Rauch, & Wei, 2020). In addition, living in an urban area is reported to be protective against anxiety during the COVID-19 pandemic (Cao et al., 2020).

The associated factors of depression with comorbid anxiety were found to be similar to those of depression, where participants with comorbid stress and those who underwent assessment after the declaration of COVID-19 were found to have higher odds of depression with comorbid anxiety symptoms, while higher psychological QoL was associated with lower odds of depression and comorbid anxiety symptoms. Comorbid stress may lead to dysfunction of the mesocortical dopaminergic pathway, the noradrenaline system in the locus coeruleus, increased reactivity of the amygdala, and increased serum proinflammatory cytokines. This may have increased

the risk of developing depression with comorbid anxiety symptoms among the participants (Tafet & Nemeroff, 2016). Our finding of higher odds of depression with comorbid anxiety is in line with the finding reported by a study of the psychological effect of COVID-19 in 4872 Chinese adults, which indicated that the prevalence of depression with comorbid anxiety was 19.4% (Gao et al., 2020). The association between higher psychological QoL and lower odds of depression with comorbid anxiety was also well supported by similar findings reported by other studies of the relationship between psychological QoL and depression and anxiety (Olusina & Ohaeri, 2003; Shumye et al., 2019; Woon et al., 2020).

Our study highlights a few public health implications. First, since comorbid stress and fear of being infected with COVID-19 elevate the odds of acquiring depression symptoms and depression with comorbid anxiety symptoms, whereas better psychological QoL is protective against depression and depression with comorbid anxiety in the urban population, at a time when COVID-19 is still prevalent globally, there is a need for public health authorities and mental health providers to offer online psychotherapy. Doing this may help to alleviate chronic stress and improve psychological QoL among urban dwellers. This will require the mobilization and preparation of counselors, psychologists, and psychiatrists to offer this new norm of mental health service to the public. Examples of effective psychosocial interventions for the management of stress, anxiety, and depression are biofeedback and mindfulness-based psychosocial interventions. Biofeedback-involved training helps regulate certain involuntary bodily processes, such as blood pressure, pulse rate, blood flow, and muscle tension, to enhance mental health. Mindfulness-based stress reduction (MBSR) is an eight-week intervention program that focuses on body awareness; mindfulness meditation; and exploration of one's behavior, thinking, and emotion. It focuses on nonjudgmental acceptance of one's bodily sensations, mind functioning, and mental state to reduce distress and improve wellbeing. Biofeedback training is available online, while MBSR can be conducted online and has been found to be effective in reducing depression, anxiety, and stress symptoms (Khoury, Sharma, Rush, & Fournier, 2015; Muller et al., 2020; Sidi, 2020). Evidence from systematic reviews and meta-analyses has supported the efficacy of online psychotherapy for the treatment of psychiatric illnesses. A systematic review conducted by Backhaus et al. (2012) which reviewed 65 studies investigating the efficacy of videoconferencing psychotherapy (VCP) for treatment of psychiatric illnesses indicated that VCP produced similar clinical outcomes to conventional face-to-face psychotherapy and was associated with good user satisfaction. Moreover, a systematic review and meta-analysis that assessed 69 studies on the efficacy of online psychotherapy for the treatment of depressive and anxiety disorders also revealed that online psychotherapy improves depressive and anxiety symptoms better than control

procedures do, including waitlisting and treatment-as-usual, and it was shown to be more cost effective compared with psychotherapies which were conducted face-to-face. An example of an effective online psychotherapy for treatment of depression and anxiety is online cognitive behavioral therapy (CBT; Arberg, Linton, Hultcrantz, Heintz, & Jonsson, 2014; Ahern, Kinsella, & Semkowska, 2018).

Second, as higher social relationship QoL is protective against anxiety, public health authorities and government agencies should intensively promote the use of online social platforms. Videoconferencing and web-conferencing applications are of utmost importance to sustain social communication and social relationships among the people in urban communities when COVID-19 infection is still prevalent and social distancing has become the current norm in daily living. This measure may be valuable for curbing the increasing likelihood of anxiety in urban communities.

Finally, since better physical health QoL is protective against anxiety, considering the current situation where social distancing is the new norm in our daily living and to avoid the disruption of continuous follow-up of patients with pre-existing medical illnesses in urban communities, telemedicine—which involves treating doctors' online consultations with those who have pre-existing medical illnesses—may be an alternative to address the increasing prevalence of anxiety in urban communities. A systematic review of reviews on the efficacy of telemedicine found 21 systematic reviews reporting that telemedicine produces significant therapeutic effectiveness for a wide range of psychiatric and medical illnesses, enhances that efficacy of health services, and exhibits good technical effectiveness and reliability. Another 18 reviews indicated telemedicine was promising for the treatment of psychiatric and medical illnesses, but more research was required to draw a firm conclusion (Ekeland, Bowes, & Flottorp, 2010). A more recent systematic review of 44 studies also pinpointed the benefits of telemedicine in terms of ease of use, tendency to improve outcomes, cost effectiveness, and communication between therapist and patients. Other benefits of telemedicine include increased access to healthcare, reduced travel time of patients, improved medication adherence, reduced waiting time and readmissions, and serving as a good modality for education (Kruse et al., 2017).

Our study had some limitations. First, the causal relationship between various factors and the occurrence of anxiety symptoms, depression symptoms, and depression with comorbid anxiety symptoms could not be evaluated due to the cross-sectional design of this study. Second, the demographic distributions of the participants in this study did not reflect the demographic distributions of the Malaysian urban population. Hence, our study findings may not be generalized to the entire urban population of the country. Third, this study utilized the DASS-21 to assess the prevalence of anxiety, depression, and

stress in the participants. Although cut-off scores for depression, anxiety, and stress were evaluated for caseness in the DASS-21, it is a self-reported symptom screening instrument, and it is not intended to be used as a diagnostic tool. Hence, future studies using diagnostic tools, such as the Structural and Clinical Interview for the DSM or Mini International Neuropsychiatric Interview, are recommended to confirm our findings. Fourth, we did not record the respondents' education level and monthly income, which could be confounding factors that potentially influenced our findings. Finally, COVID-19-related stressors, such as real or impending loss of income and loss of employment, panic buying, lifestyle restrictions, and accommodation changes during COVID-19, which could be confounding factors influencing the outcomes of the study, were not assessed. Despite the above limitations, this study provided valuable data to fill the gap in the literature on the prevalence of psychological complications and their associated factors in urban communities. This study also added valuable information on the psychological effect of COVID-19 on the urban population, independent of the effect of the movement lockdown.

Conclusion

This study investigated the prevalence of anxiety symptoms, depression symptoms, and depression with comorbid anxiety symptoms among Malaysian urban dwellers and recorded a relatively high prevalence of these psychological complications compared with other Malaysian studies. We found that comorbid stress, the COVID-19 pandemic, physical health QoL, psychological QoL, and social relationship QoL were significantly associated with the occurrence of depression symptoms, anxiety symptoms, and depression with comorbid anxiety symptoms. Our study findings led us to recommend the following measures: (1) the use of online psychotherapy (online biofeedback training, MBSR, and CBT), (2) the promotion of online social platforms to sustain social communications and social relationships, and (3) the use of telemedicine to curb the increasing trend of depression and anxiety among the urban population because the COVID-19 pandemic is still widespread and the war against this infection pandemic is ongoing.

Acknowledgements We thank the nurses of Advanced Medical and Dental Institute, Universiti Sains Malaysia for their assistance in data collection.

Authors' Contribution All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Mohammad Farris Iman Leong Bin Abdullah], [Hazwani Ahmad Yusof] and [Noorsuzana Mohd Shariff]. The first draft of the manuscript was written by [Mohammad Farris Iman Leong Bin Abdullah] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding This research work was funded by the CIMB Foundation (311.CIPPT.4117614). The funding source has no role in the design of the research, data collection, data analysis, writing of the manuscript, and publication of the manuscript.

Data Availability All pertinent data, materials, and codes for analysis will be made available by the authors upon written request by any party.

Code Availability All pertinent data, materials, and codes for analysis will be made available by the authors upon written request by any party.

Declarations

Research Involving Human Participants This research involved human participants and received approval from the Human Research Ethics Committee of Universiti Sains Malaysia (USM/JEPeM/19030190). All the procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Written informed consent to participate in the study was signed from each participant before they were enrolled in the study.

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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