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People with Suspected COVID-19 Symptoms Were More Likely Depressed and Had Lower Health-Related Quality of Life: The Potential Benefit of Health Literacy

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Abstract: The coronavirus disease 2019 (COVID-19) epidemic affects people's health and health-related quality of life (HRQoL), especially in those who have suspected COVID-19 symptoms (S-COVID-19-S). We examined the effect of modifications of health literacy (HL) on depression and HRQoL. A cross-sectional study was conducted from 14 February to 2 March 2020. 3947 participants were recruited from outpatient departments of nine hospitals and health centers across Vietnam. The interviews were conducted using printed questionnaires including participants' characteristics, clinical parameters, health behaviors, HL, depression, and HRQoL. People with S-COVID-19-S had a higher depression likelihood (OR, 2.88; $p < 0.001$), lower HRQoL-score (B, −7.92; $p < 0.001$). In comparison to people without S-COVID-19-S and low HL, those with S-COVID-19-S and low HL had 9.70 times higher depression likelihood ($p < 0.001$), 20.62 lower HRQoL-score ($p < 0.001$), for the people without S-COVID-19-S, 1 score increment of HL resulted in 5% lower depression likelihood ($p < 0.001$) and 0.45 higher HRQoL-score ($p < 0.001$), while for those people with S-COVID-19-S, 1 score increment of HL resulted in a 4% lower depression likelihood ($p = 0.004$) and 0.43 higher HRQoL-score ($p < 0.001$). People with S-COVID-19-S had a higher depression likelihood and lower HRQoL than those without. HL shows a protective effect on depression and HRQoL during the epidemic.

Keywords: coronavirus; COVID-19; epidemic; suspected COVID-19 symptoms; comorbidity; healthy eating; physical activity; health literacy; depression; health-related quality of life

1. Backgrounds

The outbreak of novel coronavirus disease (COVID-19) was first reported in December 2019 in Wuhan, China [1]. COVID-19 has been spreading to a growing number of countries and is recognized as a global health concern that has set global public health institutions on high alert [2–4]. The World Health Organization (WHO) declared the COVID-19 emergency to be the sixth public health emergency of international concern (PHEIC) on 30 January 2020 [5]. According to the report on 24 March 2020, the total number of people diagnosed with COVID-19 was 372,757 cases, with 16,231 deaths in 170 countries/regions; among these, 123 cases have been reported in Vietnam [6,7]. COVID-19 was officially declared a pandemic by WHO on 11 March 2020 [8]. Treatments and vaccines for COVID-19 are currently in development. Therefore, prevention and supportive care are highly recommended [7,9–13], especially in countries with weaker healthcare systems, as suggested by WHO director-general Tedros Adhanom Ghebreyesus [14]. Vitally, intense surveillance is emphasized to prevent the sustained transmission in new locations [15]. The public health response to prevent the spread of COVID-19 has been initiated at different levels in all countries affected [16].

The COVID-19 pandemic causes panic and mental health problems for the public [17,18], as experienced previously with the Middle-East respiratory syndrome coronavirus (MERS-CoV) [19,20]. Additionally, myths and misinformation about this epidemic, travel bans and executive orders to quarantine travelers might affect the public's psychological health [17,21,22]. This may influence people's health and quality of life. Health literacy (HL) is defined as the ability to find, understand, appraise and apply health-related information that could help healthcare systems and individuals achieve a better quality of care, lifestyle, disease management, treatment decision, and health outcomes [23,24]. Health literacy is recognized as a key factor in reducing health inequities and improving health and well-being [25,26]. Adequate HL enables health-friendly environments, efficient health policies implementation, effective health promotional efforts, better self-care, healthcare outcomes, and lower expenditures [27].

Vietnam has a long border and several bilateral communications with China [28]. This puts Vietnam at high risk for the COVID-19 pandemic. Vietnam also has the lowest health literacy score among studied Asian countries [29,30]. Health literacy is considered to be an essential element of public health practice to generate effective interventions and maximize health outcomes [31,32].

Improving health literacy is a strategic approach to preventing and controlling diseases [33]. Therefore, health professionals need to understand patients' health literacy before delivering interventions or education [34], in order to improve health-related quality of life [35,36].

People with health problems and who need to visit clinics are vulnerable populations. The COVID-19 pandemic causes panic and anxiety, which further exaggerates their health outcomes, especially for those who present at outpatient departments (OPD) with suspected COVID-19 symptoms (S-COVID-19-S). From a public health perspective, it is crucial to find the protective factors that benefit daily health-related behaviors, mental health, and quality of life. We hypothesized that people with S-COVID-19-S are more likely to have depression and lower health-related quality of life (HRQoL), while those with higher HL have better mental health and HRQoL during the COVID-19 pandemic. Therefore, we aimed to investigate the association of S-COVID-19-S with depression and HRQoL, and the effect modification of health literacy on the associations among people who visited OPDs of 9 hospitals and health centers in Vietnam.

2. Research Methods

2.1. Study Design and Settings

A cross-sectional study was conducted from 14 February to 2 March 2020. Participants were recruited from outpatient departments (OPD) of six hospitals and three health centers across Vietnam, including three hospitals and one health center in the North, one health center in the Center, and three hospitals and one health center in the South.

2.2. Sampling and Sample Size

People who visited the OPD in hospitals and health centers were invited to the survey. Studied participants were aged 18 to 85 years, understood the Vietnamese language, and were not in any emergency condition. Patients with a diagnosis of psychotic disorder, dementia, or blindness were excluded, to avoid interaction of health literacy measurements [37].

A total sample of 4029 participants was interviewed, including 500 from Thai Nguyen National Hospital in Thai Nguyen Province, 530 from the Military Medical Hospital 103 in Hanoi, 502 from Hai Phong University of Medicine and Pharmacy Hospital and 497 from Kien Thuy District Health Center in Haiphong city, 500 from Trieu Phong District Health Center, Thua Thien Hue province, 500 from Thu Duc Hospital, 250 from Tan Phu District Hospital, and 250 from Hospital District 2, and 500 from Thu Duc District Health Center in Ho Chi Minh city. After cleaning the data (82 individuals aged less than 18 or above 85 years, or with incomplete interviews, were excluded), the sample of 3947 participants was analyzed.

2.3. Research Instruments and Assessments

2.3.1. Social Demographics and Clinical Indicators

Participants were asked about the reason to visit the OPD, and screened for suspected COVID-19 symptoms (S-COVID-19-S) [38], e.g., common symptoms (fever, cough, dyspnea), and less common symptoms (myalgia, fatigue, sputum production, confusion, headache, sore throat, rhinorrhea, chest pain, hemoptysis, diarrhea, and nausea/vomiting). People presenting at OPD with any of those symptoms were classified as having S-COVID-19-S. They were also asked about age (years), gender (women vs. men), marital status (never married vs. ever married), education (elementary/illiterate, junior high school, senior high school, college/university or above), occupation (employed, own business, others), ability to pay for medication (very difficult to very easy), social status (people were asked to place themselves into the society at three levels from low, middle to high), body height (cm), weight (kg), and comorbidity. Body mass index (BMI, kg/m^2) was calculated.

2.3.2. Health-Related Behaviors

Participants were asked about the current smoking status (yes vs. no), drinking status (yes vs. no), eating behavior (less healthy or unchanged vs. healthier during the outbreak). The physical activity was assessed using the short version of the International Physical Activity Questionnaire (IPAQ) with seven items was used to evaluate the physical activity level, which was widely used [39]. Patients were asked about their time spent (days per week, and minutes per day) over the last 7 days, on different levels of physical intensity (vigorous, moderate, walking, and sitting). The IPAQ was validated and used in the Vietnamese context [40,41]. The overall physical activity was scored using a metabolic equivalent task scored in minutes per week (named as MET-min/week) [42]. The MET-min/week was calculated as the sum of minutes spent on activities at different levels of vigorous, moderate, walking, and sitting over the last seven days multiplied by 8.0, 4.0, and 3.3, 1.0, respectively [39].

2.3.3. Health Literacy

Health literacy (HL) was measured using the 12-item short form of the health literacy questionnaire (HLS-SF12), which has been validated in general populations in Asia [30], and in Vietnam [43]. Participants rated their perceived difficulty of each item on 4-point Likert scales (1 = very difficult, 2 = difficult, 3 = easy, and 4 = very easy). The HL index was standardized to unified metrics from 0 to 50 using the formula;

$$Index = (Mean - 1)*(50/3) \quad (1)$$

where *Index* is the specific index calculated, *Mean* is the mean of all participating items for each individual, *1* is the minimum possible value of the mean (leading to a minimum value of the index of 0), *3* is the range of the mean, and *50* is the chosen maximum value of the new metric. Thus, a higher HL index score represents a better HL level [44].

2.3.4. Depression

Depression was assessed using the patient health questionnaire (PHQ-9) [45]. The PHQ-9 is in use in the Vietnam context [40,46]. Participants rated each item on a 4-point Likert scale from 0 (not at all) to 3 (almost every day) over the last 2 weeks. Total PHQ-9 score ranges from 0–27. Scores ≥ 10 are classified as depression [45,47,48].

2.3.5. Health-Related Quality of Life

Health-related quality of life (HRQoL) was assessed using the 36-Item Short Form Survey (SF-36) which was developed at RAND as part of the Medical Outcomes Study [49]. This was also used in Vietnamese Americans [50]. Scoring algorithms are given in detail in the user manual [51,52]. The possible calculated scores range from 0 to 100, with a higher score representing a better HRQoL.

2.4. Data Collection Procedure

Research assistants (doctors, nurses, and medical students) received a 4 h training session on data collection by two senior researchers at each hospital or health center. The infection control training was also provided, e.g., using the mask, washing hands, positioning according to guidelines of the Centers for Disease Control and Prevention (CDC) [53], and World Health Organization (WHO) [54].

All qualified patients were invited to participate in the survey. Research assistants contacted and asked for voluntary participation from patients and relatives who visit the OPD. The consent form was obtained before administering the survey. The interviews were then conducted at the OPD. It takes about 30 min to complete the questionnaire. Finally, all the data was cleaned, keyed-in and analyzed confidentially by researchers.

2.5. Ethical Considerations

The study protocol was approved by each participating hospital, and the Institutional Ethical Review Committee of Hanoi School of Public Health, Vietnam (IRB No. 029/2020/YTCC-HD3).

2.6. Data Analysis

Firstly, descriptive analysis was used to explore the distribution of different variables. The chi-squared test and one-way ANOVA test were used, respectively. Secondly, we used bivariate and multivariate analyses to investigate the determinants of depression and HRQoL. The factors associated with depression or HRQoL at $p < 0.20$ in the bivariate model were selected into the multivariate model [55]. Finally, the interaction analysis was conducted to examine the potential benefit of health literacy on improving depression and HRQoL. The significance level was set at a p-value < 0.05. All statistical analyses were performed using the IBM SPSS Version 20.0 (IBM Corp, Armonk, NY, USA) [56].

3. Results

3.1. Participants' Characteristics

The mean age of the study population was 44.4 ± 17.0 years, with 23.5% of them aged 60 years or above. Out of all participants, 35.1% had presented at the outpatient department with suspected COVID-19 symptoms (S-COVID-19-S), 44.3% were men, and 7.4% were depressed. The mean scores of HL index and HRQoL were 29.9 ± 7.7 and 69.6 ± 17.5, respectively. The prevalence of depression was significantly higher in people with S-COVID-19-S, and varied by different groups of age, education, ability to pay for medication, social status, comorbidity, eating behavior, physical activity, and had lower HL score ($p < 0.05$; Table 1). The HRQoL score was significantly lower in the people with S-COVID-19-S, and varied by different categories of age, gender, marital status, education, occupation, ability to pay for medication, social status, comorbidity, and physical activity ($p < 0.001$; Table 1). Additionally, the HRQoL score was significantly lower in the people with depression ($p < 0.001$; Table 1).

Table 1. Participants' characteristics, health literacy index score, depression and health-related quality of life of participants.

	Total (n = 3947)	**PHQ < 10 (n = 3653)**	**PHQ ≥ 10 (n = 294)**		**HRQoL**	
	Frequency (%)	**Frequency (%)**	**Frequency (%)**	p [1]	**Mean ± SD**	p [2]
Reasons to visit OPD *				<0.001		<0.001
Without S-COVID-19-S	2560 (64.9)	2455 (67.2)	105 (35.7)		73.6 ± 15.2	
With S-COVID-19-S	1387 (35.1)	1198 (32.8)	189 (64.3)		62.1 ± 18.8	
Age, year				<0.001		<0.001
18–39	1788 (45.3)	1691 (46.3)	97 (33.0)		74.3 ± 15.6	
40–59	1231 (31.2)	1158 (31.7)	73 (24.8)		69.6 ± 17.1	
≥60	928 (23.5)	804 (22.0)	124 (42.2)		60.6 ± 17.9	
Gender				0.171		<0.001
Women	2197 (55.7)	2022 (55.4)	175 (59.5)		68.3 ± 17.7	
Men	1747 (44.3)	1628 (44.6)	119 (40.5)		71.2 ± 17.1	
Marital status				0.957		<0.001
Never married	865 (22.0)	800 (22.0)	65 (22.1)		75.3 ± 15.5	
Ever married	3070 (78.0)	2841 (78.0)	229 (77.9)		67.9 ± 17.6	
Education				<0.001		<0.001
Elementary school or Illiterate	347 (8.8)	294 (8.1)	53 (18.0)		55.1 ± 19.7	
Junior high school	869 (22.1)	820 (22.5)	49 (16.7)		68.3 ± 16.4	
Senior high school	1083 (27.5)	1021 (28.0)	62 (21.1)		72.3 ± 15.5	
College/university or above	1639 (41.6)	1509 (41.4)	130 (44.2)		71.5 ± 17.2	
Occupation				0.108		<0.001
Employed	753 (19.2)	700 (19.3)	53 (18.1)		72.6 ± 17.9	
Own business	1402 (35.7)	1311 (36.1)	91 (31.1)		69.7 ± 17.2	
Others	1770 (45.1)	1621 (44.6)	149 (50.9)		68.1 ± 17.3	
Ability to pay for medication				<0.001		<0.001
Very or fairly difficult	1764 (44.7)	1589 (43.5)	175 (59.5)		65.1 ± 17.8	
Very or fairly easy	2182 (55.3)	2063 (56.5)	119 (40.5)		73.2 ± 16.3	
Social status				<0.001		<0.001
Low	482 (12.2)	396 (10.8)	86 (29.3)		59.5 ± 18.3	
Middle or high	3464 (87.8)	3256 (89.2)	208 (70.7)		71.0 ± 16.9	
BMI, kg/m^2				0.085		0.241
Normal weight (BMI < 25.0)	3514 (89.1)	3244 (88.9)	270 (92.2)		69.5 ± 17.7	
Overweight/obese (BMI ≥ 25.0)	428 (10.9)	405 (11.1)	23 (7.8)		70.5 ± 15.6	
Comorbidity				0.034		<0.001

Table 1. *Cont.*

	Total (n = 3947)	PHQ < 10 (n = 3653)	PHQ ≥ 10 (n = 294)		HRQoL	
	Frequency (%)	Frequency (%)	Frequency (%)	p [1]	Mean ± SD	p [2]
None	3309 (84.4)	3076 (84.8)	233 (80.1)		70.8 ± 16.8	
One or more	611 (15.6)	553 (15.2)	58 (19.9)		63.3 ± 19.4	
Smoking				0.583		0.662
Smoke	471 (12.0)	433 (11.9)	38 (13.0)		69.9 ± 18.4	
No smoke	3465 (88.0)	3210 (88.1)	255 (87.0)		69.6 ± 17.3	
Drinking alcohol				0.379		0.080
Drink	1257 (32.1)	1170 (32.3)	87 (29.8)		70.3 ± 17.2	
No drink	2658 (67.9)	2453 (67.7)	205 (70.2)		69.3 ± 17.6	
Eating behavior **				<0.001		0.642
Eat less healthy or unchanged	2931(74.6)	2686 (73.9)	245 (83.6)		69.6 ± 17.8	
Eat healthier	996 (25.4)	948 (26.1)	48 (16.4)		69.9 ± 16.4	
Physical activity, MET-min/wk				<0.001		<0.001
Tertile 1 (0.0–748.5)	1314 (33.3)	1159 (31.7)	155 (52.7)		65.3 ± 19.1	
Tertile 2 (≥748.5–3399.0)	1316 (33.3)	1244 (34.1)	72 (24.5)		70.7 ± 16.1	
Tertile 3 (≥3399.0–4453.8)	1317 (33.4)	1250 (34.2)	67 (22.8)		72.7 ± 16.2	
HL index, mean ± SD	29.9 ± 7.7	30.4 ± 7.5	24.5 ± 8.4	<0.001		
HRQoL score, mean ± SD	69.6 ± 17.5	71.3 ± 16.5	48.1 ± 14.5	<0.001		

Abbreviations: PHQ, patient health questionnaire; HRQoL, health-related quality of life; SD, standard deviation; OPD, outpatient department; S-COVID-19-S, suspected corona virus disease-2019 symptoms; BMI, body mass index; MET-min/week, metabolic equivalent task scored in minute per week; HL, health literacy. [1] Result of Chi-square test. [2] Result of ANOVA test. * The suspected COVID-19 symptoms including common symptom (fever, cough, dyspnea), less common symptom (myalgia, fatigue, sputum production, confusion, headache, sore throat, rhinorrhea, chest pain, hemoptysis, diarrhea, and nausea/vomiting). ** People were asked whether their eating behavior is getting worse, better, or unchanged during COVID-19 outbreak as compared to those before the outbreak.

3.2. Depression

In the bivariate analysis, the odds of depression were significantly higher in people with S-COVID-19-S, aged 60 years or above, and with comorbidity ($p < 0.05$; Table 2). The odds of depression were significantly lower in people with higher education attainment, who found it very or fairly easy to pay for medication, with middle or high social status, who ate healthier, had more physical activity, and had a higher HL as compared to their counterparts ($p < 0.05$; Table 2). In multivariate analysis, as compared to the people without S-COVID-19-S, those people with S-COVID-19-S had a higher likelihood of depression (odds ratio, OR, 2.88; 95% confidence interval, 95%CI, 2.18, 3.80, $p < 0.001$). People with college/university or above educational attainment had higher odds of depression as compared to those people with elementary school/illiterate attainment (OR, 2.12; 95%CI, 1.34, 3.35, $p = 0.001$). In comparison to the people who had a low social status, ate less healthy or unchanged, had less physical activity (tertile 1), those people with middle or high social status (OR, 0.45; 95%CI, 0.33, 0.63, $p < 0.001$), ate healthier (OR, 0.59; 95%CI, 0.42, 0.83, $p = 0.003$), had more physical activity (OR, 0.59; 95%CI, 0.42, 0.82, $p = 0.001$ for tertile 2; OR, 0.56; 95%CI, 0.40, 0.78, $p = 0.001$ for tertile 3) had lower odds of depression, respectively (Table 2). People with higher HL score had lower odds of depression (OR, 0.91; 95%CI, 0.90, 0.93, $p < 0.001$; Table 2).

Table 2. Determinants of depression and health-related quality of life among people visiting outpatient department (n = 3947).

	Depression (PHQ ≥ 10)				HRQoL			
	Bivariate		Multivariate		Bivariate		Multivariate	
	OR (95%CI)	p	OR (95%CI)	p	B (95%CI)	p	B (95%CI)	p
Reasons to visit OPD *								
Without S-COVID-19-S	1.00		1.00		0.00		0.00	
With S-COVID-19-S	3.69 (2.88, 4.73)	<0.001	2.88 (2.18, 3.80)	<0.001	−11.53 (−12.61, −10.45)	<0.001	−7.92 (−8.95, −6.89)	<0.001
Age, year, mean ± SD								
18–39	1.00		1.00		0.00		0.00	
40–59	1.10 (0.80, 1.50)	0.554	0.81 (0.56, 1.15)	0.244	−4.71 (−5.91, −3.50)	<0.001	−0.91 (−2.11, 0.30)	0.141
≥60	2.69 (2.04, 3.55)	<0.001	1.15 (0.79, 1.68)	0.464	−13.65 (−14.96, −12.33)	<0.001	−3.60 (−5.13, −2.08)	<0.001
Gender								
Women	1.00		1.00		0.00		0.00	
Men	0.85 (0.66, 1.08)	0.171	0.92 (0.71, 1.20)	0.556	2.85 (1.76, 3.95)	<0.001	1.89 (0.82, 2.95)	0.001
Marital status								
Never married	1.00				0.00		0.00	
Ever married	0.99 (0.75, 1.32)	0.957			−7.31 (−8.61, −6.02)	<0.001	−2.82 (−4.12, −1.51)	<0.001
Education								
Elementary school or Illiterate	1.00		1.00		0.00		0.00	
Junior high school	0.33 (0.22, 0.50)	<0.001	0.72 (0.45, 1.16)	0.175	13.20 (11.11, 15.28)	<0.001	6.82 (4.85, 8.78)	< 0.001
Senior high school	0.34 (0.23, 0.50)	<0.001	1.24 (0.78, 1.99)	0.363	17.15 (15.12, 19.17)	<0.001	6.70 (4.71, 8.69)	<0.001
College/university or higher	0.48 (0.34, 0.67)	<0.001	2.12 (1.34, 3.35)	0.001	16.40 (14.45, 18.35)	<0.001	4.70 (2.66, 6.75)	<0.001
Occupation								
Employed	1.00				0.00		0.00	
Own business	0.92 (0.65, 1.30)	0.627			−2.88 (−4.42, −1.34)	<0.001	2.25 (0.73, 3.77)	0.004
Others	1.21 (0.88, 1.68)	0.243			−4.53 (−6.01, −3.05)	<0.001	0.18 (−1.26, 1.61)	0.808
Ability to pay for medication								
Very or fairly difficult	1.00		1.00		0.00		0.00	
Very or fairly easy	0.52 (0.41, 0.67)	<0.001	1.02 (0.77, 1.34)	0.909	8.13 (7.06, 9.19)	<0.001	2.75 (1.74, 3.76)	<0.001
Social status								
Low	1.00		1.00		0.00		0.00	
Middle or high	0.29 (0.22, 0.39)	<0.001	0.45 (0.33, 0.63)	<0.001	11.54 (9.92, 13.17)	<0.001	4.62 (3.09, 6.15)	<0.001
BMI, kg/m^2								
Normal weight (BMI < 25.0)	1.00		1.00		0.00			

Table 2. *Cont.*

	Depression (PHQ ≥ 10)				HRQoL			
	Bivariate		Multivariate		Bivariate		Multivariate	
	OR (95%CI)	*p*	OR (95%CI)	*p*	B (95%CI)	*p*	B (95%CI)	*p*
Overweight/obese (BMI ≥ 25.0)	0.68 (0.44, 1.06)	0.087	0.90 (0.57, 1.44)	0.669	1.05 (−0.71, 2.80)	0.241		
Comorbidity								
None	1.00		1.00		0.00		0.00	
One or more	1.39 (1.02, 1.87)	0.034	0.98 (0.69, 1.39)	0.907	−7.44 (−8.93, −5.96)	<0.001	−2.81 (−4.18, −1.45)	<0.001
Smoking								
Smoke	1.00				0.00			
No smoke	0.91 (0.64, 1.29)	0.583			−0.38 (−2.06, 1.31)	0.662		
Drinking alcohol								
Drink	1.00				0.00		0.00	
No drink	1.12 (0.87, 1.46)	0.379			−1.05 (−2.22, 0.13)	0.080	1.74 (0.61, 2.87)	0.003
Eating behavior *								
Eat less healthy or unchanged	1.00		1.00		0.00			
Eat healthier	0.56 (0.40, 0.76)	<0.001	0.59 (0.42, 0.83)	0.003	0.30 (−0.96, 1.55)	0.642		
Physical activity, MET-min/wk								
Tertile 1 (0.0–748.5)	1.00		1.00		0.00		0.00	
Tertile 2 (≥748.5–3399.0)	0.43 (0.32, 0.58)	<0.001	0.59 (0.42, 0.82)	0.001	5.44 (4.12, 6.75)	<0.001	1.11 (−0.08, 2.29)	0.067
Tertile 3 (≥3399.0–44538)	0.40 (0.30, 0.54)	<0.001	0.56 (0.40, 0.78)	0.001	7.37 (6.05, 8.68)	<0.001	2.72 (1.52, 3.92)	<0.001
HL index (1 score increment)	0.91 (0.90, 0.93)	<0.001	0.93 (0.91, 0.95)	<0.001	0.94 (0.87, 1.00)	<0.001	0.59 (0.52, 0.66)	<0.001

Abbreviations: PHQ, patient health questionnaire; HRQoL, health-related quality of life; OR, odd ratio; B, regression coefficient; CI, confidence interval; OPD, outpatient department; S-COVID-19-S, suspected corona virus disease-2019 symptoms; BMI, body mass index; MET-min/week, metabolic equivalent task scored in minute per week; HL, health literacy. * People were asked whether their eating behavior is getting worse, better, or unchanged during Covid-19 outbreak as compared to those before the outbreak.

3.3. Health-Related Quality of Life

In the bivariate analysis, the HRQoL score was significantly lower in people with S-COVID-19-S, older age, ever married, had own business or others, with comorbidity ($p < 0.05$; Table 2). The HRQoL score was significantly higher in men and in people with higher education attainment, with better ability to pay for medication, with middle or high social status, who did more physical activity, and who had higher HL as compared to their counterparts ($p < 0.05$; Table 2). In multivariate analysis, the HRQoL score was significantly lower in the people with S-COVID-19-S (regression coefficient, B, −7.92; 95% confidence interval, 95%CI, −8.95, −6.89, $p < 0.001$), aged 60 years or older (B, −3.60; 95%CI, −5.13, −2.08, $p < 0.001$), ever married (B, −2.82; 95%CI, −4.12, −1.51, $p < 0.001$), with comorbidity (B, −2.81; 95%CI, −4.18, −1.45, $p < 0.001$; Table 2). The HRQoL score was significantly higher in men (B, 1.89; 95%CI, 0.82, 2.95, $p = 0.001$), and in people with higher education attainment (B, 6.82; 95%CI, 4.85, 8.78, $p < 0.001$ for junior high school; B, 6.70; 95%CI, 4.71, 8.69, $p < 0.001$ for senior high school; and B, 4.70; 95%CI, 2.66, 6.75, $p < 0.001$ for college/university or higher), in people with their own business (B, 2.25; 95%CI, 0.73, 3.77, $p = 0.004$), in people with better ability to pay for medication (B, 2.75; 95%CI, 1.74, 3.76, $p < 0.001$), in people with middle or high social status (B, 4.62; 95%CI, 3.09, 6.15, $p < 0.001$), in people who did not drink (B, 1.74; 95%CI, 0.61, 2.87, $p = 0.003$), in those who did more physical activity (B, 2.72; 95%CI, 1.52, 3.92, $p < 0.001$ for the 3rd tertile), and in people with higher HL (B, 0.59; 95%CI, 0.52, 0.66, $p < 0.001$; Table 2).

3.4. Effect Modification of Health Literacy

The results of interaction analysis showed that as compared to people without S-COVID-19-S and low HL, those people with S-COVID-19-S and low HL had a 9.70 times higher likelihood of depression (OR, 9.70; 95%CI, 4.02, 23.41, $p < 0.001$) and a 20.62 lower HRQoL score (B, −20.62; 95%CI, −24.63, −16.62, $p < 0.001$); for people without S-COVID-19-S, 1 score increment of HL resulted in 5% lower likelihood of depression (OR, 0.95; 95%CI, 0.93, 0.97, $p < 0.001$) and 0.45 higher HRQoL score (B, 0.45; 95%CI, 0.37, 0.54, $p < 0.001$), while for those people with S-COVID-19-S, 1 score increment of HL had 4% lower likelihood of depression (OR, 0.96; 95%CI, 0.93, 0.99, $p = 0.004$) and 0.43 higher HRQoL score (B, 0.43; 95%CI, 0.30, 0.57, $p < 0.001$; Table 3). Since it is suspected that people with low HL, presenting less common symptoms only, may not suspect COVID-19 infection, we conducted a sensitivity analysis for the sample with less common symptoms excluded ($n = 700$). The results showed that the effect modification of HL on depression and HRQoL remained significant (Table S1).

Table 3. Interaction effect of suspected Covid-19 symptoms and health literacy on depression and health-related quality of life (n = 3947).

Interaction	Depression (PHQ ≥ 10)				HRQoL			
	Model 1		Model 2		Model 1		Model 2	
	OR (95%CI)	*p*	OR (95%CI)	*p*	B (95%CI)	*p*	B (95%CI)	*p*
Without S-COVID-19-S	1.00		1.00		0.00		0.00	
With S-COVID-19-S	12.09 (5.06, 28.89)	<0.001	9.70 (4.02, 23.41)	<0.001	−24.88 (−28.86, −20.90)	<0.001	−20.62 (−24.63, −16.62)	<0.001
HL index (1-score increment)	0.95 (0.93, 0.97)	<0.001	0.95 (0.93, 0.97)	<0.001	0.66 (0.58, 0.73)	<0.001	0.45 (0.37, 0.54)	<0.001
With S-COVID-19-S × HL index (1-score increment)	0.95 (0.92, 0.98)	0.001	0.96 (0.93, 0.99)	0.004	0.54 (0.41, 0.68)	<0.001	0.43 (0.30, 0.57)	<0.001

Abbreviations: PHQ, patient health questionnaire; HRQoL, health-related quality of life; OR, odd ratio; B, regression coefficient; CI, confidence interval; S-COVID-19-S, suspected corona virus disease-2019 symptoms; HL, health literacy. Model 1: interaction between S-COVID-19-S and health literacy, Model 2: interaction between S-COVID-19-S and health literacy after adjusted for education, social status, eating behavior, and physical activity, as analyzed for depression; adjusted for age, gender, marital status, education, occupation, ability to pay for medication, social status, comorbidity, drinking and physical activity as analyzed for HRQoL.

4. Discussion

The most important finding of the current study was that people with S-COVID-19-S had a higher likelihood of depression and lower HRQoL. Fortunately, those people having S-COVID-19-S and with higher HL had a low occurrence of depression and better HRQoL compared to those people with lower HL. Health literacy was found to be a protective factor for improving depression and HRQoL during the COVID-19 epidemic, especially for those who have S-COVID-19-S. To improve health literacy and control the disease and its consequences during the outbreak, governments must firstly recognize COVID-19 as an emergency public health concern [5], and find the balance between public health and civil liberties [57], as well as cultural sensitivity [58]. The government needs to provide the public with updated, timely, accurate, transparent, brief, simple information and knowledge regarding the epidemic, pathogenicity, and transmissibility which help with better controlling the disease [58,59]. In Vietnam, the leaders of the government have been leading the government in actions against COVID-19 directly [60]. The healthcare and public health communities and global and domestic public health preparedness capacity buildings need to be sustained and strengthened in order to effectively respond to the epidemic [61,62]. The ministry of health of Vietnam has been directing all healthcare institutions at all levels and collaborating with other sectors to communicate with the public, in order to prevent and control the disease [7]. These messages apply for every government, especially in Vietnam, a country with the lowest HL level among all studied Asian countries [29,30]. The main reason for the low HL level may be linked with accessibility of reliable information. Therefore, it is critical for the government and the ministry of health to provide accessible platforms with official and reliable information regarding the COVID-19 pandemic. In addition, it is suggested that people should enhance their life-long learning behaviors (e.g., watching health-related television programs, reading official websites) to improve individual health literacy [63]. The above may further contribute to preventing and controlling infectious diseases [64,65].

We also found that older people had a lower HRQoL score compared to the younger age groups. This was consistent with previous studies in Vietnam [66–68]. Furthermore, men had a better HRQoL score than women did, which was found in the current study and in previous studies [68,69]. People with comorbidities had a lower HRQoL score than those people without, which was in the line with previous studies [68,70,71]. In respiratory patients, those who suffer from at least one chronic condition were significantly associated with decreased HRQoL [72].

The present study shows that people who have attained college/university level of education or above had a higher prevalence of depression. Members of this group usually have jobs and have to work every day, while their children's schools have postponed the new semester [73]. Going to work and/or taking care of children during the pandemic creates a burden of stress which further affects their HRQoL, as found in the current study. Therefore, people with education at college/university level or above had slightly lower HRQoL as compared to those with high school levels of education [71]. Nevertheless HRQoL was still higher in people with higher levels of educational attainment in the current study and in the previous one [68]. Furthermore, people who had ever married had lower HRQoL. Logically, people who had their own businesses had better HRQoL than those who employed. In addition, participants with middle or high social status had a lower likelihood of depression and better HRQoL. People with higher social status are likely wealthier. The present study demonstrates that people with a better ability to pay for medication had better HRQoL. Similarly, previous studies have shown that higher income is positively associated with higher HRQoL in the general population [68,71].

Physical activity was positively associated with HRQoL, whereby people with more physical activity had better HRQoL [68]. Physical activity was also summarized as a protective factor of depression [74], and exercise is suggested to be an effective treatment for depression [75]. In addition, people who did not drink had better HRQoL than those who drank alcohol. The association between alcohol consumption and reduced HRQoL has been found in previous studies [76–78]. Healthy eating was associated with a lower likelihood of depression in the current study. Previous studies have elucidated that higher diet quality is associated with a lower risk of depression [79,80]. Dietary

intake has been recommended for prevention of depression [81,82]. Therefore, healthy lifestyles are highly recommended to preventing depression and improving the quality of life during the COVID-19 pandemic.

There are limitations in the current study. Firstly, the study was conducted during the global COVID-19 outbreak, and both interviewers and the studied participants were vulnerable to coronavirus infection. This requires great effort on the parts of institutions, researchers, and assistants in order to strictly follow the safety guidelines during data collection. Fortunately, there no new cases were detected during the data collection period [7]. Secondly, causal relationships cannot be determined from this cross-sectional study. The sample size was adequate for exploring the associations and interactions that provide substantial evidence and directions for future studies and public health interventions for controlling the disease.

5. Conclusions

During the global COVID-19 pandemic, people with S-COVID-19-S were more likely to have depression and low HRQoL. Meanwhile, higher HL was associated with a lower depression likelihood and higher HRQoL. Importantly, a potential benefit of HL was found in that it can help to protect the mental health and HRQoL of people with S-COVID-19-S during the pandemic. Further studies are required to explore the benefits of HL in healthcare providers and medical students. Efforts of individuals and governments to improve health literacy can significantly contribute to COVID-19 prevention and control.

Supplementary Materials: The following are available online at http://www.mdpi.com/2077-0383/9/4/965/s1, Table S1: Interaction effect of common suspected Covid-19 symptoms and health literacy on depression and health-related quality of life.

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