Cardiovascular Health Behaviors for Co-Morbid Anxiety and Depression Among Patients with Hypertension

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Research article

Abstract

Background: Anxiety and depression in hypertensive patients may lead to poor blood pressure control and increases the risk of disease mortality. Lifestyle impacts depression and anxiety. This study aimed to assess cardiovascular health behaviors (CHBs) associated with co-morbid anxiety and depression among patients with hypertension.

Methods: We included 488 hypertensive patients from Changsha, China. We measured anxiety and depression using the self-rating anxiety scale (SAS), and the self-rating depression scale (SDS), respectively. CHBs (smoking, overweight/obesity, leisure physical activity (LPA), and fruit and vegetable consumption (FVC)) were assessed using the Cardiovascular Health in Ambulatory Care Research Team (CANHEART) index. We compared anxiety and depression prevalence of participants in different socio-demographic, CHBs, co-morbidities, family histories, assessed risk factors and their biological synergistic interaction.

Results: The proportion of not ideal in smoking, overweight/obesity, LPA, and FVC were 63.9%, 49.8%, 30.7%, 78.3%, respectively. Displaying comorbidity of HLP and not obtaining adequate amounts of LPA were risk factors for both anxiety and depression. The synergy interaction between obtaining secondary education or less and displaying comorbidity of hyperlipidemia (HLP) for anxiety (OR=5.238, 95% CI=2.784, 9.856), and between not obtaining adequate amounts of LPA and obtaining manual labor for depression (OR=7.164, 95% CI=3.553, 14.443) was statistically significant.

Conclusion: Our study indicated that doctors should pay more attention to the psychiatric health of hypertensive patients at lower education levels and with second comorbidities. More importantly, patients with hypertension working on manual jobs need to pay closer attention to how they spend their leisure time and strengthen LPA.

Background

High blood pressure is the most leading risk factor for global disease burden (1). China PEACE Million Person Project reported that 44.7% of the Chinese adults aged 35–75 years had hypertension, of whom 44.7% were aware of their diagnose, 30.1% were being treated, and only 7.2% had achieved control of their blood pressure (2). The risk factors for hypertension consist of lifestyle and genetic factors (3). Positive lifestyle modifications may potentially help to control high blood pressure in several studies, such as diet (4), weight control, regular physical activity, no alcohol use, and sufficient sleep time (5, 6).

Several studies indicate the association between psychiatric comorbidities and hypertension (7, 8). Patients with depression display a higher risk of developing hypertension (9, 10), and reviews concluded a positive relationship between comorbid anxiety and hypertension (11–13). Hypertension was diagnosed earlier in patients with depression and anxiety than in patients with neither psychological illness (14). Prevalence of depression and anxiety in patients with hypertension were reported about 4.8%-69.4% (15) and 8.9–55.3% (16) in a meta-analysis, respectively. There is a negative relationship between depression and blood pressure control in patients with hypertension (17, 18), and anxiety may mediate the relationship between emotional reactivity and blood pressure elevations (19). The World Health Organization Global Burden of Disease Survey estimated that major depression will be the second leading cause of disability by the year 2020 (20). Studies have found that hypertensive patients with anxiety or depression may display increased healthcare utilization (21) and the treatment of depression or anxiety disorders in individuals with hypertension may help improve medication adherence rates and healthcare outcomes (22).

Depression and anxiety appeared to lead to unhealthy lifestyles in rising studies, included physical inactivity, unhealthy diet, smoking habits (23), higher calorie intake, and body fat (24). Studies indicated that lifestyle changes had the potential to reduce the risk or symptoms of depression and anxiety (25, 26). Physically active people have a reduced tendency to develop depression over time, and aerobic exercise was founded more effective than occupational therapy for depression (27).

Although numerous studies have hypothesized about a relationship between lifestyle and psychological illness, there have been few studies that reported the influences of lifestyle among patients with hypertension co-morbid anxiety and depression,

and the exploration of risk factors in co-morbid hypertensive patients is rare. This study aimed to explore cardiovascular health behaviors (smoking, overweight/obesity, LPA, and FVC) and comorbidities (diabetes mellitus (DM), HLP, and cardiovascular disease other than stroke (CVD)) that associated with anxiety and depression among patients with hypertension, to develop a tailored intervention for the hypertension cases.

Methods

Study design

This cross-sectional study was conducted from January to June 2018, with a total of 488 patients with hypertension that had been recruited from hospital cardiology outpatient clinics. Patients were asked to complete an electronic questionnaire and the data were collected anonymously. Investigators provided detailed instructions for filling and checked for integrity after submission. The following inclusion criteria were used: (1) 18 years or elder, (2) with hypertension, (3) commitment to complete the questionnaire. Hypertension was defined as systolic blood pressure ≥ 140 mmHg, and/or diastolic blood pressure ≥ 90 mmHg when measured three times on different days. Alternatively, patients met the inclusion criteria if they were already being treated for hypertension [9]. Exclusion criteria were: (1) marked cognitive impairment, (2) active suicidal intent or plan, (3) inability to speak Chinese. This study was approved by the Human Ethics Committee of the Third Xiangya Hospital.

Measures

The questionnaire was used to collect the information described below.

Zung's Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS): The main outcomes were anxiety and depression, which were assessed using the SAS and SDS, respectively. Both the SAS and the SDS are 20 item Likert scales, which are measured on a 4-point (1–4) scale. Items refer to affective and somatic symptoms. For SAS, 15 items express a negative experience, and 5 express a positive experience and are reverse scored. SDS, on the other hand, includes 10 items that express a negative experience, and 10 that express a positive experience and are reverse scored. For both the SAS and SDS, the total raw score ranges from 20 to 80, which is converted to an index score by multiplying 1.25. The cut-off points are usually used as an index score of 45 and above (raw score 36 and above) for anxiety and an index score of 50 and above (raw score 40 and above) for depression (28).

Cardiovascular Health Factors and Behaviors: The CANHEART index is a tool for measuring cardiovascular health using data from the Canadian Community Health Survey. There are 6 cardiovascular health factors/behaviors (smoking, overweight/obesity, LPA, FVC, diabetes, and hypertension) in the CANHEART index for adults aged 20 years and older, and 4 health factors/behaviors (smoking, overweight/obesity, LPA, and FVC) for youth aged 12–19 years. This study used the CANHEART index as a reference to explore the relationship between cardiovascular health behaviors and depression or anxiety disorder among patients with hypertension. We used the 4 items from both the adult and youth CANHEART index as behavior-related risk factors for patients aged 18 years and older. The values were 0 (not ideal) and 1(ideal) for each item. Ideal cardiovascular health for these 4 items was defined as follows: (1) Smoking: nonsmoker or former daily or occasional smoker who quit more than 12 months ago for adults, and never tried smoking or never smoked a whole cigarette for youth. (2) Overweight/obesity: body mass index (BMI) < 25 kg/m^2, and BMI was recorded as Underweight < 18.5 kg/m2, Normal 18.5–24.9 kg/m2, Normal 18.5–24.9 kg/m2, Obesity ≥ 30 kg/m2. (3) LPA: ≥ 1.5 kcal/kg/d (equivalent to ≥ 30 min of walking per d) for adults, and ≥ 3.0 kcal/kg/d (equivalent to ≥ 60 min of walking or 20 min of running/jogging per d) for youths. (4) FVC: fruit and vegetables consumed ≥ 5 times per d. Not ideal means one or more of the above conditions are not satisfied (29).

Independent variables: The independent variables included socio-demographic characteristics (age, sex, marital status, education, occupation, and residential location), co-morbidities, and family history. Age categories were recorded as 18–44 years, 45–59 years, 60–75 years, or 75 ~ years. Marital status was recorded as never married, married, or

separated/divorced/widowed. Education was grouped as secondary or less, or pre-college or more. The occupation was recorded as mental labor or manual labor. Residential location was recorded as urban or rural. Co-morbidities included DM, HLP, and CVD. Family history included family history of hypertension (FM-HYP) and cardiovascular disease (FM-CVD).

Statistical Analysis

Continuous variables were presented as mean ± standard deviation (SD) and categorical variables were summarized as proportions. We compared continuous factors using Student's t-tests and compared categorical variables using chi-square or Fisher's exact tests. For those with obviously skewed distribution, median (1st quartile, 3rd quartile) was utilized to describe their features, and comparisons in the two sets were carried out with Mann-Whitney U tests. We used bivariate logistic regression models to uncover factors associated with, 1) anxiety among hypertension patients (yes = 1/no = 0), 2) depression among hypertension patients (yes = 1/no = 0). Determinants were selected from potential variables using the stepwise binary logistic regression forward likelihood ratio. The interaction effects between determinants were calculated using three metrics for biological synergistic interaction: RERI, the relative excess risk due to interaction; AP, the attributable proportion due to interaction; and S, the synergy index, RERI CI > 0, AP CI > 0, S CI > 1 at the same time were set as a significant level of biological interaction (30). All tests were two-sided and $p < 0.05$ was set as the significant level. All data management and statistical analyses were carried out using SPSS version 21.0 (IBM SPSS Statistics, IBM Corporation).

Results

Study population

A total of 488 patients with hypertension completed the questionnaire. The mean age of the participants was 52.1 years and 62.9% of the sample was male. 88.9% of the sample was married, and 59.8% with secondary education or less. About 56.1% of patients undertaken mental labor and about 70.1% lived in urban areas. DM, HLP, and CVD were present in 20.7%, 40.6%, and 38.7% of the patients, respectively. More than half of the participants had an FM-HYP (55.1%), and about a third of the sample had an FM-CVD (32.6%) (Table 1).

Table 1
Characteristics and bivariate logistic regression for anxiety and depression in patients with hypertension in Hunan, China, 2018 (N = 488)

Variable	Total	Anxiety	No anxiety	OR(95%CI)	Depression	No depression	OR(95%CI)
	%	%	%		%	%	
N(%)	488	152(31.1)	336(68.9)	—	178(36.5)	310(63.5)	—
Demographic characteristics							
Mean Age	52.1	55.0 ± 14.3	50.7 ± 15.3	0.004	54.0 ± 15.8	51.0 ± 14.7	0.030
Age categories							
18−44	29.5	23.0	32.4	1.0	28.7	30.0	1.0
45−59	35.9	33.6	36.9	1.281(0.776, 2.115)	28.1	40.3	0.729(0.454, 1.171)
60−74	28.7	37.5[a]	24.7	2.139(1.286, 3.557)*	36.0[b]	24.5	1.536(0.953, 2.473)
75	5.9	5.9	6.0	1.401(0.585, 3.359)	7.3	5.2	1.482(0.661, 3.323)
Sex							
Male	62.9	55.9	66.1	1.0	60.1	64.5	1.0
Female	37.1	44.1	33.9	1.535(1.037, 2.271)*	39.9	35.5	1.206(0.825, 1.764)
Marital status							
Never married	9.4	9.2	9.5	1.0	10.1	9.0	1.0
Married	88.9	88.2	89.3	1.021(0.528, 1.976)	87.1	90.0	0.864(0.463 1.613)
Separated, divorced, windowed	1.6	2.6	1.2	2.286(0.499, 10.467)	2.8	1.0	2.593(0.551, 12.203)
Education							
Secondary or less	59.8	72.4	54.2	2.216(1.463, 3.357)**	68.5	54.8	1.794(1.218, 2.643)*
Pre-college or more	40.2	27.6	45.8	1.0	31.5	45.2	1.0
Occupation							
Mental labor	56.1	43.4	61.9	1.0	47.2	61.3	1.0
Manual labor	43.9	56.6	38.1	2.117(1.435, 3.124)**	52.8	38.7	1.772(1.221, 2.572)*
Residential location							

Notes: **p < 0.001, *p < 0.05.

Abbreviations: DM: Diabetes mellitus; HLP: Hyperlipidemia; CVD: Cardiovascular disease other than stroke; FM-HYP: Family history of hypertension; FM-CVD: Family history of cardiovascular disease; LPA: Leisure physical activity, FVC: Fruit and vegetable consumption.

Variable	Total	Anxiety	No anxiety	OR(95%CI)	Depression	No depression	OR(95%CI)
Urban	70.1	63.8	72.9	1.0	67.4	71.6	1.0
Rural	29.9	36.2	27.1	1.527(1.014, 2.298)*	32.6	28.4	1.219(0.818, 1.817)
Co-morbidities							
DM							
No	79.3	72.4	82.4	1.0	73.0	82.9	1.0
Yes	20.7	27.6	17.6	1.793(1.139, 2.820)*	27.0	17.1	1.790(1.149, 2.791)*
HLP							
No	59.4	42.1	67.3	1.0	48.3	65.8	1.0
Yes	40.6	57.9	32.7	2.825(1.904, 4.191)**	51.7	34.2	2.059(1.413, 2.999)**
CVD							
No	61.3	50.0	66.4	1.0	53.4	65.8	1.0
Yes	38.7	50.0	33.6	1.973(1.336, 2.916)*	46.6	34.2	1.681(1.154, 2.450)*
Family history							
FM-HYP							
No	44.9	42.8	45.8	1.0	46.6	43.9	1.0
Yes	55.1	57.2	54.2	1.133(0.770,1.667)	53.4	56.1	0.895(0.618, 1.295)
FM-CVD							
No	67.4	62.5	69.6	1.0	66.9	67.7	1.0
Yes	32.6	37.5	30.4	1.376(0.920, 2.058)	33.1	32.3	1.041(0.703, 1.542)
Cardiovascular health behaviors							
Smoking							
Ideal	36.1	36.2	36.0	1.0	36.5	35.8	1.0
Not ideal	63.9	63.8	64.0	0.993(0.666, 1.479)	63.5	64.2	0.970(0.661, 1.423)
Overweight/Obesity							
Ideal	50.2	48.7	50.9	1.0	53.9	48.1	1.0

Notes: **p < 0.001, *p < 0.05.

Abbreviations: DM: Diabetes mellitus; HLP: Hyperlipidemia; CVD: Cardiovascular disease other than stroke; FM-HYP: Family history of hypertension; FM-CVD: Family history of cardiovascular disease; LPA: Leisure physical activity, FVC: Fruit and vegetable consumption.

Variable	Total	Anxiety	No anxiety	OR(95%CI)	Depression	No depression	OR(95%CI)
Not ideal	49.8	51.3	49.1	1.092(0.745, 1.603)	46.1	51.9	0.791(0.546, 1,144)
LPA							
Ideal	69.3	53.3	76.5	1.0	55.6	77.1	1.0
Not ideal	30.7	46.7	23.5	2.852(1.899, 4.281)**	44.4	22.9	2.686(1.806, 3.995)**
FVC							
Ideal	21.7	18.4	23.2	1.0	25.8	19.4	1.0
Not ideal	78.3	81.6	76.8	1.339(0.827, 2.168)	74.2	80.6	0.689(0.444, 1.067)

Notes: **p < 0.001, *p < 0.05.

Abbreviations: DM: Diabetes mellitus; HLP: Hyperlipidemia; CVD: Cardiovascular disease other than stroke; FM-HYP: Family history of hypertension; FM-CVD: Family history of cardiovascular disease; LPA: Leisure physical activity, FVC: Fruit and vegetable consumption.

Cardiovascular Health Factors and Behaviors

The proportion of patients that not displayed the ideal status of smoking, overweight/obesity, leisure physical activity, and fruit and vegetable consumption behaviors were 63.9%, 49.8%, 30.7%, 78.3%, respectively (Table 1).

Anxiety and depression

The SAS and SDS results are shown in Table 1. The mean SAS and SDS index scores were 40.54 ± 8.91 (raw score was 32.43 ± 7.13) and 45.09 ± 12.11 (raw score was 36.07 ± 9.69). Overall, about 31.1% and 36.5% of all patients with hypertension showed a potential clinical diagnosis of anxiety and depression, respectively.

The following characteristics were shown to be potential risk factors for anxiety among patients with hypertension: 60−74 years, female, secondary education or less, a career in manual labor, residing in a rural area, the existence of comorbidities with DM, HLP, or CVD, and lack of leisure physical activity (p-values all < 0.05). Potential risk factors for depression in patients with hypertension were secondary education or less, a career in manual labor, the existence of comorbidities with DM, HLP, or CVD, and lack of leisure physical activity (p-values all < 0.05) (Table 1).

Results of bivariate logistic regression analysis for predictors of anxiety and depression are shown in Table 1. Patients 60−74 years, females, obtaining a secondary education or less, working in manual labor, residing in rural areas, displaying comorbidities such as DM, HLP, and CVD, and not obtaining adequate amounts of LPA were significantly associated with anxiety, displaying ORs of OR = 2.139, 95% CI = 1.286−3.557; OR = 1.535, 95% CI = 1.037−2.271; OR = 2.216, 95% CI = 1.463−3.557; OR = 2.117, 95% CI = 1.435−3.124; OR = 1.527, 95% CI = 1.014−2.298; OR = 1.793, 95% CI = 1.139−2.820; OR = 2.825, 95% CI = 1.904−4.191; OR = 1.973, 95% CI = 1.336−2.916; OR = 2.852, 95% CI = 1.899−4.281; respectively. Obtaining a secondary education or less, working in manual labor, displaying comorbidities such as DM, HLP, and CVD, and not obtaining adequate amounts of LPA were significantly associated with depression, displaying ORs of OR = 1.794, 95% CI = 1.218−2.643; OR = 1.772, 95% CI = 1.221−2.572; OR = 1.790, 95% CI = 1.149−2.791; OR = 2.059, 95% CI = 1.413−2.999; OR = 1.681, 95% CI = 1.154−2.450; OR = 2.686, 95% CI = 1.806−3.995, respectively (Table 1).

Stepwise logistic regression analysis

As shown in our stepwise logistic regression analysis forward likelihood ratio, female (aOR) = 1.794, 95% CI = 1.148, 2.801), obtaining a secondary education or less (aOR = 2.035, 95% CI = 1.296, 3.194), displaying comorbidity of HLP (aOR = 2.691,

95% CI = 1.775, 4.079), and not obtaining adequate amounts of LPA (aOR = 3.277, 95% CI = 2.101, 5.111) were predictors of anxiety; Obtaining manual labor (aOR = 1.828, 95% CI = 1.236, 2.704), displaying comorbidity of HLP (aOR = 1.848, 95% CI = 1.250, 2.730), and not obtaining adequate amounts of LPA were predictors of depression (aOR = 2.737, 95% CI = 1.816, 4.126) (Table 2).

Table 2
Multivariable logistic regression analysis for the determination of anxiety and depression in patients with hypertension in Hunan, China, 2018 (N = 488)

Variable	Model1(for anxiety)	Variable	Model2(for depression)
	adjust OR(95%CI)		adjust OR(95%CI)
Sex		Occupation	
Male	1.0	Mental labor	1.0
Female	1.794(1.148, 2.801)*	Manual labor	1.828(1.236, 2.704)*
Education		HLP	
Secondary or less	2.035(1.296, 3.194)*	No	1.0
Pre-college or more	1.0	Yes	1.848(1.250, 2.730) *
HLP		LPA	
No	1.0	Ideal	1.0
Yes	2.691(1.775, 4.079)**	Not ideal	2.737(1.816, 4.126) **
LPA			
Ideal	1.0		
No ideal	3.277(2.101, 5.111)**		

Note: **$p < 0.001$, *$p < 0.05$. For anxiety: Omnibus Test of Model Coefficients: $P < 0.001$; Model 1 are adjusted for age categories, sex, education, occupation, residential location, co-morbidities with DM, HLP, CVD, LPA; Model 2 are adjusted for education, occupation, co-morbidities with DM, HLP, CVD, LPA.

Nagelkerke R^2: 19.0%; Hosmer and Lemeshow test: 0.757; Overall prediction percentage: 72.7%; For depression: Omnibus Test of Model Coefficients: $P < 0.001$; Nagelkerke R^2: 12.0%; Hosmer and Lemeshow test: 0.291; Overall prediction percentage: model 2 = 67.2%.

Abbreviations: HLP: Hyperlipidemia; LPA: Leisure physical activity.

Interaction effects analysis

In patients with both hypertension and anxiety, the synergistic interaction between obtaining a secondary education or less and co-morbid HLP was statistically significant, and the proportion attributed to this interaction was 58.7% (interaction OR = 5.238, 95% CI = 2.784, 9.856; RERI = 3.076, 95% CI = 0.072−6.080; AP = 0.587, 95% CI = 0.301−0.873; S = 3.648, 95% CI = 1.169, 11.383). While, in patients with both hypertension and depression, the synergistic interaction between not obtaining adequate amounts of LPA and obtaining manual labor was statistically significant, and the proportion attributed to this interaction was 68.0% (interaction OR = 7.164〠95% CI = 3.553, 14.443; RERI = 4.871, 95% CI = 1.077−8.666; AP = 0.680, 95% CI = 0.490−0.870; S = 4.769, 95% CI = 1.589, 14.313) (Table 3).

Table 3
Interaction analysis between potential risk factors among hypertension patients with anxiety or depression in Hunan, China, 2018 (N = 488)

Disorder	Risk factor		OR (95%CI)	RERI (95%CI)	AP (95%CI)	S (95%CI)
Anxiety	Sex	Education	2.746(1.706, 4.420)	0.683(-0.969, 2.335)	0.249(-0.325, 0.823)	1.643(0.378, 7.139)
		HLP	4.899(2.712, 8.849)	1.579(-0.615, 3.773)	0.322(-0.050, 0.694)	1.681(0.776, 3,640)
		LPA	6.437(3.028, 13.681)	2.081(-0.772, 4.934)	0.323(-0.023, 0.669)	1.620(0.837, 3.1336)
	Education	HLP	5.238(2.784, 9.856)[***]	3.076(0.072, 6.080)	0.587(0.301, 0.873)	3.648(1.169, 11.383)
		LPA	7.345(3.735, 14.442)	3.592(-0.599, 7.782)	0.489(0.166, 0.812)	2.304(1.038, 5.118)
	HLP	LPA	6.959(3.633, 13.331)	1.198(-2.399, 4.795)	0.172(-0.283, 0.628)	1.252(0.651, 2.406)
Depression	Occupation	HLP	3.490(1.964, 6.201)	1.864(0.223, 3.505)	0.534(0.236, 0.832)	3.975(0.754, 20.951)
		LPA	7.164(3.553, 14.443)[***]	4.871(1.077, 8.666)	0.680(0.490, 0.870)	4.769(1.589, 14.313)
	HLP	LPA	4.943(2.580, 9.469)	1.225(-1.251, 3.700)	0.248(-0.170, 0.666)	1.451(0.695, 3.026)

Notes: [***]significant biological synergistic interaction; Sex, reference male; Education, reference pre-college and above; HLP: reference no; LPA, reference not ideal; Occupation, reference mental labor.

Abbreviations: HLP: Hyperlipidemia; LPA: Leisure physical activity.

Discussion

In this cross-sectional study, anxiety and depression appeared in 31.1% and 36.5% of patients with hypertension, respectively. Anxiety was associated with female, secondary education or less, comorbid HLP, and lack of LPA, and the results indicated that a synergistic interaction exists between comorbid HLP and secondary education or less. Depression was associated with manual labor, comorbid HLP, and lack of LPA, and the results indicated that a synergistic interaction exists between a manual labor career and lack of LPA.

In our study, the prevalence of depression in patients with hypertension was slightly higher than the pooled prevalence of 29.8% that was previously reported in a meta-analysis using the same scale (15). This difference was mainly due to the overestimation of depression rates when analyzing patients with hypertension in a hospital setting. The pooled rate of depression in patients with hypertension in a hospital setting was higher than the rate of depression in hypertension patients in the community (27.2% vs 26.3%, however not all studies used the same assessment). The prevalence of anxiety was ranged from 8.9–55.3%, as determined by different anxiety measures (16). Differences may also result from using different threshold scores for anxiety, and different patient's ages. However, there is no reported pooled prevalence of anxiety in patients with hypertension.

Hypertension, DM, and HLP are the three most common major chronic conditions that can lead to severe vascular events and deaths. The prevalence of concurrent hypertension and hypercholesterolemia was 6.3% in 2011–2012 and has increased significantly in the past 12 years (31). Emotional distress may occur in response to the disease manifestation, complications, progression, impact on self-image, and the need for continuous non-pharmacological and pharmacological treatment (32).

People diagnosed with chronic disease can have a lower quality of life, develop somatic symptoms, and experience role impairment, all of which may lead patients to develop feelings of distress. Anxiety is a common psychological problem in the general adult population, and it is not specifically related to hypertension, as other chronic illness is also associated with an increased incidence of anxiety or severity of anxiety symptoms (33). Taking into consideration the findings of this study, we suggest that the presence of a second chronic disease, especially HLP, may affect the ability of hypertension patients to control their emotions, and can lead to an increased risk of anxiety in hypertension patients.

It is well established that LPA is a critical component of a healthy lifestyle and that it plays an important role in the prevention of chronic diseases, including hypertension and HLP (34). A high prevalence of anxiety disorder (17.0%) and depression disorder (39.1%) were found in a sample of chronic disease patients from three Southeast Asian countries, of these patients, 39.0% engaged in low physical activity (35). People with chronic conditions are more likely to have anxiety or depressive disorders than the general population and are also more likely to partake in low levels of LPA. Physical activity has benefits for physical health, as well as for the treatment of depression. In this study, insufficient LPA is one of the risk factors that increased the incidence of both anxiety and depression in patients with hypertension, which is consistent with previous studies (36, 37).

In this study, we found that patients with lower levels of education were at a higher risk for anxiety in combination with hypertension. Additional studies have also uncovered this relationship between lower education and anxiety (38). Patients with a lower level of education may find it more difficult to get adequate information to control the illness and promote a healthy lifestyle. We also found that patients with hypertension that performed manual labor were at a higher risk for depression. Manual work is typically characterized by repetitive work, manual handling and prolonged static postures, and the need to work for a long time, with insufficient time for recovery. Workers in manual jobs are more likely to suffer from musculoskeletal disorders, which are also commonly associated with depressive symptoms (39).

Our study found that working a manual job and not partaking in sufficient LPA could increase the risk of depression among patients with hypertension independently. Moreover, the two factors also had a clear interaction on depression in patients with hypertension. When patients with hypertension worked a manual job and did not partake in LPA, the risk of depression was 7.164 times that of those who worked in non-manual jobs and partook in sufficient amounts of LPA. 68.0% of the results could be attributed to the interaction between labor style and leisure-time physical activity. Whereas the health effects of LPA are considered to be beneficial, the physical activity paradox suggests there are contrasting health effects for occupational physical activity and LPA (40), which could lead to the observed synergistic effect between manual labor and lack of LPA. A previous study revealed that both male and female manual workers may be less likely to engage in LPA (41), and both physical inactivity and sedentary lifestyle appear to be significantly related to symptoms of depression (36).

Our study has several limitations. Due to the cross-sectional design of this study, we cannot conclude the causal relationship between these two risk factors and depression among patients with hypertension. Secondly, although LPA was one of the potential risk factors in our initial design, LPA measurement guidelines are not detailed enough and need further structuring.

Conclusion

Our results, obtained from patients with hypertension recruited from hospital cardiology outpatient clinics, suggest that the prevalence of depression is higher than anxiety in this group. Patients with HLP and low levels of LPA are at a higher risk of developing anxiety and depression. Patients with lower levels of education, of which have comorbidities, such as HLP, are more likely to suffer from anxiety, while those working in manual labor are more likely to experience depression. Our work indicates that doctors should pay more attention to the psychiatric healthy of hypertension patients at lower education levels and with second comorbidities. More importantly, patients with hypertension working on manual jobs need to pay closer attention to how they spend their leisure time and strengthen LPA.

Abbreviations

aOR

adjusted odds ratio;

AP

the attributable proportion due to interaction;

BMI

body mass index;

CANHEART

Cardiovascular Health in Ambulatory Care Research Team;

CHBs

cardiovascular health behaviors;

CI

Confidence Interval;

CVD

cardiovascular disease other than stroke;

DM

diabetes mellitus;

FM-CVD

family history of cardiovascular disease;

FM-HYP

family history of hypertension;

FVC

fruit and vegetable consumption;

HLP

hyperlipidemia;

LPA

leisure physical activity;

OR

odds ratio;

RERI

the relative excess risk due to interaction;

S

the synergy index;

SAS

self-rating anxiety scale;

SD

standard deviation;

SDS

self-rating depression scale.

Declarations

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