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Analysis of the Current Status and Influencing Factors of Physical Activity in Cardiovascular Disease Patients Visiting the Emergency Department

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Abstract: To investigate the current status and influencing factors of physical activity among patients with cardiovascular diseases seeking emergency care. A convenience sampling method was used to select patients with cardiovascular diseases who visited the emergency department of a tertiary hospital in Chengdu from December 2023 to July 2024 as the study subjects. Data were collected through on-site questionnaire surveys and medical record reviews. The research tools included a general information questionnaire, the short form of the International Physical Activity Questionnaire (IPAQ-SF), the Patient Health Questionnaire Depression Scale (PHQ-9), the Exercise Self-Efficacy Scale (ESES), and the Social Support Rating Scale (SSRS). Data were entered into Excel, and statistical analyses were conducted using SPSS 26.0. Among the 1,080 patients, physical activity levels were generally low, with only 380 patients (37.3%) meeting the guideline-recommended level of activity. Regression analysis showed that depression score, exercise self-efficacy, and social support entered the regression equation, collectively explaining 26.7% of the total variance in physical activity among cardiovascular disease patients seeking emergency care. The physical activity status of cardiovascular disease patients is suboptimal.

1. Introduction

Cardiovascular diseases (CVD) are the most common chronic diseases and the leading cause of death both globally and in China, with a high rate of emergency department (ED) visits. Rui PKK et al. found that over a continuous seven-year period, 23.6% of emergency visits in the United States were related to hypertension [1]. Similar conclusions were drawn by Shen Jiaxin [2] in an analysis of 240,000 emergency visits and Wei Pengli in an analysis of 54,900 emergency visits, where cardiovascular diseases ranked among the top three diagnoses. Currently, the evaluation of CVD outcomes and burden is primarily based on inpatient data, with little consideration given to the emergency department. In reality, the emergency department is often the first point of care for

patients presenting with severe and potentially life-threatening conditions. For many CVD cases, the onset may be sudden and life-threatening, with some patients even dying in the ED before they are admitted to the hospital. A significant portion of deaths among CVD patients occurs in the ED, such as those from acute myocardial infarction (16.4%), heart failure (5.8%), intracranial hemorrhage (8.1%), and stroke (2.7%).

Exercise, as a first-line intervention for cardiovascular diseases, has been proven effective and offers a wide range of benefits for the cardiovascular system, such as improving cardiovascular hemodynamics [3], preventing and delaying the onset [4] and progression [5] of hypertension, and reducing the incidence of both primary and secondary cardiovascular events [6]. It is one of the most effective methods for preventing CVD. However, studies have shown a marked decline in physical activity levels among the population [7], and globally, insufficient physical activity accounts for over 6% of the CVD burden and 9% of premature deaths [8]. Appropriate physical exercise can reduce the risk of CVD incidence and mortality [9-11].

Patients visiting the ED for cardiovascular issues often present with acute and severe conditions, requiring timely treatment and urgent care [12]. However, some patients may seek care early due to strong self-care awareness, before the disease becomes critical [13]. Current research on CVD patients mainly focuses on those in inpatient wards. In contrast, the ED, as the primary point of care for patients with sudden and severe illnesses, has not received enough attention regarding the physical activity levels of its patients and their impact on disease management.

This study aims to systematically investigate the physical activity status of CVD patients in the ED, addressing this significant research gap. Compared to general inpatients, ED patients with CVD may be more likely to seek care due to acute exacerbations or worsening symptoms, and their physical activity levels may be closely related to the acute onset of their condition. This study will deeply analyze the physical activity characteristics of this population to help understand whether insufficient physical activity is a potential risk factor for ED visits. The study focuses on CVD patients during the emergency phase, exploring the impact of physical activity on disease management at this critical time. Additionally, the research will employ comprehensive and multidimensional survey methods, combining self-reports with objective measurements, providing new perspectives on applying physical activity in the ED.

2. Materials and Methods

2.1. Study Design

A convenience sampling method was used to select 1,018 cardiovascular disease (CVD) patients who visited the emergency department (ED) of a large tertiary hospital in Chengdu from December 2023 to July 2024. The inclusion criteria were: (1) patients diagnosed with CVD at the time of the visit or with a history of CVD; (2) age ≥18 years; (3) patients able to communicate normally and complete the questionnaire with complete data. Exclusion criteria were: (1) patients with coexisting psychiatric disorders or intellectual disabilities; (2) patients with musculoskeletal diseases or other conditions that severely impair physical activity; (3) patients currently participating in other interventional studies; (4) patients who are bedridden long-term or use a wheelchair. All patients provided informed consent, allowing their data to be used for further clinical research. The study protocol was approved by the Ethics Committee of Sichuan Provincial People's Hospital (Approval No. 413 of 2024) and was registered with the Chinese Clinical Trial Registry (ChiCTR2400087323).

2.2. Data Collection

Data collection took place in the emergency waiting area of a tertiary hospital in Chengdu, following triage. During the questionnaire process, the researchers were present to clarify any unclear points and check for completeness. Any missing information was completed by the respondents before collecting the questionnaire, which was then coded after all data had been collected.

Research Tools:

The study population information included: (1) **Demographic information**: age, gender, education level, living situation, occupation, health insurance, monthly income, marital status, etc.; (2) **Disease-related information**: smoking, alcohol consumption, dietary habits, height, weight, waist circumference, knowledge of physical activity, etc.; (3) **Emergency visit details**: vital signs, diagnosis, disease classification, etc.

The **International Physical Activity Questionnaire, Short Form (IPAQ-SF)**: Developed by the International Physical Activity Working Group in 1997, this is a widely recognized subjective measurement tool for assessing physical activity levels [14]. It consists of seven items covering sedentary behavior, walking, moderate-intensity, and vigorous-intensity activities. During the survey, patients were asked about the frequency and duration of different intensities of physical activity per week. The intensity of activities in the IPAQ-SF is expressed in Metabolic Equivalent Tasks (MET). MET is the ratio of the rate of energy expenditure during physical activity to the rate of energy expenditure at rest. Different intensities of physical activities are assigned different MET values: 3.3 for walking, 4.0 for moderate-intensity activities, and 8.0 for vigorous-intensity activities. The energy expenditure formula is Energy expenditure for each type of physical activity (MET-min/week) = MET value for the activity × average daily activity time (minutes) × number of days of activity in the past 7 days. Low and high levels of physical activity were categorized based on 60 minutes of moderate or higher-intensity activity per day.

The **Self-Efficacy for Exercise Scale (SEE)**: This scale, developed by Resnick, assesses exercise self-efficacy, with lower scores indicating poorer exercise self-efficacy. In this study, the Cronbach's alpha coefficient for the SEE was 0.937.

The **Social Support Rating Scale (SSRS)**: The SSRS was developed by Xiao Shuiyuan's team in 1993. In this study, the Cronbach's alpha coefficient for the SSRS was 0.707.

The **Patient Health Questionnaire-9 (PHQ-9)**: This scale was filled out based on the respondent's overall condition over the past two weeks. The PHQ-9 is used to screen and assess depression in patients and has good reliability and validity. In this study, the Cronbach's alpha coefficient for the PHQ-9 was 0.772.

2.3. Statistical Analysis

All data were entered into Excel to establish a database, and statistical analysis was performed using SPSS 26.0. The significance level was set at $\alpha=0.05$, and $P<0.05$ was considered statistically significant.

3. Results

3.1. General Information

A total of 1,018 CVD patients were included, of whom 502 were male (49.31%) and 516 were female (50.69%), with ages ranging from 18 to 82 years (mean age: 44.28±15.73 years). Marital status: 250 (24.56%) were unmarried, 690 (67.78%) were married, and 78 (7.66%) were divorced or

widowed. Education level: 412 (40.47%) had a junior high school education or below, 182 (17.88%) had a high school or technical secondary education, 382 (37.52%) had an undergraduate or college education, and 42 (4.13%) had a master's degree or higher. Living situation: 160 (15.72%) lived alone, while 858 (84.28%) did not. Employment status: 625 (61.39%) were employed, while 393 (38.61%) were unemployed. Monthly income: 403 (39.59%) earned less than 3,000 yuan, 333 (32.71%) earned 3,000 - 5,000 yuan, 205 (20.14%) earned 5,001 - 10,000 yuan, and 77 (7.56%) earned more than 10,000 yuan.

3.2. Emergency Visit and Health Status

Table 1: Emergency Visit and Health Status

Variable	n	%
BMI		
Underweight	29	2.8
Normal	434	42.6
Overweight	385	37.8
Obese	170	16.7
Temperature		
Normal	1018	100
Pulse		
Normal	923	90.7
Tachycardia	95	9.3
Respiration		
Normal	916	90
Rapid	102	10
Blood Pressure		
Normal	470	46.2
Hypertension	527	51.8
Alcohol Consumption		
Non-drinker	647	63.6
Occasional drinker	160	15.7
Frequent drinker	211	20.7
Smoking		
Never smoked	551	54.1
Former smoker	373	36.6
Current smoker	94	9.2
High-Salt Diet		
Yes	316	31
No	702	69
High-Fat Diet		
Yes	348	34.2
No	670	65.8
Medication Usage		
Never	740	72.7
Not sure	63	6.2
Consistently	155	15.2
Intermittently	60	5.9
Mode of Arrival		
Self-arrived	518	50.9
Admitted through ED	475	46.7
Referred from lower-level facility	25	2.5
Outcome		

Admitted	360	35.4
Sent home	317	31.1
Observed	341	33.5
Primary Diagnosis		
Coronary heart disease	188	18.5
Hypertension	203	19.9
Diabetes	207	20.3
Stroke	225	22.1
Hyperlipidemia	195	19.2
Number of Comorbidities		
0	691	67.9
1	213	20.9
2	98	9.6
3	16	1.6
Disease Severity		
Critical	1	0.1
Severe	112	11
Sub-emergent	476	46.8
Non-emergent	429	42.1
Time of Visit		
8 AM - 5:59 PM	332	32.6
6 PM - 11:59 PM	346	34
12 AM - 7:59 AM	340	33.4
Number of ED Visits in One Year		
0 times	906	89
1 time	98	9.6
2 times	10	1
3 times	4	0.4

3.3. Current Status of Physical Activity among Cardiovascular Patients in the Emergency Department

Among the 1,018 study subjects, 446 (43.8%) were assessed as having low levels of physical activity, 381 (37.4%) had moderate levels, and 191 (18.8%) had high levels of physical activity. A total of 380 (37.3%) met the recommended physical activity levels, while 638 (62.7%) did not meet the recommended levels. The details of weekly physical activity are shown in Table 2.

Table 2: Weekly Physical Activity

tem	Minimum Value	Maximum Value	Average Value
Total energy expenditure per week (MET)	33	4158	1615.23 ±1235.28
Total activity time per week (min)	10	2490	433.31 ±453.51

3.4. The Influencing Factors of Physical Activity in Cardiovascular Patients Visiting the Emergency Department

Using independent sample t-tests and variance analysis (ANOVA), the total energy expenditure from physical activity was found to have statistically significant differences about work status and the level of knowledge about physical activity among cardiovascular disease patients with different sociodemographic characteristics who visited the emergency department. When self-efficacy in physical activity, self-rated depression, and social support were included in the regression equation,

the model significance test (ANOVA) yielded an F value of 74.767 and a P value of 0.000, leading to the following results.

Table 3: Summary of the Regression Model

R	R Square	Adjusted R Square	Standard Error of the Estimate
0.52	0.27	0.267	1057.899

Table 4: Regression Analysis Table

	Unstandardized Coefficients	Standardized Coefficients		
	B	Standard Error	Beta	t
(Constant)	-704.628	281.685		-2.501
Work Status	101.709	68.947	0.04	1.475
Physical Activity Knowledge	-24.399	42.798	-0.015	-0.57
Self-Rated Depression	55.058	3.249	0.512	16.947
Self-Efficacy in Exercise	6.738	2.621	0.077	2.571
Social Support	25.093	5.264	0.13	4.767

4. Discussion

4.1. Emergency Visits and Healthy Lifestyles

In this survey, the emergency visits of cardiovascular disease (CVD) patients were mainly concentrated between 6:00 PM and midnight, with the vast majority of patients making their first emergency visit. The results were shown in Table 1. This phenomenon may be closely related to the circadian rhythm and physiological characteristics of the human body. Studies have shown that cardiovascular events, such as myocardial infarction and stroke, have a higher incidence during the night and early morning hours, possibly due to factors like increased sympathetic nervous activity and blood pressure fluctuations during these times. Additionally, increased daytime activity may trigger or exacerbate the risk of cardiovascular events in the evening. Cardiovascular diseases often have a hidden nature, particularly in the early stages, when symptoms may not be noticeable or are easily overlooked. By the time patients experience severe symptoms, the condition may have progressed to a level that requires emergency treatment. The sudden onset of cardiovascular events often leaves patients unprepared, leading to an increase in first-time emergency visits. Furthermore, many patients may lack sufficient awareness or vigilance regarding their cardiovascular health before their first emergency visit. This lack of awareness can result in the condition progressing to a severe stage by the time symptoms appear. This study further found that stroke was the most common reason for emergency visits among CVD patients, consistent with findings from other studies. Research has indicated that stroke is a leading cause of emergency visits and hospitalizations among middle-aged and elderly populations, particularly in the absence of preventive medical interventions [15]. The high incidence of stroke may be related to poor management of hypertension, insufficient physical activity, and unhealthy dietary habits among patients. Although most respondents in this survey did not smoke or drink alcohol, the proportion of those who were overweight reached 37.8%. Overweight and obesity are recognized risk factors for CVD and are closely associated with adverse metabolic indicators, such as hypertension, hyperglycemia, and hyperlipidemia [16]. Poor weight control may offset the positive effects of not smoking and not drinking alcohol, leading to an increased cardiovascular risk.

4.2. Physical Activity Status of Emergency Cardiovascular Patients

This study found that the level of physical activity among CVD patients was generally insufficient. A total of 62.7% of patients did not meet physical activity standards, with nearly half of the surveyed population engaging in low levels of physical activity, and only 18% having high levels of activity. Research has shown that insufficient physical activity can lead to hypertension, dyslipidemia, and insulin resistance, thereby increasing the risk of CVD [17]. Although some patients had long activity durations (nearly 6 hours per day), a significant portion of patients engaged in very little physical activity (as little as 10 minutes per week). The results were shown in Table 2.These differences may reflect variations in lifestyle habits, physical conditions, and the severity of the disease among patients [18]. Therefore, promoting physical activity, especially increasing the amount of exercise among populations with low levels of physical activity, should be an important strategy for the prevention and management of CVD.

4.3. Influencing Factors of Physical Activity among Emergency Cardiovascular Patients

Among the influencing factors of physical activity in emergency cardiovascular patients, self-rated depression, exercise self-efficacy, and social support were found to explain 26.7% of the influencing factors. Depression, self-efficacy, and social support are known factors affecting physical activity which the results were shown in Table 3 and 4. Depressive symptoms can reduce a patient's desire to be active, increase feelings of fatigue, and thus decrease physical activity [19]. On the other hand, exercise self-efficacy, which refers to a patient's confidence in their ability to successfully participate in and complete exercise, directly influences their engagement in physical activity [20]. Social support, including encouragement, companionship, and support from family and friends, can also increase a patient's willingness and motivation to engage in physical activity [21]. These factors collectively explain a portion of the variance in physical activity, but there are still some potential influencing factors that have not been identified. This suggests that psychological and social factors play a certain role in the physical activity levels of patients, but biological indicators such as inflammation status and cardiopulmonary function may also have important impacts on a patient's physical activity. The patient's living environment, such as community safety, accessibility of exercise facilities, and air quality, may also significantly influence their level of physical activity.

5. Conclusion

The emergency visits of cardiovascular disease (CVD) patients are concentrated between 6:00 PM and midnight, and their physical activity levels are generally insufficient. Self-rated depression, exercise self-efficacy, and social support explain part of the variance in physical activity, but there are still many unexplained factors.

6. Limitations and Future Directions

Although this study provides important insights, there are still some limitations. First, the measurement of physical activity relies on self-reports from patients, which may introduce bias. Second, other influencing factors of physical activity remain to be explored. Future research could further explore how personalized interventions can be used to improve the physical activity levels of CVD patients, thereby reducing the rate of emergency visits.

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