INJ
E-ISSN: 2961-8592

An Idea Nursing Journal
https://ihj.ideajournal.id/index.php/INJ/index

Volume 5(3), 274-287
© The Author(s) 2026
https://doi.org/10.53690/inj.v5i03.886

Original Article

Factors Associated with Physical Activity among Cardiovascular Patients in North Sulawesi: A Cross-Sectional Study

Sharon Priscilla Sandag[1], Sumarmi[2], Salmah Arafah[1], Ferdy Lainsamputty[*3]

[1]Master of Nursing Student, Sekolah Tinggi Ilmu Kesehatan Tanawali Persada Takalar, Indonesia.
[2]Department of Nursing, Faculty of Medicine and Health Sciences, Universitas Islam Negeri Alauddin, Indonesia.
[3]Department of Nursing, Faculty of Nursing, Universitas Klabat, North Sulawesi, Indonesia.

Abstract

Background: Physical activity (PA) is a cornerstone of cardiovascular disease (CVD) management and is associated with improved cardiovascular outcomes. However, many cardiovascular patients remain insufficiently active. This study aimed to identify demographic and clinical factors associated with PA among cardiovascular patients in North Sulawesi, Indonesia.

Methods: This descriptive correlational study employed a cross-sectional design. Convenience sampling was used to recruit 50 cardiovascular patients from a tertiary hospital in North Sulawesi, Indonesia. PA was assessed using the International Physical Activity Questionnaire-Short Form (IPAQ-SF) and expressed as metabolic equivalent task minutes per week (MET-min/week). Data were analyzed using descriptive statistics, the Mann–Whitney U test, and Spearman's rank correlation.

Result: The largest proportion of participants had a moderate level of PA (40.0%). Place of living ($p = 0.032$) and regular exercise habits ($p = 0.049$) were significantly associated with PA. Participants living in urban areas and those engaging in regular exercise reported higher PA levels. Age ($r = 0.300$, $p = 0.034$), body mass index (BMI) ($r = 0.315$, $p = 0.026$), and systolic blood pressure (BP) ($r = 0.394$, $p = 0.005$) were positively correlated with PA.

Conclusion: In this sample of cardiovascular patients, PA was associated with place of living, regular exercise habits, age, BMI, and systolic BP. These findings suggest that behavioral, environmental, and clinical characteristics may be relevant to PA participation. However, causal relationships cannot be inferred due to the cross-sectional design. The findings should also be interpreted cautiously given the small sample size and single-hospital setting.

*Correspondence:
Ferdy Lainsamputty
Jl. Arnold Mononutu, Kelurahan Airmadidi Atas, Kecamatan Airmadidi, Kabupaten Minahasa Utara, 95371
Email: ferdy.l@unklab.ac.id

Article info :
Received: 10 July 2026 | Revised: 01 Nov 2026| Accepted: 04 Nov 2026| Available Online: 10 Nov 2026
This is an Open Access article distributed under the terms of the
https://creativecommons.org/licenses/by/4.0/

Keywords :
Cardiovascular Disease; Clinical Characteristics; Demographic Characteristics; Physical Activity.

Background

Cardiovascular disease (CVD) remains the leading cause of mortality and disability worldwide, accounting for nearly one-third of all deaths globally. Despite substantial advances in prevention and treatment, the burden of coronary artery disease (CAD), heart failure (HF), stroke, and other cardiovascular conditions continues to increase, particularly in low- and middle-income countries. Recent epidemiological reports indicate that cardiovascular morbidity is strongly associated with population aging, unhealthy lifestyles, obesity, hypertension, diabetes mellitus, and physical inactivity (1–3). In Indonesia, CVD has become one of the most important public health challenges, with increasing prevalence reported in national health surveys. North Sulawesi is among the provinces experiencing a growing burden of cardiovascular conditions, highlighting the need to identify modifiable behavioral factors that can improve outcomes (4).

Physical activity (PA) is widely recognized as a cornerstone of CVD prevention and management. Regular PA improves cardiorespiratory fitness, endothelial function, blood pressure (BP) control, glucose metabolism, and overall quality of life among cardiovascular patients. Furthermore, physically active individuals experience lower risks of cardiovascular events, hospitalization, and mortality compared with inactive individuals (5–7). Recent evidence suggests that even moderate increases in daily step counts and moderate-to-vigorous PA are associated with substantial reductions in cardiovascular mortality and all-cause mortality. Consequently, promoting PA has become a major focus of secondary prevention programs worldwide (8, 9).

Previous studies have demonstrated that PA behaviors are influenced by multiple demographic factors. Age, gender, marital status, employment, education, socioeconomic status, place of living, and social support have consistently been identified as important determinants of PA participation. Older adults often face barriers related to functional decline and chronic illness, whereas younger individuals may encounter occupational and time constraints. Likewise, higher educational attainment and stronger social support have been associated with better adherence to PA recommendations (10–12). Urban-rural disparities may further contribute to differences in PA levels due to variations in infrastructure, accessibility of healthcare services, recreational facilities, and neighborhood walkability (13, 14).

In addition to demographic characteristics, clinical factors may influence PA among cardiovascular patients. BMI, BP, oxygen saturation, pulse rate, disease severity, medication burden, and previous cardiac surgery can affect functional capacity and exercise tolerance. Patients with obesity, uncontrolled hypertension, advanced HF, or

multiple comorbidities frequently report lower levels of PA due to symptoms such as fatigue, dyspnea, and reduced physical performance (9, 15). Moreover, medication-related side effects and recovery following cardiac surgery may influence participation in daily physical activities and structured exercise programs (16, 17). Understanding these clinical correlates is essential for developing individualized interventions that promote active lifestyles among cardiovascular patients.

This study is guided by Pender's Health Promotion Model (HPM), which explains health-promoting behaviors as being influenced by individual characteristics, prior experiences, perceived benefits, perceived barriers, self-efficacy, and interpersonal influences. Demographic and biological characteristics serve as personal factors that may shape engagement in health-promoting behaviors such as PA. Among cardiovascular patients, factors including age, gender, socioeconomic status, BMI, disease characteristics, social support, and environmental context may influence patients' ability and willingness to remain physically active. The model also emphasizes the role of interpersonal and environmental influences in shaping health behavior (18–20). Therefore, Pender's HPM provides an appropriate theoretical framework for examining the associations between demographic and clinical characteristics and PA among cardiovascular patients in the North Sulawesi context.

Although substantial evidence has linked PA with improved cardiovascular outcomes, much of the available literature has been derived from high-income countries and community-based populations rather than patients with established CVD. Evidence from Indonesia remains limited, particularly regarding how demographic and clinical characteristics are associated with PA among cardiovascular patients. This gap is especially relevant in North Sulawesi, where cardiovascular disease represents an important health burden and patients may experience distinct contextual influences related to residence, access to healthcare services, exercise opportunities, and sociocultural characteristics. Furthermore, previous studies have often examined demographic and clinical factors separately, while limited evidence is available regarding the associations of both demographic and clinical characteristics with PA among cardiovascular patients in this regional context. Understanding these associations is important for informing context-sensitive nursing assessment and the development of locally appropriate strategies to support PA participation in cardiovascular care. Therefore, this study aimed to identify demographic and clinical factors associated with PA among cardiovascular patients receiving care at a tertiary hospital in North Sulawesi, Indonesia.

Methods

Research Design

This study employed a descriptive correlational design with a cross-sectional approach. The study was conducted in the outpatient cardiovascular clinic of a tertiary hospital in North Sulawesi, Indonesia, in July 2024. The clinic provides follow-up care for patients

with various cardiovascular conditions, including heart failure (HF), coronary artery disease (CAD), and other cardiovascular diseases (CVDs).

Sample/Participants

A convenience sampling method was used to recruit eligible patients attending the outpatient cardiovascular clinic during the data collection period. The minimum sample size was calculated using G*Power version 3.1 for a bivariate correlation analysis (21). Assuming a medium effect size ($\rho = 0.40$), a significance level of 0.05, and a statistical power of 0.80, the minimum required sample size was 46 participants. A total of 50 patients were enrolled, with all eligible patients approached agreeing to participate (0% refusal rate).The inclusion criteria were adults aged ≥18 years, diagnosed with CVD by a cardiologist, receiving outpatient care, clinically stable, able to communicate in Bahasa Indonesia, and willing to provide written informed consent. Patients experiencing acute cardiovascular events requiring hospitalization, severe cognitive or psychiatric disorders, severe mobility limitations unrelated to cardiovascular disease, or an inability to complete the questionnaire were excluded.Given the non-probability sampling approach, the sample may not fully represent the broader population of patients with CVD, potentially introducing selection bias.

Instrument/Questionnaire

Data were collected using demographic and clinical data collection forms and the International Physical Activity Questionnaire-Short Form (IPAQ-SF). Physical activity (PA) was assessed using the IPAQ-SF, a widely used self-report instrument for evaluating PA levels among adults (22). The questionnaire consists of seven items assessing the frequency (days/week) and duration (minutes/day) of walking, moderate-intensity PA, vigorous-intensity PA, and sitting time over the preceding seven days.PA levels were calculated as metabolic equivalent task minutes per week (MET-min/week) according to the IPAQ scoring protocol. Standard MET values of 3.3, 4.0, and 8.0 were assigned to walking, moderate-intensity PA, and vigorous-intensity PA, respectively. Total PA was calculated by summing the MET-min/week values across all activity categories. Participants were subsequently classified as having low, moderate, or high PA levels based on the official IPAQ classification criteria.The IPAQ has demonstrated acceptable reliability and validity across diverse populations and has been widely used in cardiovascular research (23–26).

Demographic and Clinical Characteristics

Demographic characteristics included age, gender, marital status, employment status, educational level, place of residence, ethnicity, monthly income, regular exercise, and social support. Clinical characteristics included body mass index (BMI), systolic and diastolic blood pressure, peripheral oxygen saturation (SpO_2), pulse rate, duration of diagnosis, primary cardiovascular diagnosis, medications, and history of cardiac surgery.

Data Collection

Data were collected in July 2024 at the outpatient cardiovascular clinic. Potential participants were identified by the research team according to the predefined eligibility criteria and subsequently approached for recruitment.

Before participation, eligible patients received information regarding the study objectives, procedures, voluntary participation, confidentiality, and their right to withdraw at any time without affecting their healthcare services. Written informed consent was obtained before data collection.

Demographic and clinical characteristics were recorded using structured data collection forms, while PA was assessed using the IPAQ-SF. Upon completion, all questionnaires and data collection forms were checked for completeness and accuracy. Participant information was coded and securely stored to maintain confidentiality.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 27.0. Descriptive statistics were used to summarize demographic and clinical characteristics and PA levels. Continuous variables were summarized using means, standard deviations, minimums, and maximums, while categorical variables were presented as frequencies and percentages.

The Shapiro–Wilk test was performed to assess the normality of continuous variables. Because the distributions were non-normal, the Mann–Whitney U test was used to compare two independent groups, while Spearman's rank correlation coefficient was applied to examine associations between variables.Multivariable analysis was not performed because the relatively small sample size (n = 50), compared with the number of potential explanatory variables, could increase the risk of model overfitting and unstable parameter estimates. Statistical significance was established at $p < 0.05$.

Ethical Clearance

Ethical approval was obtained from the Institutional Review Board (IRB) of a public hospital in North Sulawesi, Indonesia (approval number: 139/EC/VII/2024). All participants received information about the study and provided written informed consent before participation. Participation was voluntary, and participants were informed of their right to withdraw at any stage without consequences for their medical care. Confidentiality and anonymity were maintained through participant coding and secure data storage. All collected data were used exclusively for research purposes.

Result and Discussion

Demographic of Participants

Table 1 presents the demographic characteristics of the participants (n = 50). The mean age was 50.78 years (SD = 12.34), ranging from 18 to 70 years. Slightly more than half of the participants were male (52.0%), while 48.0% were female. The majority were married (72.0%), whereas 28.0% were single. Regarding employment status, 56.0% of participants were employed and 44.0% were unemployed. Most participants had a low

educational level (60.0%), while 40.0% had a high educational level. In terms of residence, 72.0% lived in urban areas and 28.0% in rural areas. The majority belonged to the Minahasan tribe (66.0%), whereas 34.0% were from non-Minahasan ethnic groups. Monthly income was evenly distributed, with 50.0% earning less than 3.5 million and 50.0% earning 3.5 million or more. More than half of the participants (58.0%) reported not engaging in regular exercise, while 42.0% exercised regularly. Most participants reported high social support (70.0%).

Table 1. Demographic Characteristics (n = 50)

Variables	n (%)	Mean (SD)	Min – Max
Age (years)		50.78 (12.34)	18 – 70
Gender			
Female	24 (48.0)		
Male	26 (52.0)		
Marital status			
Single	14 (28.0)		
Married	36 (72.0)		
Employment status			
Unemployed	22 (44.0)		
Employed	28 (56.0)		
Education			
Low education	30 (60.0)		
High education	20 (40.0)		
Place of living			
Urban	36 (72.0)		
Rural	14 (28.0)		
Tribes			
Non Minahasan	17 (34.0)		
Minahasan	33 (66.0)		
Monthly income			
<3,5 million	25 (50.0)		
≥3,5 million	25 (50.0)		
Regular exercise			
No	29 (58.0)		
Yes	21 (42.0)		
Social support			
Low	15 (30.0)		
High	35 (70.0)		

Table 2 presents the clinical characteristics of the participants (n = 50). The mean BMI was 26.03 kg/m² (SD = 4.86), ranging from 18.13 to 40.89 kg/m². The mean systolic BP was 112.78 mmHg (SD = 13.66), while the mean diastolic BP was 74.28 mmHg (SD = 8.86). The mean oxygen saturation (SpO_2) was 97.44% (SD = 1.65), and the mean pulse rate was 72.78 beats per minute (SD = 12.62). Participants had been diagnosed with CVD for an average of 3.60 years (SD = 4.76), with a duration ranging from 1 to 25 years. Regarding clinical diagnoses, more than half of the participants had HF (52.0%), while 40.0% had CAD. Other CVDs were reported in 26.0% of participants. The mean number of medications used was 3.64 (SD = 1.23). In terms of medication use, statins were the most commonly prescribed drugs, used by 80.0% of participants. Angiotensin II receptor blockers (ARBs) were used by 52.0%, followed by antiplatelet agents (48.0%), nitrates (46.0%), beta blockers (44.0%), diuretics (38.0%), angiotensin-converting enzyme (ACE) inhibitors (24.0%), anticoagulants (20.0%), and calcium channel blockers (12.0%). Nearly half of the participants (48.0%) reported a history of cardiac surgery.

Table 2. Participants' Clinical Characteristics (n = 50)

Variables	n (%)	Mean (SD)	Min – Max
Body mass index (kg/m^2)		26.03 (4.86)	18.13 – 40.89
Systolic blood pressure (mmHg)		112.78 (13.66)	80.00 – 140.00
Diastolic blood pressure (mmHg)		74.28 (8.86)	55.00 – 90.00
SpO_2 (%)		97.44 (1.65)	89.00 – 99.00
Pulse (x/min)		72.78 (12.62)	44.00 – 98.00
Duration of diagnosis (years)		3.60 (4.76)	1 – 25
Main diagnoses			
Heart failure			
No	24 (48.0)		
Yes	26 (52.0)		
Coronary artery disease			
No	30 (60.0)		
Yes	20 (40.0)		
Other cardiovascular diseases			
No	37 (74.0)		
Yes	13 (26.0)		
Number of medications		3.64 (1.23)	1 – 6
Antiplatelet			
No	26 (52.0)		
Yes	24 (48.0)		
Anticoagulant			
No	40 (80.0)		
Yes	10 (20.0)		
Calcium channel blocker			
No	44 (88.0)		
Yes	6 (12.0)		
Angiotensin-converting enzyme inhibitor			
No	38 (76.0)		
Yes	12 (24.0)		
Angiotensin II receptor blockers			
No	24 (48.0)		
Yes	26 (52.0)		
Beta blocker			
No	28 (56.0)		
Yes	22 (44.0)		
Diuretic			
No	31 (62.0)		
Yes	19 (38.0)		
Nitrate			
No	27 (54.0)		
Yes	23 (46.0)		
Statin			
No	10 (20.0)		
Yes	40 (80.0)		
History of cardiac surgery			
No	26 (52.0)		
Yes	24 (48.0)		

Note: Kg – Kilogram; Min – Minute; mmHg - Millimeters of Mercury.

Table 3 presents the PA levels of cardiovascular patients (n = 50). The mean walking activity was 1006.57 MET-min/week (SD = 1580.62), ranging from 0 to 8910 MET-min/week. The mean moderate-intensity PA was 606.80 MET-min/week (SD = 1431.87), while vigorous-intensity PA had a mean of 210.40 MET-min/week (SD = 758.89). The overall PA level had a mean score of 1823.77 MET-min/week (SD = 2395.29), with values ranging from 99 to 9440 MET-min/week. Based on PA classification, 40.0% of participants were categorized as having a moderate level of PA.

Table 3. Description of PA among Cardiovascular Patients (n = 50)

Variables	n (%)	Mean (SD)	Min – Max
Walking (MET-min/week)		1006.57 (1580.62)	0 – 8910
Moderate activity (MET-min/week)		606.80 (1431.87)	0 – 8400
Vigorous activity (MET-min/week)		210.40 (758.89)	0 – 3840
Physical activity (MET-min/week)		1823.77 (2395.29)	99 – 9440
Low	16 (32.0)		
Moderate	20 (40.0)		
High	14 (28.0)		

Note: MET – Metabolic Equivalent of Task in health and fitness; Min – Minute.

Table 4 presents the results of bivariate analyses examining differences in PA levels across participants' demographic characteristics. Place of living was significantly associated with PA (Z = -2.142, p = 0.032), with participants living in urban areas reporting higher PA levels (2112.31 ± 2459.06 MET-min/week) than those residing in rural areas (1081.81 ± 2126.46 MET-min/week). Regular exercise was also significantly associated with PA (Z = 1.969, p = 0.049), as participants who engaged in regular exercise demonstrated substantially higher PA levels (2762.55 ± 3099.21 MET-min/week) compared with those who did not exercise regularly (1143.96 ± 1428.29 MET-min/week).

Table 4. Differences between Categorical Variables of Demographic Characteristics and PA (n = 50)

Variables	Mean (SD)	Statistics	*p*-value
Gender		1.877	0.061
Female	1572.65 (2303.06)		
Male	2055.56 (2499.82)		
Marital status		1.374	0.169
Single	699.32 (354.23)		
Married	2261.05 (2698.76)		
Employment status		-1.184	0.236
Unemployed	1832.14 (2090.01)		
Employed	1817.19 (2648.53)		
Education		0.783	0.433
Low education	1557.57 (2094.08)		
High education	2223.06 (2797.06)		
Place of living		-2.142	0.032*
Urban	2112.31 (2459.06)		
Rural	1081.81 (2126.46)		
Tribes		-0.554	0.580
Non Minahasan	2113.32 (2605.22)		
Minahasan	1674.60 (2307.44)		
Monthly income		1.156	0.248
<3,5 million	1245.44 (1507.09)		
≥3,5 million	2402.09 (2957.31)		
Regular exercise		1.969	0.049*
No	1143.96 (1428.29)		
Yes	2762.55 (3099.21)		
Social support		-0.668	0.504
Low	2240.44 (2893.08)		
High	1645.19 (2170.88)		

*Note: *p < 0.05; **p < 0.01; ***p < 0.001.*

Table 5 presents the results of bivariate analyses examining differences in PA levels across participants' clinical characteristics. None of the clinical variables showed a statistically significant association with PA ($p > 0.05$). Participants without HF reported higher PA levels (2019.82 ± 2480.30 MET-min/week) than those with HF (1443.19 ± 2243.61 MET-min/week), although this difference was not statistically significant ($Z = -1.036$, $p = 0.300$). Likewise, participants with CAD demonstrated higher PA levels (1965.98 ± 1988.57 MET-min/week) than those without CAD (1728.96 ± 2660.85 MET-min/week), but the difference was not significant ($Z = 1.617$, $p = 0.106$). Similarly, no significant differences in PA were observed according to the presence of other CVDs ($p = 0.492$), use of antiplatelet agents ($p = 0.111$), anticoagulants ($p = 0.280$), calcium channel blockers ($p = 0.244$), angiotensin-converting enzyme inhibitors ($p = 0.569$), angiotensin II receptor blockers ($p = 0.156$), beta blockers ($p = 0.333$), diuretics ($p = 0.741$), nitrates ($p = 0.992$), or statins ($p = 0.285$). In addition, PA levels did not differ significantly between participants with and without a history of cardiac surgery ($Z = 0.846$, $p = 0.398$).

Table 5. Differences between Categorical Variables of Clinical Characteristics and PA (n = 50)

Variables	Mean (SD)	Statistics	*p*-value
Heart failure		-1.036	0.300
No	2019.82 (2480.30)		
Yes	1443.19 (2243.61)		
Coronary artery disease		1.617	0.106
No	1728.96 (2660.85)		
Yes	1965.98 (1988.57)		
Other cardiovascular diseases		-0.687	0.492
No	1725.78 (2096.20)		
Yes	2102.65 (3183.02)		
Antiplatelet		1.595	0.111
No	1754.03 (2689.97)		
Yes	1899.32 (2084.83)		
Anticoagulant		-1.081	0.280
No	2038.80 (2585.95)		
Yes	963.62 (1109.86)		
Calcium channel blocker		-1.166	0.244
No	1934.16 (2499.38)		
Yes	1014.18 (1268.63)		
Angiotensin-converting enzyme inhibitor		-0.569	0.569
No	1732.33 (2034.93)		
Yes	2113.31 (3392.41)		
Angiotensin II receptor blockers		1.420	0.156
No	1495.20 (2251.52)		
Yes	2127.06 (2526.29)		
Beta blocker		0.969	0.333
No	1798.16 (2715.99)		
Yes	1856.35 (1975.10)		
Diuretic		-0.330	0.741
No	2050.51 (2567.21)		
Yes	1453.82 (2097.88)		
Nitrate		0.010	0.992
No	2127.57 (2885.90)		
Yes	1467.13 (1640.05)		
Statin		1.069	0.285
No	1085.85 (1238.28)		
Yes	2008.25 (2574.26)		
History of cardiac surgery		0.846	0.398
No	1672.08 (2215.61)		
Yes	1988.10 (2614.02)		

Table 6 presents the correlation analysis between continuous variables and PA among 50 cardiovascular patients. Age demonstrated a significant positive correlation with PA (r = 0.300, p = 0.034). BMI was also positively correlated with PA (r = 0.315, p = 0.026). In addition, systolic BP showed a significant positive correlation with PA (r = 0.394, p = 0.005).

Table 6. Correlation between Continuous Variables and PA (n = 50)

Variables	Physical Activity
Age (years)	*r* = 0.300* *p* = 0.034
Body mass index (kg/m^2)	*r* = 0.315* *p* = 0.026
Systolic blood pressure (mmHg)	*r* = 0.394** *p* = 0.005
Diastolic blood pressure (mmHg)	*r* = 0.175 *p* = 0.223
SpO_2 (%)	*r* = 0.112 *p* = 0.441
Pulse (x/min)	*r* = -0.181 *p* = 0.207
Duration of diagnosis (years)	*r* = -0.079 *p* = 0.584
Number of medications	*r* = 0.157 *p* = 0.277

*Note: *p < 0.05; **p < 0.01; ***p < 0.001; Kg – Kilogram; Min – Minute; mmHg -*

DISCUSSION

In the present study, most cardiovascular patients had moderate PA, suggesting that the sample was not uniformly inactive but had not yet reached levels generally considered optimal for secondary cardiovascular prevention. This finding is broadly consistent with previous studies showing relatively low activity among patients with established CVD. In a nationwide Korean study, individuals with CAD reported lower levels of vigorous, leisure, transport, and total PA than those without CHD (27). Similarly, only 30.51% of UK Biobank participants with established CHD met the recommended 150 min/week of moderate-to-vigorous PA (28). Greater total activity and lower sedentary time have also been associated with lower HF risk in older women (9). Differences across studies may reflect variations in disease characteristics, measurement methods, and activity domains.

In the present sample, place of living was significantly associated with PA, with urban participants reporting higher activity levels than rural participants. This finding is consistent with evidence showing that supportive environments may facilitate daily movement. Higher daily step counts have been associated with lower CVD incidence and mortality (5, 6, 29), including among highly sedentary adults (30). Urban settings may provide greater access to walkable environments, health services, transportation, and opportunities for routine physical activity.

Participants who reported regular exercise also had higher PA levels than those who did not exercise regularly. This finding is consistent with evidence showing that habitual activity is associated with favorable cardiovascular outcomes. Accelerometer-measured light and moderate-to-vigorous activity have been associated with lower HF risk (9), while improvements in cardiorespiratory fitness have been linked with better survival

among individuals with and without CVD (17). Regular exercise may therefore contribute to higher overall activity and support continued engagement in active behaviors.

Age was positively correlated with PA in the present sample. Although PA commonly declines with increasing age, evidence indicates that older adults can still obtain substantial cardiovascular benefits from relatively modest levels of activity (5, 9). Daily step patterns have also been associated with lower mortality risk even when activity is accumulated intermittently (10). The positive association observed in this study may reflect differences in lifestyle, treatment adherence, or available time among older participants; however, these explanations remain tentative.

BMI was also positively correlated with PA. This finding differs from broader evidence showing that greater aerobic exercise is generally associated with lower body weight, waist circumference, and body fat (31), while higher PA levels have been associated with lower BMI in older women (9). In the present sample, one possible explanation is that participants with higher BMI may have increased their activity following diagnosis, whereas lower BMI in some patients may reflect poorer nutritional or functional status. These possibilities should be interpreted cautiously because they were not directly assessed.

Systolic BP was positively correlated with PA in the present sample. Previous evidence generally supports the BP-lowering effects of regular physical activity, and higher PA levels have been associated with slightly lower systolic BP in older women (9). However, the mean systolic BP in this study was approximately 113 mmHg, indicating relatively well-controlled BP. The observed positive association may therefore reflect differences in clinical or functional status rather than suggesting that higher BP promotes greater PA. This finding should be interpreted cautiously.

Clinically, these findings suggest that PA counseling should consider both behavioral and environmental factors. Patients living in less supportive environments may benefit from strategies such as home-based walking, individualized activity planning, or tele-rehabilitation. Regular exercise behavior may also be useful to assess during routine outpatient follow-up. Given the unexpected positive correlations of age, BMI, and systolic BP with PA, individualized assessment remains important rather than assuming that these characteristics consistently indicate lower activity levels.

This study has several limitations. First, the relatively small sample, convenience sampling, and single-hospital setting may limit representativeness and generalizability and may introduce selection bias. Second, the cross-sectional design and reliance on bivariate analyses preclude causal inference and may leave residual confounding. Third, PA was assessed using the self-reported IPAQ-SF, which is susceptible to recall bias, reporting inaccuracies, and possible overestimation of activity. Therefore, MET-min/week values should be interpreted cautiously. Fourth, the clinically heterogeneous sample, including patients with HF, CAD, and other cardiovascular conditions, may have influenced the observed associations. Finally, the positive correlations between BMI, systolic BP, and PA should be interpreted with caution, as they may reflect medication

effects, survivorship bias, selection bias, or unmeasured disease severity rather than stable population-level relationships.

Conclusion

This study found that the largest proportion of participants had a moderate level of PA. Place of living and regular exercise were significantly associated with PA, while age, BMI, and systolic BP showed positive correlations with PA. These findings suggest that behavioral, environmental, and clinical characteristics may be related to PA among cardiovascular patients in this study setting.

From a practical perspective, the findings may support consideration of context-sensitive strategies to promote PA, particularly for patients with limited opportunities for regular exercise or less supportive environments. Community-based exercise programs, home-based PA plans, and tele-rehabilitation may therefore be considered as potential approaches, but their effectiveness should be evaluated in future intervention studies. Larger multicenter studies using multivariable analyses and objective PA measures are also recommended to confirm these associations and improve generalizability.

Acknowledgements

The authors sincerely thank all cardiovascular patients who participated in this study for their valuable time and cooperation. We also express our gratitude to the nurses, especially Veibe Annie Undap, for their assistance with participant recruitment and data collection. Their support and dedication were essential to the successful completion of this research.

Declaration of Conflict of Interest
None.

Funding
None.

Author Contributions
SPS, FL, S was responsible for writing the original draft, methodology, visualization, writing–review and editing, and supervision. FL and S jointly contributed to investigation, data curation, and resources. FL, S, SA was responsible for validation and formal analysis.

Data Availability Statement
The data analyzed in this study can be obtained from the corresponding author upon a reasonable request.

Declaration of the Use of AI in Scientific Writing
None.

References
1. Tsao CW, Aday AW, Almarzooq ZI, Alonso A, Beaton AZ, Bittencourt MS, et al. Heart disease and stroke statistics—2022 update: a report from the American Heart Association. Circulation. 2022;145(8):e153-e639. https://doi.org/10.1161/CIR.0000000000001052
2. Mensah GA, Fuster V, Murray CJL, Roth GA, et al. Global burden of cardiovascular diseases and risks, 1990-2022. J Am Coll Cardiol. 2023;82(25):2350-2473. https://doi.org/10.1016/j.jacc.2023.11.007
3. Global Burden of Cardiovascular Diseases and Risks 2023 Collaborators. Global, regional, and national burden of cardiovascular diseases and risk factors in 204 countries and territories, 1990-2023. J Am Coll Cardiol. 2025;86(22):2167-2243. https://doi.org/10.1016/j.jacc.2025.08.015

4. Ministry of Health of the Republic of Indonesia. Indonesian Health Survey 2023 in numbers [Internet]. Jakarta: Ministry of Health of the Republic of Indonesia; 2023. Available from: https://www.badankebijakan.kemkes.go.id/ski-2023-dalam-angka/
5. Paluch AE, Bajpai S, Bassett DR, Carnethon MR, Ekelund U, Evenson KR, et al. Daily steps and all-cause mortality: a meta-analysis of 15 international cohorts. Lancet Public Health. 2022;7(3):e219-e228. https://doi.org/10.1016/S2468-2667(21)00302-9
6. del Pozo Cruz B, Ahmadi MN, Lee IM, Stamatakis E. Prospective associations of daily step counts and intensity with cancer and cardiovascular disease incidence and mortality and all-cause mortality. JAMA Intern Med. 2022;182(11):1139-1148. https://doi.org/10.1001/jamainternmed.2022.4000
7. Ahmadi MN, Clare PJ, Katzmarzyk PT, del Pozo Cruz B, Lee IM, Stamatakis E. Vigorous physical activity, incident heart disease, and cancer: how little is enough? Eur Heart J. 2022;43(46):4801-4814. https://doi.org/10.1093/eurheartj/ehac572
8. Banach M, Lewek J, Surma S, Penson PE, Sahebkar A, Martin SS, et al. The association between daily step count and all-cause and cardiovascular mortality: a meta-analysis. Eur J Prev Cardiol. 2023;30(18):1975-1985. https://doi.org/10.1093/eurjpc/zwad229
9. LaMonte MJ, LaCroix AZ, Nguyen S, Evenson KR, Di C, Stefanick ML, et al. Accelerometer-measured physical activity, sedentary time, and heart failure risk in women aged 63 to 99 years. JAMA Cardiol. 2024;9(4):336-345. https://doi.org/10.1001/jamacardio.2023.5692
10. Inoue K, Tsugawa Y, Mayeda ER, Ritz B. Association of daily step patterns with mortality in US adults. JAMA Netw Open. 2023;6(3):e235174. https://doi.org/10.1001/jamanetworkopen.2023.5174
11. Ding D, Ramirez Varela A, Bauman AE, Ekelund U, Lee IM, Heath G, et al. Towards better evidence-informed global action: lessons learnt from the Lancet series and recent developments in physical activity and public health. Br J Sports Med. 2020;54(8):462-468. https://doi.org/10.1136/bjsports-2019-101001
12. Ji H, Gulati M, Huang TY, Kwan AC, Ouyang D, Ebinger JE, et al. Sex differences in association of physical activity with all-cause and cardiovascular mortality. J Am Coll Cardiol. 2024;83(8):783-793. https://doi.org/10.1016/j.jacc.2023.12.019
13. Stamatakis E, Ahmadi M, Biswas RK, del Pozo Cruz B, Thøgersen-Ntoumani C, Murphy MH, et al. Device-measured vigorous intermittent lifestyle physical activity (VILPA) and major adverse cardiovascular events: evidence of sex differences. Br J Sports Med. 2025;59(5):316-324. https://doi.org/10.1136/bjsports-2024-108484
14. Guthold R, Stevens GA, Riley LM, Bull FC. Worldwide trends in insufficient physical activity from 2001 to 2016: a pooled analysis of 358 population-based surveys with 1.9 million participants. Lancet Glob Health. 2018;6(10):e1077-e1086. https://doi.org/10.1016/S2214-109X(18)30357-7
15. Ho FK, Zhou Z, Petermann-Rocha F, Para-Soto S, Boonpor J, Welsh P, et al. Association between device-measured physical activity and incident heart failure: a prospective cohort study of 94 739 UK Biobank participants. Circulation. 2022;146(12):883-891. https://doi.org/10.1161/CIRCULATIONAHA.122.059663
16. Song Z, Wan L, Wang W, Li Y, Zhao Y, Zhuang Z, et al. Daily stair climbing, disease susceptibility, and risk of atherosclerotic cardiovascular disease: a prospective cohort study. Atherosclerosis. 2023;386:117300. https://doi.org/10.1016/j.atherosclerosis.2023.117300
17. Kokkinos P, Faselis C, Samuel IBH, Lavie CJ, Zhang J, Vargas JD, et al. Changes in cardiorespiratory fitness and survival in patients with or without cardiovascular disease. J Am Coll Cardiol. 2023;81(12):1137-1147. https://doi.org/10.1016/j.jacc.2023.01.027
18. Chen HH, Hsieh PL. Applying the Pender's health promotion model to identify the factors related to older adults' participation in community-based health promotion activities. Int J Environ Res Public Health. 2021;18(19):9985. https://doi.org/10.3390/ijerph18199985
19. Bahabadi FJ, Estebsari F, Rohani C, Rahimi Khalifeh Kandi Z, Sefidkar R, Mostafaei D. Predictors of health-promoting lifestyle in pregnant women based on Pender's health promotion model. Int J Womens Health. 2020;12:71-77. https://doi.org/10.2147/IJWH.S235169
20. Murdaugh CL, Parsons MA, Pender NJ. Health promotion in nursing practice. 8th ed. Boston: Pearson; 2019. Available from: https://books.google.com/books?id=Bq2ltAEACAAJ
21. Faul F, Erdfelder E, Buchner A, Lang AG. Statistical power analyses using G*Power 3.1: tests for correlation and regression analyses. Behav Res Methods. 2009;41(4):1149-1160. https://doi.org/10.3758/BRM.41.4.1149
22. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003;35(8):1381-1395. https://doi.org/10.1249/01.MSS.0000078924.61453.FB
23. Blasco-Peris C, Climent-Paya V, Vetrovsky T, García-Álvarez MI, Manresa-Rocamora A, Beltrán-Carrillo VJ, Sarabia JM. International Physical Activity Questionnaire Short Form and accelerometer-assessed physical activity: concurrent validity using six cut-points in HF patients. ESC Heart Fail. 2024;11(1):126-135. https://doi.org/10.1002/ehf2.14514
24. Muliantino MR, Qadri NZ, Afriyanti E, Sarfika R. Self-efficacy in increasing physical activity of coronary heart disease patients: a cross-sectional study. J Ners. 2024;19(3):371-377. https://doi.org/10.20473/jn.v19i3.51941
25. Dharmansyah D, Budiana D. Indonesian adaptation of the International Physical Activity Questionnaire (IPAQ): psychometric properties. J Pendidik Keperawatan Indones. 2021;7(2):159-163. https://doi.org/10.17509/jpki.v7i2.39351
26. Meng Y, Zhang T, Ge X, Zheng Q, Feng T. Physical activity changes and related factors in chronic heart failure patients during the postdischarge transition period: a longitudinal study. BMC Cardiovasc Disord. 2024;24(1):232. https://doi.org/10.1186/s12872-024-03881-4

27. Goo SY, Lee MK, Lee DH, Park DH, Lee TH, Lee CJ, et al. Comparing domain- and intensity-specific physical activity in coronary heart disease and non-CHD individuals. Sci Rep. 2024;14:2622. https://doi.org/10.1038/s41598-024-52764-3
28. Chen J, Wang Y, Zhong Z, Chen X, Zhang L, Jie L, et al. Sex differences in the association of wearable accelerometer-derived physical activity with coronary heart disease incidence and mortality. Nat Cardiovasc Res. 2025;4:1539-1549. https://doi.org/10.1038/s44161-025-00732-z
29. del Pozo Cruz B, Ahmadi M, Naismith SL, Stamatakis E. Association of daily step count and intensity with incident dementia in 78 430 adults living in the UK. JAMA Neurol. 2022;79(10):1059-1063. https://doi.org/10.1001/jamaneurol.2022.2672
30. Ahmadi MN, Rezende LFM, Ferrari G, del Pozo Cruz B, Lee IM, Stamatakis E. Do the associations of daily steps with mortality and incident cardiovascular disease differ by sedentary time levels? A device-based cohort study. Br J Sports Med. 2024;58(5):261-268. https://doi.org/10.1136/bjsports-2023-107221
31. Jayedi A, Soltani S, Emadi A, Zargar M, Najafi A. Aerobic exercise and weight loss in adults: a systematic review and dose-response meta-analysis. JAMA Netw Open. 2024;7(12):e2452185. https://doi.org/10.1001/jamanetworkopen.2024.52185

How to Cite This Article:

Sandag SP, Sumarmi S, Arafah S, Lainsamputty F. Factors Associated with Physical Activity among Cardiovascular Patients in North Sulawesi: A Cross-Sectional Study. An Idea Nursing Journal.2026; 5(3):274-287. https://doi.org/10.53690/inj.v5i02.886.