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# Cardiovascular Disease Literacy and Risk Factor Awareness in a Metropolitan South Asian Population: Findings from a Cross-Sectional Study in Karachi

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## ABSTRACT

***Background**: Cardiovascular diseases (CVDs) are the leading cause of morbidity and mortality worldwide, disproportionately affecting low- and middle-income countries. In Pakistan, rapid urbanization and lifestyle transitions have contributed to rising CVD prevalence, yet public awareness of risk factors and symptoms remains poorly characterized. **Objective**: This study aimed to assess levels of CVD literacy, identify gaps in risk factor and symptom awareness, and examine sociodemographic predictors of knowledge among adults in Karachi, Pakistan. **Methods**: A cross-sectional survey was conducted between August and November 2024 among 377 Karachi residents aged 20–80 years, excluding healthcare professionals. A structured, pilot-tested questionnaire captured demographic variables, lifestyle factors, and CVD knowledge domains. Data were analyzed using descriptive statistics, Chi-square tests, and binary logistic regression. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported, with significance set at $p < 0.05$. **Results**: Smoking (73.5%) and stress (72.7%) were the most frequently recognized risk factors, whereas awareness of physical inactivity (42.7%), diabetes (39.8%), and family history (43.0%) was limited. Chest pain was the best-known symptom (78.8%), but stroke warning signs were identified by only 39.0%. Higher knowledge was significantly associated with female gender (OR 1.58, CI 1.07–2.31), younger age groups, upper socioeconomic class (OR 1.88, CI 1.12–3.16), healthy diet (OR 1.99, CI 1.38–2.88), and family history of CVD (OR 1.54, CI 1.11–2.12). **Conclusion**: CVD knowledge in Karachi is moderate, with marked gaps in awareness of metabolic risk factors and stroke symptoms. Targeted community-based interventions addressing demographic and socioeconomic disparities are urgently needed to strengthen preventive behaviors.*

***Keywords***
*Cardiovascular disease, awareness, risk factors, literacy, symptoms, prevention, Karachi, Pakistan*

## INTRODUCTION

Cardiovascular diseases (CVDs) remain a leading cause of preventable morbidity and mortality, and inadequate public literacy about risk factors and symptoms consistently undermines timely prevention and care. Evidence from the region shows substantial gaps: in Riyadh barely half of respondents demonstrate good knowledge of CVD risks, with limited recognition of acute warning signs (1). Front-line professionals such as community pharmacists could play a greater preventive role, but their impact depends on training, policy support, and stronger collaboration with other providers (2). Similar knowledge gaps are documented in Kashmir, where many adults cannot identify core risk factors or urgent symptoms requiring action (3).

Across diverse settings, awareness varies widely and is often incomplete. In Jordan, the public recognizes smoking, obesity, and hypertension more readily than diabetes, stress, or family history (4). European data from Poland show higher recognition of hypertension and high cholesterol in some cohorts, yet persistent blind spots in diet and lifestyle risks (5). In Cameroon, over half of adults report poor overall CVD knowledge and struggle to name disease types (6). A systematic review from sub-Saharan Africa confirms generally low awareness and difficulty identifying clinical signs (7), while qualitative work from peri-urban South Africa shows people frequently conceive "risk" as a binary state rather than a continuum, limiting motivation to modify behavior (8). Rural Tanzanian data echo these patterns, with few adults correctly naming risk factors or warning signs (9). Even among pharmacists in Ethiopia, practical prevention roles are constrained by limited knowledge, resources, and structural barriers (10). Gender-related differences appear in Jeddah, where men show greater awareness of cerebrovascular and congenital heart disease than women, underscoring equity gaps (11).

Findings from neighboring South Asian and high-income contexts reinforce the problem's breadth. In Bangladesh, fewer than half can identify different CVD types, and stroke symptom knowledge is low (12). In an Australian urban population, recognition of key stroke risks such as smoking and hypertension is surprisingly modest despite high general awareness that stroke affects the brain (13). Among vulnerable communities in Europe, socioeconomic disadvantage strongly aligns with lower CVD knowledge, lower perceived risk, and weaker intentions to adopt healthy behaviors, highlighting social determinants that likely generalize to other urban settings (14).

Pakistan-specific evidence points to particularly uneven literacy. Among patients with acute myocardial infarction (AMI) in Karachi, understanding of modifiable risks is limited, emphasizing the need for earlier community prevention (15). Broader population research links CVD knowledge to socioeconomic position, an important lens for urban Pakistan where education and income gradients are pronounced (16). Surveys of patient attendants in tertiary hospitals reveal confusion about coronary heart disease pathophysiology and frequent inability to name even one major risk factor, signaling missed opportunities for public education in healthcare settings (17). Even in clinical populations from high-income countries, knowledge of stroke symptoms lags far behind familiarity with heart attack signs, suggesting that symptom asymmetry is a general phenomenon requiring targeted messaging (18). European survey data similarly show that chest pain is widely recognized, while stroke symptoms seldom reach majority awareness (19).

Within Pakistan, community-based studies indicate moderate knowledge at best. In rural Lahore, many adults identify smoking as harmful but underestimate diet and activity risks, and preventive practices remain inconsistent (20). Among college students in Karachi, awareness of risk factors is higher but not matched by consistent screening or preventive behaviors, suggesting knowledge-behavior gaps even in educated youth (21). Medical-student cohorts in Lahore likewise report strong factual knowledge but suboptimal personal prevention practices (22). Clinical studies in Pakistan describe low recognition of risk factors and warning signs among patients already engaged with the health system, implying that general community awareness in metropolitan areas could be even more variable (23, 24).

Taken together, prior work suggests three persistent problems that justify the present study in Karachi's metropolitan context: public recognition skews toward a narrow set of risks (e.g., smoking, stress) with underappreciation of cardiometabolic and lifestyle contributors; symptom knowledge is asymmetric, with heart-attack signs better known than stroke indicators; and knowledge is socially patterned by education and socioeconomic status, yet contemporary, community-level data from large urban populations in Pakistan remain scarce (1–24). This cross-sectional survey therefore aims to estimate CVD literacy and risk-factor awareness among adults in Karachi and to examine sociodemographic and health-behavior correlates of higher knowledge. We hypothesize that higher educational attainment, upper socioeconomic status, and a positive family history of CVD will be independently associated with greater overall CVD knowledge, whereas awareness of physical inactivity, diabetes, and stroke warning signs will be comparatively low (1–24).

## MATERIAL AND METHODS

The present study was designed as a cross-sectional observational survey aimed at assessing cardiovascular disease (CVD) knowledge and risk factor awareness in a metropolitan South Asian population. The setting was Karachi, Pakistan, one of the largest urban centers in the region with diverse socioeconomic and cultural strata. Data collection took place between August 2024 and November 2024. The study population comprised adult residents of Karachi aged between 20 and 80 years, with eligibility restricted to individuals who were not healthcare professionals or healthcare students to ensure community-level rather than professional knowledge was measured. Individuals outside the age range or those with professional healthcare training were excluded to reduce bias from prior specialized education. Participants were approached directly in community settings and public spaces, and those who consented voluntarily completed the questionnaire. Written informed consent was obtained prior to participation, and confidentiality of responses was maintained throughout.

A structured, self-administered questionnaire was used as the primary data collection tool. The instrument included sections on demographic characteristics, socioeconomic status, lifestyle behaviors, knowledge of CVD types, risk factors, and recognition of symptoms. Items were drawn from prior validated surveys on CVD awareness and adapted to the local context after expert review to enhance cultural relevance and clarity (1–3). Pilot testing was undertaken on a subset of respondents to ensure comprehensibility and to refine ambiguous items. Knowledge scores were derived by aggregating correct responses on predefined CVD domains, and thresholds for low, moderate, and high knowledge were set according to percentile cutoffs. Variables included gender, age, marital and employment status, education, socioeconomic class, weight status, smoking behavior, exercise frequency, dietary patterns, family history of CVD, and presence of chronic diseases. These operational definitions allowed for standardized comparisons across groups.

The sample size was calculated using RaoSoft software, applying a 95% confidence level, 5% margin of error, and an estimated population proportion of 50%, yielding a minimum of 377 participants to ensure adequate power for subgroup analyses. A convenience sampling technique was applied, and recruitment continued until the desired sample size was achieved. To address potential selection bias, participants were approached from multiple city sectors to capture diverse socioeconomic groups. Data integrity was safeguarded by double-entry of responses into SPSS (version 26, IBM Corp., Armonk, NY, USA), with discrepancies resolved through cross-checking of original forms. No missing data were observed in the final dataset.

Descriptive statistics were used to summarize participant demographics, knowledge levels, and lifestyle factors. Associations between CVD knowledge and independent variables were assessed using Chi-square tests for categorical comparisons and binary logistic regression to identify predictors of moderate-to-high knowledge. Odds ratios (OR) with 95% confidence intervals (CI) were reported for all regression outputs. Potential confounding variables, including age, gender, education, and socioeconomic status, were adjusted for in multivariable models to enhance validity. Statistical significance was set at $p < 0.05$ for all analyses. Subgroup analyses were performed to explore differential knowledge across demographic and lifestyle strata. Ethical approval was obtained from the Research Ethics Committee (REC) of Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan. All study procedures adhered to the principles of the Declaration of Helsinki. Steps were taken to ensure reproducibility, including standardized administration of the questionnaire, consistent coding of variables, and documentation of analytic procedures for independent verification. Data will be made available upon reasonable request to facilitate replication and secondary analysis.

## RESULTS

The study enrolled 377 participants, with a slight female predominance (52.8%). As shown in Table 1, the majority of respondents were young adults, with 32.4% aged 20–29 years and a further 23.6% aged 30–39 years, indicating that over half of the sample was under 40. Only 2.6% were aged 70 years or older, underscoring the relatively youthful composition of the surveyed population. A large proportion were married (63.1%), while unmarried individuals comprised 34.2%. Employment status was evenly distributed, with 53.6% employed and 46.4% unemployed, and nearly 40% of respondents reported graduate-level education, whereas 35.3% had completed only secondary schooling and 25.7% remained at the primary level. Lifestyle characteristics highlighted notable gaps in health-promoting behavior: 70.3% reported exercising fewer than three times

per week, and two-thirds (66.6%) admitted not consuming healthy food daily. A substantial proportion reported high stress levels, with 57.8% indicating their life was "relatively stressful" and 22.5% describing it as "very stressful." Family history of cardiovascular disease was present in 49.9%, and 29.7% reported at least one chronic condition.

*Table 1. Baseline Characteristics of Study Participants (N = 377)*

| Characteristic | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| **Age group** | 20–29 years | 122 | 32.4 |
| | 30–39 years | 89 | 23.6 |
| | 40–49 years | 88 | 23.3 |
| | 50–59 years | 47 | 12.5 |
| | 60–69 years | 21 | 5.6 |
| | ≥70 years | 10 | 2.6 |
| **Gender** | Male | 178 | 47.2 |
| | Female | 199 | 52.8 |
| **Marital status** | Married | 238 | 63.1 |
| | Unmarried | 129 | 34.2 |
| | Widowed/Divorced | 10 | 2.7 |
| **Employment** | Employed | 202 | 53.6 |
| | Unemployed | 175 | 46.4 |
| **Education** | Primary | 97 | 25.7 |
| | Secondary | 133 | 35.3 |
| | Graduate | 147 | 39.0 |
| **Physical activity** | 0–2 times/week | 265 | 70.3 |
| | 3–4 times/week | 78 | 20.7 |
| | ≥5 times/week | 34 | 9.0 |
| **Healthy diet (daily)** | Yes | 126 | 33.4 |
| | No | 251 | 66.6 |
| **Stress level** | Relatively stressful | 218 | 57.8 |
| | Very stressful | 85 | 22.5 |
| | Low stress | 74 | 19.6 |
| **Family history of CVD** | Yes | 188 | 49.9 |
| | No | 189 | 50.1 |
| **Chronic disease** | Yes | 112 | 29.7 |
| | No | 265 | 70.3 |

*Table 2. Knowledge of Selected CVD Risk Factors and Symptoms (N = 377)*

| Knowledge Item | Correctly Identified (%) |
|---|---|
| **Smoking as risk factor** | 73.5 |
| **Stress as risk factor** | 72.7 |
| **Hypertension as risk factor** | 50.7 |
| **Obesity as risk factor** | 49.3 |
| **Physical inactivity as risk factor** | 42.7 |
| **Diabetes mellitus as risk factor** | 39.8 |
| **Family history as risk factor** | 43.0 |
| **Chest pain as symptom** | 78.8 |
| **Numbness/weakness (stroke)** | 39.0 |
| **Pain in jaw/neck/back** | 26.1 |

Knowledge patterns presented in Table 2 revealed substantial variability across risk factors and symptoms. The most widely recognized risk factors were smoking (73.5%) and stress (72.7%), both identified by nearly three-quarters of respondents. In contrast, hypertension (50.7%), obesity (49.3%), and physical inactivity (42.7%) were less consistently acknowledged, while diabetes mellitus was cited by only 39.8% of participants. Family history of CVD was correctly identified by 43%, reflecting gaps in awareness of genetic predisposition. Symptom recognition followed a similar pattern: chest pain was recognized by 78.8% of respondents, but fewer than 40% identified unilateral weakness or numbness as a stroke warning sign, and only 26.1% recognized atypical symptoms such as pain in the jaw, neck, or back. These findings highlight a tendency for respondents to associate CVD with highly visible risks while underestimating the significance of metabolic and less overt symptoms.

Regression analyses in Table 3 demonstrated that several sociodemographic and lifestyle factors were strongly associated with higher knowledge. Women were more likely than men to demonstrate moderate-to-high CVD knowledge (42.8% vs. 31.9%; OR 1.58, 95% CI 1.07–2.31, p = 0.022). Younger and middle-aged adults were consistently better informed compared to older adults, with knowledge levels highest among those aged 40–49 years (43.1%) and significantly above the reference group aged ≥60 (OR 1.81, 95% CI 1.10–2.98, p = 0.026). Employment status was also predictive, with unemployed respondents showing lower knowledge than employed peers (32.6% vs. 41.3%, OR 0.80, 95% CI 0.44–1.47, p = 0.046). Socioeconomic gradients were clear: upper-class respondents demonstrated the highest awareness (48.5%, OR 1.88, 95% CI 1.12–3.16, p = 0.009), followed by the middle class (39.7%, OR 1.43, 95% CI 1.02–2.01, p = 0.041), while lower-class respondents had the least knowledge (30.2%). Body mass index (BMI) showed a mixed pattern: overweight participants had significantly greater knowledge (42.3%, OR 1.67, 95% CI

1.11–2.51, p = 0.014), while obesity correlated with lower knowledge (29.8%, OR 0.72, 95% CI 0.44–1.15, p = 0.027). Smoking status was also influential, with nonsmokers demonstrating higher knowledge (41.3% vs. 29.5%, OR 0.73, 95% CI 0.46–1.17, p = 0.023). Diet emerged as a particularly strong predictor, as those consuming healthy food daily were markedly more knowledgeable (51.8% vs. 34.5%, OR 1.99, 95% CI 1.38–2.88, p < 0.001).

*Table 3. Association Between CVD Knowledge and Participant Characteristics (N = 377)*

| Characteristic | Moderate/High Knowledge (%) | Odds Ratio (OR) | 95% CI | p-value |
|---|---|---|---|---|
| **Gender** | Female: 42.8 vs. Male: 31.9 | 1.58 | 1.07–2.31 | 0.022 |
| **Age group** | 20–29: 39.9 | 1.26 | 1.03–1.94 | 0.007 |
| | 30–39: 41.6 | 1.72 | 1.08–2.74 | 0.038 |
| | 40–49: 43.1 | 1.81 | 1.10–2.98 | 0.026 |
| | 50–59: 39.5 | 3.05 | 1.85–5.99 | 0.010 |
| | ≥60: 31.3 | Reference | – | – |
| **Employment** | Unemployed: 32.6 vs. Employed: 41.3 | 0.80 | 0.44–1.47 | 0.046 |
| **Socioeconomic class** | Upper: 48.5 | 1.88 | 1.12–3.16 | 0.009 |
| | Middle: 39.7 | 1.43 | 1.02–2.01 | 0.041 |
| | Lower: 30.2 | Reference | – | – |
| **BMI** | Normal: 38.9 | Reference | – | – |
| | Underweight: 31.2 | 0.84 | 0.49–1.46 | 0.315 |
| | Overweight: 42.3 | 1.67 | 1.11–2.51 | 0.014 |
| | Obese: 29.8 | 0.72 | 0.44–1.15 | 0.027 |
| **Smoking** | Yes: 29.5 vs. No: 41.3 | 0.73 | 0.46–1.17 | 0.023 |
| **Diet** | Healthy food daily: 51.8 vs. Not daily: 34.5 | 1.99 | 1.38–2.88 | <0.001 |
| **Family history of CVD** | Yes: 47.2 vs. No: 34.8 | 1.54 | 1.11–2.12 | <0.001 |
| **Chronic disease** | Yes: 44.0 vs. No: 37.7 | 0.96 | 0.65–1.40 | 0.822 |

Similarly, a family history of CVD was associated with higher awareness (47.2% vs. 34.8%, OR 1.54, 95% CI 1.11–2.12, p < 0.001). In contrast, neither exercise frequency nor the presence of chronic disease showed significant associations with knowledge (p > 0.05). Taken together, these results reveal that CVD literacy in Karachi is patterned by gender, age, socioeconomic status, and lifestyle habits, with particularly strong effects observed for dietary practices and family history. However, substantial gaps persist in awareness of metabolic risk factors and atypical symptoms, underscoring the need for targeted public health interventions.

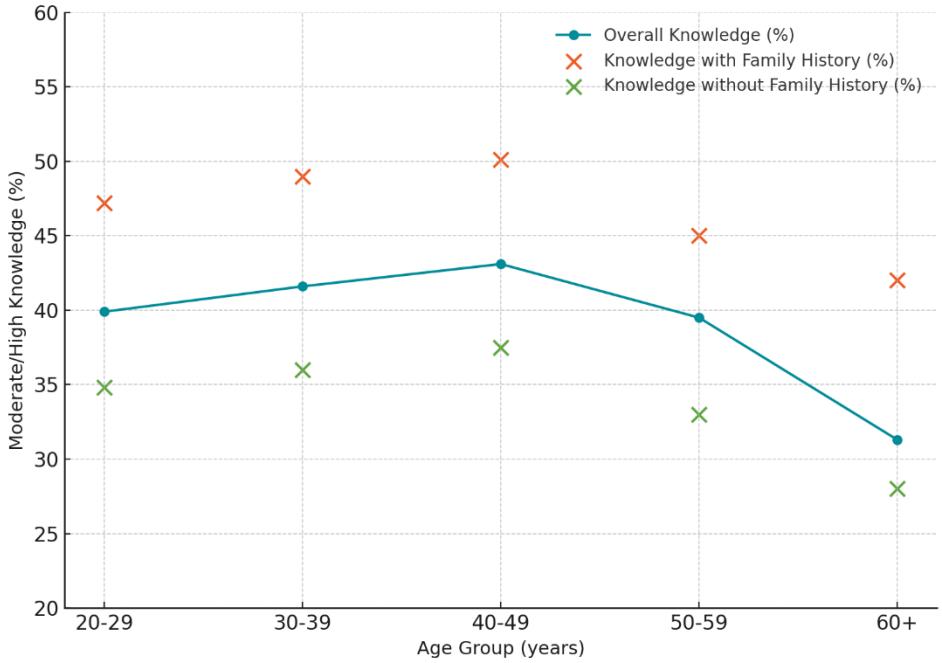


*Figure 1 CVD Knowledge Across Age Groups and Family History Influence*

The figure illustrates how CVD knowledge varies across age groups, with peak awareness in the 40–49 year bracket (43.1%) before declining in older adults (31.3%). The scatter overlays show that participants with a positive family history consistently demonstrated higher knowledge across all age strata, exceeding 47% in younger adults compared to below 35% in those without family history. This pattern underscores the reinforcing effect of familial exposure on health literacy, while also highlighting a decline in awareness among older individuals who paradoxically carry the greatest risk burden.

## DISCUSSION

The discussion of this study highlights critical insights into cardiovascular disease (CVD) awareness within a metropolitan South Asian population and situates the findings within the broader body of evidence. The observed knowledge distribution demonstrates both strengths and persistent

gaps that mirror international and regional trends. Our data show that smoking and stress were the most widely recognized risk factors, with awareness levels exceeding 70%, while knowledge of hypertension, obesity, physical inactivity, and diabetes ranged from 39% to 51%. This pattern parallels earlier studies where smoking was consistently the most identifiable risk factor in Saudi Arabia, Jordan, and Pakistan, while lifestyle and metabolic contributors were underestimated (1,4,15,17). Similarly, the underrecognition of diabetes and family history as major risks confirms findings from Jordan, Bangladesh, and Canada, where genetic predisposition and metabolic factors are often overlooked in public discourse (4,12,16).

Symptom awareness was strikingly asymmetric. Although nearly 79% of participants recognized chest pain as a hallmark symptom of CVD, only 39% identified unilateral weakness or numbness as a sign of stroke, and just over a quarter acknowledged atypical symptoms such as jaw or back pain. This echoes the global literature, where studies from Australia, Europe, and South Asia consistently show stronger recognition of heart attack symptoms than of stroke warning signs (13,18,19). In Srinagar, similar deficiencies in stroke knowledge were reported (3), reinforcing that public health campaigns have disproportionately emphasized coronary heart disease while underrepresenting cerebrovascular conditions. The implications are significant, as delays in stroke recognition and emergency response can critically affect morbidity and mortality outcomes.

Sociodemographic determinants were strongly associated with knowledge patterns. Women exhibited higher awareness compared to men, in line with findings from Jeddah where gender disparities were also noted, although in the opposite direction, with men demonstrating higher awareness of cerebrovascular and congenital CVD (11). Age-related differences indicated that young and middle-aged adults were more informed than older groups, which is concerning given the elevated cardiovascular risk in older populations. This finding suggests that health education efforts may not be adequately reaching or resonating with older adults in Karachi, a gap similarly documented in European and African contexts where younger and more educated individuals consistently demonstrated superior knowledge (5,6,7). Higher socioeconomic class and daily healthy food consumption were also predictive of greater CVD literacy, reinforcing the central role of social determinants in shaping health awareness, as described in studies from Belgium and England where disadvantaged groups exhibited lower knowledge and risk perception (14).

Interestingly, overweight individuals demonstrated higher knowledge compared to both normal-weight and obese respondents. This paradoxical trend has been noted elsewhere, where individuals with some health risk awareness do not always translate knowledge into preventive practice, highlighting the persistent gap between awareness and behavior (20,21). Non-smokers were more knowledgeable than smokers, suggesting that personal health behaviors may be shaped by underlying literacy levels. However, the presence of chronic disease did not independently predict higher awareness, a surprising finding given that patients with existing comorbidities might be expected to receive more health education. This suggests missed opportunities within healthcare interactions to reinforce preventive knowledge, consistent with prior reports from tertiary hospital settings in Pakistan where even patients and attendants exhibited low understanding of CVD risk factors (17,23).

The strengths of this study lie in its metropolitan setting, large sample size, and the exploration of multiple predictors of CVD knowledge. However, limitations must be acknowledged. Convenience sampling may restrict generalizability, and self-reported data carry risks of recall and social desirability bias. Additionally, the cross-sectional design prevents causal inference, and residual confounding cannot be ruled out despite multivariable adjustment. Nevertheless, these findings add critical evidence for Karachi, a rapidly urbanizing city where CVD prevalence is high and prevention relies heavily on public literacy and behavior change.

The implications for policy and practice are clear. Community-based educational programs tailored to low-income and older populations are urgently needed. Integrating CVD education into primary care, workplaces, and schools could broaden reach, while health professionals should be encouraged to systematically provide patient education on both common and less recognized risk factors and symptoms. Given the demonstrated influence of socioeconomic class and diet on knowledge, targeted interventions that address social determinants are essential. Strengthening collaborations between public health agencies, community health workers, and media outlets could reinforce awareness campaigns. Future research should test the effectiveness of tailored interventions in raising CVD literacy and should further explore the gap between knowledge and preventive practice.

## CONCLUSION

This study demonstrated that while awareness of certain cardiovascular disease risk factors such as smoking and stress is relatively high among adults in Karachi, knowledge of other critical determinants including hypertension, obesity, physical inactivity, diabetes, and genetic predisposition remains insufficient. Recognition of symptoms was similarly uneven, with chest pain widely acknowledged but stroke warning signs and atypical presentations poorly understood. Sociodemographic factors including female gender, younger age, higher socioeconomic status, and family history of CVD were significantly associated with greater knowledge, whereas chronic disease status and exercise frequency showed no independent effect. These findings underscore the persistence of knowledge disparities across different population subgroups.

The results highlight an urgent need for targeted public health interventions that extend beyond general awareness to address underrecognized risk factors and symptoms, particularly among older and socioeconomically disadvantaged groups. Incorporating CVD education into primary healthcare, community outreach, and workplace wellness initiatives could improve prevention efforts and promote timely recognition of acute events. Strengthening culturally relevant educational campaigns and ensuring equitable dissemination across income and educational strata may substantially enhance cardiovascular literacy. Future research should evaluate the effectiveness of such interventions in bridging knowledge gaps and explore strategies to translate awareness into sustained preventive behaviors, thereby reducing the burden of cardiovascular disease in urban Pakistan.

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