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RESEARCH ARTICLE

CARDIOVASCULAR HEALTH LITERACY AND RECOGNITION OF RISK FACTORS AMONG NON-MEDICAL UNIVERSITY STUDENTS IN LAHORE

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Abstract

Background: Cardiovascular disease remains a leading cause of global morbidity and premature mortality, with increasing involvement of younger adults in Pakistan. Despite this trend, limited evidence exists regarding the level of cardiovascular awareness among non-medical university students, a group representing a large proportion of the young adult population. This study assessed their understanding of cardiovascular disease, associated risk factors, and recognition of early warning symptoms.
Methods: A descriptive cross sectional survey was conducted among two hundred non-medical university students in Lahore. Data were collected using a structured questionnaire designed to assess knowledge of cardiovascular disease types, major risk factors, and symptoms of myocardial infarction and stroke.
Results: Knowledge levels varied across different domains. Nearly half of the participants were unable to identify a single cardiovascular condition, although commonly known heart attack symptoms such as chest pain were frequently recognized. Awareness of atypical myocardial infarction symptoms and stroke warning signs was comparatively low. Students demonstrated better understanding of lifestyle related risk factors including smoking, unhealthy diet, stress, and high cholesterol, whereas physical inactivity and diabetes were less frequently identified.
Conclusions: The study highlights important gaps in cardiovascular knowledge among non medical university students, particularly in symptom recognition. Strengthening structured cardiovascular education within universities and expanding community based preventive services may help improve awareness and support earlier response to cardiovascular risk among young adults.
Keywords: Cardiovascular disease, health literacy, non-medical students, University students.

INTRODUCTION

Cardiovascular diseases have been described as a broad cluster of disorders that influence the functioning of the heart and vessels, and these conditions have been said to include coronary artery disease stroke rheumatic illnesses congenital malformations venous thrombosis and disturbances of peripheral circulation[1]. They have continued to be identified as the foremost cause of mortality worldwide and almost eighteen million deaths are attributed to them each year which establishes them as a major contributor to global health loss[2]. A great portion of these deaths has been produced by heart attacks and strokes and their outcomes rely heavily upon early identification and rapid treatment[3]. Even though considerable progress has been achieved in diagnostic and therapeutic technologies in many countries the general burden of cardiovascular disease has not shown a comparable decline and in some settings it appears to be rising[4]. This rise has been viewed most prominently in low income societies where urban expansion changes in lifestyle and insufficient awareness have created circumstances that tend to promote earlier cardio-vascular vulnerability[5]. In Pakistan the younger population has increasingly been exposed to multiple risks that include unhealthy eating, limited exercise, tobacco use, excessive body weight and uncontrolled blood pressure or cholesterol and these exposures may place people at risk far sooner than before[6].

Cardiovascular disorders have frequently been regarded as largely preventable since many influencing factors can be modified by suitable intervention and behavioral adjustment[7]. Leading health organizations have emphasized that the presence of smoking, high blood pressure, elevated cholesterol, lack of physical activity, poor eating habits, increased blood sugar and excess weight can contribute strongly to the development of these diseases[8]. Within the Pakistani context these factors are shaped by pressures that include rising dependence on processed low cost foods and increased academic and financial strain among students which may intensify unhealthy routines[9]. Furthermore a common belief that heart disease mostly affects older adults has resulted in younger individuals giving limited attention to early symptoms or hazardous behaviors[10]. This difficulty in recognizing early warning signs has been documented in Karachi and other large cities where many patients did not understand the significance of initial symptoms of myocardial infarction[11].

Research that has been carried out around the country has suggested that the general population does not possess adequate awareness of cardiovascular disease and this issue becomes clearer when questions about identifying symptoms are posed[12]. A number of studies have shown that individuals often struggle to detect early signs of heart attack or stroke and this misunderstanding has contributed to considerable delays in reaching medical care which can seriously harm prognosis[13]. University students who belong to non medical programs have demonstrated similar trends[14,15]. Although they are generally well educated and familiar with modern communication tools many have still been found unable to explain key cardiovascular symptoms or recognize the major risk contributors[16]. One investigation noted that only a small portion of these students achieved scores above the average on a cardiovascular knowledge measure even though many among them reported a family history of heart disease[14]. This disconnects between assumed understanding and actual knowledge may leave students at greater risk when faced with genuine health emergencies[14].

The period spent at university is often believed to shape long term habits for many young adults[17]. Routines that involve extended study hours, irregular schedules, increased stress, minimal structured exercise and reliance on fast foods may gradually heighten cardiovascular risk[18]. Students who are not enrolled in health related courses usually do not receive organized instruction on symptom recognition or approaches to prevent disease[19]. As a result information is sometimes collected from incomplete or unreliable sources[19]. In addition cultural expressions which is used to describe vague discomfort may lead people to ignore early warning signs of cardiac distress[20]. Many individuals may attempt home remedies or delay seeking professional care until symptoms intensify and such patterns can persist throughout adulthood increasing overall risk[11].

The way students view health professionals also requires consideration when preventive strategies are being planned[21]. Pharmacists in South Asian contexts including Pakistan are often the most easily reached healthcare providers and interact frequently with the public[22]. Their role in counseling on medication safety and in offering advice on blood pressure management, smoking cessation and lifestyle modification has been recognized internationally[23]. Nevertheless within Pakistan, pharmacists continue to be perceived mainly as individuals who dispense medicines instead of as contributors to preventive healthcare and this perception restricts their potential involvement in community practices[24]. Understanding how students regard the pharmacist role may therefore offer helpful insight for strengthening cardiovascular prevention programs[25].

Despite increasing interest in cardiovascular disease across the country there remains a shortage of studies that specifically examine awareness among non medical university students. Most previous research has been carried out with medical students or general community members and thus has left an important space in understanding how well non medical students are prepared to recognize symptoms risk factors and preventive strategies. The importance of filling this gap is significant because these students form a considerable portion of the future working population in Pakistan and better cardiovascular literacy among them could have meaningful long term benefits for society.

Accordingly this study has been designed to evaluate cardiovascular awareness among non medical university students in Lahore. Their level of understanding regarding different cardiovascular disease types, recognition of early symptoms and awareness of risk contributors has been investigated along with their perceptions of pharmacists and their preventive function. By presenting these findings the study seeks to support efforts to develop targeted education policies inform health related discussions and contribute to broader attempts to reduce cardiovascular disease among young adults.

METHODS

Study Design

A descriptive cross sectional design was employed for this investigation and the collection of data was carried out over approximately three months between May and July of the year 2025. This approach was selected since information could be obtained from the target population at a single point rather than through long term follow up which was not feasible for the purpose of this study. Through this strategy an attempt was made to form a brief yet informative picture of how non medical university students have understood cardiovascular conditions and whether early symptoms and risk contributors were being recognized by them.

Study setting and population

The study was undertaken among learners who were enrolled in non medical academic programs in several universities in the city of Lahore in Pakistan. Participation involved students from both undergraduate and postgraduate studies.

The recruitment process was performed online and a link to the questionnaire was circulated through institutional communication routes and student groups so that broader access could be reached efficiently. A number of exclusion rules were introduced so that individuals with formal exposure to health sciences would not be included. Students who were studying medicine, pharmacy, dentistry nursing or allied disciplines and those who had earlier training related to health were excluded. Only those between the ages of eighteen and thirty who were registered in an academic program at the time of data collection were allowed to take part. Before completing the survey they were shown a short description of the study and their consent was obtained digitally which ensured that the group reflected young adults who have not generally been taught cardiovascular topics in a structured manner.

Sample size and sampling technique

A total of 200 students formed the final sample for the study. A convenience sampling approach was adopted because it allowed the survey to be distributed quickly across institutions without the need for accessing formal enrollment lists. All two hundred individuals who received the questionnaire completed it which produced a full response rate. The sample was appropriate for the statistical procedures that were planned including the exploration of possible relationships between demographic characteristics and student's knowledge.

Data collection tool

Information was gathered with the use of a structured questionnaire that had been designed specifically for this research project. The instrument was modified to suit the cultural and educational environment of Pakistan and was reviewed internally by academic staff to ensure that each item was understandable and relevant. The questionnaire was organized into four sections.

- The first section invited participants to report demographic details and information related to general health which included age gender marital status household education dietary habits exercise routine smoking behavior perceived stress personal health rating body weight group and family cardiovascular history.
- The second section required students to indicate if they had any chronic illnesses whether they were taking long term medication and how often they had their blood pressure blood sugar or cholesterol measured.
- The third section was created to test knowledge of cardiovascular disease by asking students to identify various cardiovascular conditions recognize warning signs of myocardial infarction and stroke and select correct modifiable and non modifiable risk contributors. Each correct answer received one point and the total possible score was twenty five.
- The final section asked for their viewpoints regarding the part pharmacists might play in preventive cardiovascular care including lifestyle advice and simple screening activities.

Data collection procedure

The survey was administered through online platform Google Forms. Access to the questionnaire was given by sharing the link in university related communication channels and student discussion groups. An introductory note was presented before the start of the survey explaining the purpose and assuring participants that their identities would not be revealed. Consent was requested electronically before proceeding. The online method allowed students from different universities to take part conveniently and helped reduce the chance of interviewer influence. The collection of responses continued for nearly eight weeks so that students were given adequate time to complete the survey according to their own schedules.

Ethical considerations

Approval for the study was granted by the Ethical Review Committee of the Lahore University of Biological and Applied Sciences (Ref: UBAS/UG/007/08/25). Students were informed that participation was voluntary and that they could discontinue the survey at any time without facing any negative consequence. No identifying information was obtained and confidentiality was therefore maintained. Submission of the completed questionnaire served as confirmation of their consent.

Statistical analysis

The analysis of data was performed using the software SPSS version 26. Descriptive statistics were used for summarizing the characteristics of participants and their knowledge scores. Continuous data were expressed through means, medians or interquartile ranges while frequencies and percentages were applied for categorical information. A univariate logistic regression model was run in order to examine whether demographic or lifestyle variables such as age, gender, marital status, education level, smoking, physical activity, diet, weight, class family history of cardiovascular disease or the presence of chronic illnesses were associated with greater knowledge. Odds ratios with confidence intervals of 95% were calculated. A significance value below 0.05 was considered significant.

RESULTS

It was observed that all 200 non medical students who had been provided with the questionnaire completed it and in this way a response rate of one hundred percent was obtained. A median age of twenty three years with an interquartile range of four years was recorded and the majority of participants which accounted for approximately 86.5% were situated within the age range of 20-29 nine years. A greater proportion of the respondents were female at 70.5% and most of them at 85.5% indicated that they were not married. Nearly all participants who came to 95% were engaged in higher education at the time when the survey was administered.

When self evaluation of health was requested a tendency toward positive assessments was noticed. A combined 73.5% considered their health to be either very good or good and 15% assessed it as excellent

while only a smaller portion measured at 11.5% described their condition as fair or poor. According to self reported weight categories more than half of the participants at 57% believed themselves to fall within a normal weight group while 15.5% regarded themselves as underweight and 26% as overweight and a minor group of 1.5% labeled themselves as obese. Reports of smoking were uncommon since only 5.5% admitted to this habit.

Table 1: Demographic and clinical characteristics of participants (n=200).

Characteristic	Frequency (%)
Age	
20–29 years	173 (86.5)
30–39 years	18 (9.0)
40–49 years	7 (3.5)
≥ 50 years	2 (1.0)
Gender	
Male	59 (29.5)
Female	141 (70.5)
Marital status	
Single	171 (85.5)
Married	29 (14.5)
Education level	
Intermediate or lower	10 (5.0)
Higher education	190 (95.0)
Self-rated health	
Excellent	30 (15.0)
Very good	70 (35.0)
Good	77 (38.5)
Fair	22 (11.0)
Poor	1 (0.5)
Weight status	
Underweight	31 (15.5)
Normal	114 (57.0)
Overweight	52 (26.0)
Obese	3 (1.5)
Smokers	11 (5.5)
Exercise per week	
0–2 times	119 (59.5)
3–5 times	55 (27.5)
≥ 5 times	26 (13.0)
Healthy diet daily	64 (31.8)
Stress level	
Very stressful/Stressed	65 (32.5)
Moderately stressful	111 (55.5)
Stress free	24 (12.0)
Family history of CVD	62 (31.3)
Chronic diseases	
Hypertension	33 (16.5)
Diabetes	1 (0.5)
Dyslipidemia	4 (2.0)
Coronary heart disease	1 (0.5)

Patterns in lifestyle behavior displayed several concerns. Physical activity was performed infrequently by many as 59.5% stated that they exercised fewer than two times each week while only 13% indicated engaging in exercise at least five times. A similar pattern was noticed in dietary practices where 31.8% noted that they consumed healthy meals on a daily basis. Stress was also reported frequently as more than half at 55.5% described their routine as moderately stressful and an additional 32.5% described it as stressful or very stressful.

A family history of cardiovascular disease was reported by 31.3% of the sample. Chronic health conditions were not common since hypertension was found in 16.5%, dyslipidemia in 2% and only isolated instances of diabetes and coronary heart disease at 0.5% each were recorded. Monitoring of basic health measures was performed infrequently. Almost one quarter of participants 22.2% had never checked their blood pressure and more than half had never undergone cholesterol measurement at 64.1% or blood glucose measurement at 53.5%. Findings about demographics and clinical characteristics of participants are illustrated in Table 1

CVD Knowledge

Awareness of CVD types

Student's knowledge of the wider categories of cardiovascular disease was found to be quite limited. A median value of two with an interquartile range of four was recorded for the identification of cardiovascular disease types and this result indicated that awareness within the sample was generally low. An especially notable observation was that almost half of the group at 43.5% was not able to name even a single cardiovascular condition. For those who did attempt to answer the condition mentioned most frequently was coronary heart disease at 59.2% and after that congenital heart disease at 44.7% and rheumatic heart disease at 40.5% were reported.

Awareness of additional cardiovascular disorders declined considerably. Peripheral arterial disease, cerebrovascular disease and venous thromboembolism were identified by 32.7%, 28.6%, and 35.5%of the students and these levels indicated that the majority were familiar only with a limited set of commonly referenced conditions. The broader clinical range of cardiovascular disease therefore seemed to remain largely unrecognized by many participants which suggested that their understanding was confined to a narrow portion of the cardiovascular field.

Heart attack symptom recognition

A moderate degree of understanding was demonstrated by students when questions regarding the symptoms of myocardial infarction were presented and a median score of three with an interquartile range of two was recorded. Awareness of the common warning signs appeared stronger since almost 79.4% identified chest pain and 72.1% recognized shortness of breath and 69% referred to pain extending toward the arm or shoulder. These particular symptoms were evidently the ones with which students seemed most familiar.

In contrast a noticeable decline was observed when attention was given to symptoms that were less typical. Only 36% of participants associated discomfort of the jaw neck or back with the occurrence of a heart attack and merely 33% mentioned dizziness or faintness as possible indicators. An additional observation that deserves attention was that 10.9% of the respondents did not name any myocardial infarction symptom at all which indicated that a segment of the group possessed very limited awareness of how an acute cardiac event might present itself.

Table 2: Knowledge of CVD types, heart attack symptoms, stroke symptoms, and risk factors (n=200).

Category	Frequency (%)
CVD types identified	
Coronary heart disease	119 (59.2)
Congenital heart disease	88 (44.7)
Deep vein thrombosis / pulmonary embolism	71 (35.5)
Rheumatic heart disease	81 (40.5)
Peripheral arterial disease	65 (32.7)
Cerebrovascular disease	57 (28.6)
Heart attack symptoms	
Chest pain/discomfort	158 (79.4)
Shortness of breath	142 (72.1)
Arm/shoulder pain	138 (69.0)
Weakness/light-headedness	66 (33.0)
Jaw/neck/back pain	72 (36.0)
Stroke symptoms	
Confusion/speech difficulty	95 (50.8)
Numbness/weakness	116 (61.1)
Dizziness/loss of balance	114 (58.8)
Severe headache	88 (45.1)
Visual disturbance	72 (37.5)
Risk factors	
Smoking	128 (68.1)
Obesity	125 (65.4)
Unhealthy diet	152 (77.0)
Physical inactivity	120 (62.8)
High LDL cholesterol	129 (66.8)
Hypertension	130 (66.3)
Family history of CVD	114 (59.7)
Stress	136 (71.2)
Diabetes mellitus	91 (47.4)

Stroke symptom recognition

Awareness of stroke symptoms was variable. The median score was 3.0 (IQR: 4.0). The most frequently identified symptoms included sudden numbness or weakness (61.1%), loss of balance or coordination (58.8%), and confusion or difficulty speaking (50.8%). Fewer respondents recognized sudden vision loss (37.5%) or unexplained severe headache (45.1%). More than one-quarter (27.8%) could not identify any stroke symptom.

Awareness of CVD risk factors

As per Table 2, knowledge of CVD risk factors was comparatively stronger. The median score for risk factor identification was 7.0 (IQR: 5.0). The most commonly identified risks included unhealthy diet (77.0%), stress (71.2%), smoking (68.1%), high LDL cholesterol (66.8%), and hypertension (66.3%). Recognition of obesity (65.4%), physical inactivity (62.8%), and family history (59.7%) was moderate. Diabetes was the least recognized risk factor (47.4%). Nearly one in five students (18.6%) could not identify any risk factor.

Factors associated with CVD knowledge

Overall knowledge scores ranged from 0 to 25. The median score was 15 (IQR: 10). Table 3 illustrated approximately 21.8% of respondents scored between 20 and 25, whereas 7.5% failed to provide any correct response. The univariate analysis showed that gender was the only factor meaningfully linked to higher cardiovascular knowledge, with females scoring significantly better than males (p=0.032; OR=0.38; 95% CI: 0.15–0.92). None of the other variables examined such as age, marital status, level of education, smoking behavior, physical activity, dietary habits, and family history of CVD, existing chronic conditions, or perceived weight demonstrated a statistically significant relationship with knowledge scores.

Table 3: Association between CVD knowledge and participant characteristics.

Variable	Moderate/High Knowledge (%)	OR (95% CI)	p-value
Gender			
Male	48.7	Reference	—
Female	65.7	0.38 (0.15–0.92)	0.032*
Age			
20–29	59.5	Reference	—
30–39	66.7	0.82 (0.33–2.06)	0.655
40–49	80.0	0.91 (0.37–2.21)	0.835
≥ 50	100	1.13 (0.45–2.85)	0.812
Other variables			
Education, marital status, smoking, exercise, diet, BMI, family history, and chronic illness	—	Not significant	> 0.05

*Significant at $p < 0.05$.

Table 4: Perceptions of pharmacists' role in CVD prevention and management.

Service	Pharmacist (%)	Nurse (%)	Not Sure (%)
Medication management	71.5	15.5	13.0
Smoking cessation advice	47.0	27.0	26.0
Diet counseling	42.0	24.0	34.0
Exercise counseling	35.0	34.0	31.0
Blood pressure measurement	25.5	58.5	16.0
Blood glucose measurement	24.5	59.5	16.0
Blood cholesterol testing	22.5	59.0	18.5

Perceptions of pharmacists' role in CVD prevention

As per Table 4, a generally favorable impression of pharmacists was shown by the students and this was particularly evident in matters concerning the use of medications preventive guidance and lifestyle related support. It was indicated by 71.5% of the respondents that pharmacists should be involved actively in assisting patients with the management of prescribed treatments. Nearly half of the students considered pharmacists appropriate individuals to approach for smoking cessation at 47% or for receiving advice related to healthier dietary choices at 42%. Views became less uniform when the topic of counseling for physical activity was introduced since only about 35% regarded pharmacists as suitable professionals for this form of guidance.

When attention was directed toward routine clinical assessments a different preference emerged. Nurses were chosen by most students for the measurement of blood pressure at 58.5%, for testing of blood glucose at 59.5% and for cholesterol evaluation at 59%. Despite this preference a considerable number of participants expressed willingness to utilize preventive services if they were made available within community pharmacies. More than two thirds indicated that counseling related to medications diet or exercise would be accepted from a pharmacist and approximately half stated that they would feel comfortable receiving checks for blood pressure cholesterol or blood glucose in the pharmacy setting.

DISCUSSION

The findings of this study have offered an extensive and sometimes rather revealing view of how cardiovascular disease has been understood by non medical university students in Lahore. Although sections of the group demonstrated some grasp of commonly discussed lifestyle risks the general pattern that emerged suggested that students knowledge remained uneven and at several points unexpectedly incomplete. This collection of stronger and weaker areas has been seen in other regions as well but it continues to highlight a persistent gap between the scientific understanding of cardiovascular disease and what young adults genuinely absorb in daily life. When comparisons are made to earlier studies in the Middle East South Asia and various African nations it becomes clear that young populations often maintain general awareness of risk factors yet struggle to recognize disease categories and urgent symptoms[26,27].

A major challenge that appeared in the results involved student's difficulties in identifying cardiovascular disease types beyond the widely known examples. Nearly half of the participants were unable to name any cardiovascular condition which resembled trends previously seen in the studies of Abdelmoneim *et al.*, in Kuwait, Muhihi *et al.*, in Tanzania, Aminde *et al.*, in Cameroon and Vaidya *et al.*, in Nepal where heart disease has been commonly narrowed down to heart attacks in public understanding[28-31]. Although coronary heart disease was recognized more frequently by students in the present study this familiarity did not appear to extend toward disorders such as cerebrovascular disease or venous thromboembolism. Such selective recognition may have been encouraged by public messages that strongly emphasize heart attacks while paying limited attention to other cardiovascular problems that carry major burdens of disability.

Student's challenges in identifying cardiovascular disease types were also reflected in their difficulties recognizing early symptoms particularly those that do not present in classical form. Chest pain and breathlessness were acknowledged widely as warning signs of myocardial infarction but symptoms like jaw discomfort, back pain and sudden dizziness were far less familiar. These findings are especially concerning because atypical symptoms are commonly seen in women younger individuals and patients with diabetes. Previous studies from Karachi and other Pakistani cities have reported that many patients seek medical assistance only after long delays due to poor recognition of early symptoms[11,32]. Within this context the inability of some students to list any sign of myocardial infarction pointed toward a serious gap in symptom awareness even among educated young people.

A similar pattern of partial awareness was observed with regard to stroke symptoms. Students tended to remember the more widely taught signs such as sudden weakness, imbalance and disturbances in speech but they did not show the same familiarity with severe headaches or sudden loss of vision which also serve as critical warning signs. In contrast to the populations in the United States and parts of Europe where public health education campaigns have been extensive for many years the level of stroke literacy among the students in this study appeared more fragmented[33,34]. Cultural factors might also play a role as stroke in Pakistan is often conceptualized primarily as a neurological event rather than a disorder linked to the cardiovascular system. Similar interpretations have been reported in Tehran and some East African countries which suggests that this misunderstanding extends beyond national boundaries[35,36].

Despite the knowledge gaps mentioned above students showed somewhat better understanding of modifiable risk factors associated with cardiovascular disease. Many participants identified smoking, poor diet, stress and elevated cholesterol levels as significant contributors and these findings were consistent with research from Turkey, Malaysia and the United Arab Emirates[37-39]. However awareness of diabetes and physical inactivity as major risks was noticeably weaker which is concerning given the increasing prevalence of diabetes in Pakistan. Another discrepancy that emerged was the difference between what students stated they knew and what they actually practiced. High stress, low exercise levels and irregular dietary habits were reported widely despite students acknowledging the relevance of these behaviors to cardiovascular disease. Investigations conducted in Karachi and Gujarat have reported similar contradictions indicating that behavioral change requires more than basic knowledge and may depend on motivation, social supports and environmental conditions[40,41].

The study also revealed clear gender differences in cardiovascular awareness with female students performing better than their male counterparts. Similar findings have been reported in a study of Kuwait where women have often demonstrated stronger engagement with health related information[28]. While the reasons for this difference remain uncertain it has been suggested that increased attention to care giving roles and greater openness toward health communication may contribute. The absence of meaningful associations with factors such as age, marital status, education level or family history contrasts with findings from India and Tehran where exposure to health education or chronic illness in the family predicted greater awareness[35,42]. This lack of pattern observed in the present study may imply that cardiovascular health information is not being systematically incorporated into non-medical university education.

Students attitudes toward pharmacists offered further insight. Pharmacists were viewed positively for providing counseling and lifestyle guidance but students were less inclined to see them as providers of routine health assessments. Similar patterns have been observed in a study of Malaysia where pharmacists have traditionally been associated more with dispensing than with preventive care[43]. In Pakistan the development of community pharmacy practice into a preventive service remains limited which may explain why students continued to favor nurses for clinical checks. Still the willingness expressed by many participants to receive advice from pharmacists suggested that there is potential for expanding their preventive role especially in areas where physician access is reduced.

When all findings are considered a complex picture emerges consisting of partial knowledge misconceptions and inconsistencies between awareness and action. Although students demonstrated under-standing in select areas critical gaps remained in symptom recognition and daily practice. These results emphasize the need for structured cardiovascular health education tailored specifically to non-medical students. Interactive teaching strategies practical demonstrations and real case examples could support better symptom identification. Moreover the integration of pharmacists into health promotion activities both within and outside university settings may broaden access to preventive services and enrich overall cardiovascular education.

Limitations of the study

This study has several limitations that should be considered when interpreting the findings. First, the cross sectional design limits the ability to establish causal relationships between cardiovascular knowledge and associated factors. The results therefore reflect awareness at a single point in time rather than changes over time. Second, data were collected using a self-administered online questionnaire, which may introduce response bias, as participants could overestimate or underestimate their knowledge and health behaviors. Third, convenience sampling was used, which restricts the generalizability of the findings to all non-medical university students in Lahore or other regions of Pakistan. Finally, the study relied on self-reported information for lifestyle behaviors and health monitoring practices, which may be affected by recall bias.

CONCLUSIONS

The results of this investigation have indicated that non-medical university students in Lahore possessed only a limited and uneven grasp of cardiovascular disease and that important gaps remained in their recognition of early symptoms as well as less commonly known risk factors. Even though certain lifestyle risks were known by many participants. However this awareness was not reflected consistently in their day to day behaviors. These findings have pointed toward a clear need for universities to provide more organized education on cardiovascular health and to support a broader preventive role for community pharmacists. By strengthening both theoretical awareness and practical understanding it may become more likely that young adults will respond more appropriately and effectively when faced with cardiovascular risks in the years ahead.

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AUTHOR'S CONTRIBUTIONS

Shahzad S: conceptualization, methodology, data analysis. **Arshad F:** writing original draft. **Shahbaz A:** editing, review. **Kaleem L:** supervision, writing, data collection. **Nasir R:** data collection, review, editing. **Akbar M:** review, editing. **Zaidi SHH:** data cleaning, editing. **Abid AR:** statistical analysis. **Hussain S:** final

proofreading. Final manuscript was checked and approved by both authors.

DATA AVAILABILITY

Upon reasonable request, the corresponding author will provide the datasets created or examined during this investigation.

CONFLICT OF INTEREST

None to declare.

REFERENCES

1. Kaptoge S, Pennells L, De Bacquer D, *et al*. World Health Organization cardiovascular disease risk charts: revised models to estimate risk in 21 global regions. The Lancet Global Health 2019; 7(10), e1332-e1345. *https://doi.org/10.1016/S2214-109X(19)30318-3*
2. Roth GA, Mensah GA, Johnson CO, *et al*. Global burden of cardiovascular diseases and risk factors, 1990-2019: Update from the GBD 2019 Study. J Am Coll Cardiol. *https://doi.org/10.1016/j.jacc.2020.11.010*
3. Schieb LJ, Greer SA, Ritchey MD, *et al*. Vital signs: Avoidable deaths from heart disease, stroke, and hypertensive disease, United States, 2001-2010. MMWR Morb Mortal Wkly Rep [Internet]. 2013.
4. Mensah GA, Roth GA, Fuster V. The global burden of cardiovascular diseases and risk factors: 2020 and beyond. J American Coll Cardiol 2019; 74(20): 2529-2532. *https://doi.org/10.1016/j.jacc.2019.10.009*
5. Scott A Lear, Martin McKee, Perry Hystad, *et al*. Social factors, health policy, and environment: implications for cardiovascular disease across the globe. European Heart J 2025; 46(30):2959-2973. *https://doi.org/10.1093/eurheartj/ehaf212*
6. Shaikh SA, Memon SF, Shah H, *et al*. Prevalence of the modifiable risk factors of cardiovascular diseases in young adults of district Hyderabad Sindh Pakistan: Risk factors of cardiovascular diseases in young adults of district Hyderabad. Pakistan J Health Sci 2025; 6(1): 30-35. *https://doi.org/10.54393/pjhs.v6i1.2569*
7. Stewart J, Manmathan G, Wilkinson P. Primary prevention of cardiovascular disease: A review of contemporary guidance and literature. JRSM Cardiovascular Disease 2017; 6: 2048004016687211. *https://doi.org/10.1177/2048004016687211*
8. Wild SH, Byrne CD. ABC of obesity. Risk factors for diabetes and coronary heart disease. BMJ (Clinical research ed.) 2006; 333(7576): 1009-1011. *https://doi.org/10.1136/bmj.39024.568738.43*
9. Irfan FM, Irfan FM, Rehman S, *et al*. Eating habits and lifestyle practice of young adults in Karachi, Pakistan: A cross-sectional survey: Eating habits of young adults. Diet Factor. J Nutri Food Sci; 2024;5(2):08-13. *https://doi.org/10.54393/df.v5i2.129*
10. Gooding HC, Gidding SS, Moran AE, *et al*. Challenges and Opportunities for the Prevention and Treatment of Cardiovascular Disease Among Young Adults: Report From a National Heart, Lung, and Blood Institute Working Group. J American Heart Assoc 2020; 9(19), e016115. *https://doi.org/10.1161/JAHA.120.016115*
11. Khan MS, Jafary FH, Faruqui AM, *et al*. High prevalence of lack of knowledge of symptoms of acute myocardial infarction in Pakistan and its contribution to delayed presentation to the hospital. BMC Public Health 2007; 7: 284. *https://doi.org/10.1186/1471-2458-7-284*
12. Jafary FH, Aslam F, Mahmud H, *et al*. Cardiovascular health knowledge and behavior in patient attendants at four tertiary care hospitals in Pakistan- A cause for concern. BMC Public Health 2005; 5: 124. *https://doi.org/10.1186/1471-2458-5-124*
13. Ramamurthy D, Panda M, Rangappa M, *et al*. Acute myocardial infarction treatment delay in South Asia: a systematic review and meta-analysis. Future Cardiol 2025; 21(11): 913-927. *https://doi.org/10.1080/14796678.2025.2541525*
14. Mustaqeem M, Sadullah S, Farooq MZ, *et al*. Knowledge awareness and behaviour of non-medical students about cardiovascular diseases. Journal of Ayub Medical College, Abbottabad 2015; 27(4): 894-899.
15. Amro NR, Rasheed O, Khdour M, *et al*. Knowledge of cardiovascular disease among undergraduate university students in Palestine. International Knowledge Sharing Platform, IISTE; 2017. *https://dspace.alquds.edu/handle/20.500.12213/809*
16. Ajrash K, Bulletin GAABM, 2024 undefined. Healthy behaviors between medical and non-medical university students. bahrainmedicalbulletin.com. 2024;46:1.
17. Noonan A, Tierney A, Norton C, Ng K, Woods C. Prevalence of health-related behaviours and associated factors in university students in Ireland: a 4-year repeated cross-sectional study. BMJ Public Health 2024; 2(2): e001514. *https://doi.org/10.1136/bmjph-2024-001514*
18. Whatnall MC, Patterson AJ, Brookman S, *et al*. Lifestyle behaviors and related health risk factors in a sample of Australian university students. J American College Health 2020; 68(7): 734-741. *https://doi.org/10.1080/07448481.2019.1611580*
19. Hayder I, Ahmed W, Dahar SA. (2024). Occurrence and responsiveness level of common non-communicable disease (NCDs), and its associated hazards in non-medical undergraduate students of Karachi. Pak J Biochem Mol Biol 2024; 56(3): 129-136. *https://www.pjbmb.com/index.php/pjbmb/article/view/103*
20. Nawaz H, Ullah B, Gul F, *et al*. Factors and barriers affecting delayed hospital arrival of patients with st-elevated myocardial infarction for PCI in Tertiary Care Hospital Peshawar. Pak J Med Cardiol Rev 2025; 4(4): 42-52. *https://doi.org/10.64105/fhs7af63*
21. Tran DT, Silvestri-Elmore A. Healthcare-seeking behaviours in college students and young adults: A review. J Res Nurs 2021; 26(4): 320-338. *https://doi.org/10.1177/1744987120951594*
22. Aziz MM, Ji W, Masood I, Farooq M, *et al*. Patient satisfaction with community pharmacies services: A cross-sectional survey from Punjab, Pakistan. Int J Env Res Public Health 2018; 15(12), 2914. *https://doi.org/10.3390/ijerph15122914*
23. Cheema E, Sutcliffe P, Singer DR. The impact of interventions by pharmacists in community pharmacies on control of hypertension: a systematic review and meta-analysis of randomized controlled trials. British J Clinical Pharmacol 2014; 78(6): 1238-1247. *https://doi.org/10.1111/bcp.12452*
24. Hashmi FK, Hassali MA, Khalid A, *et al*. A qualitative study exploring perceptions and attitudes of community pharmacists about extended pharmacy services in Lahore, Pakistan. BMC Health Services Res 2017; 17(1), 500. *https://doi.org/10.1186/s12913-017-2442-6*
25. Wilbur K. Pharmacy student perceptions of public health service roles and responsibilities. The Int J Pharm Practice 2011; 19(3): 179-184. *https://doi.org/10.1111/j.2042-7174.2011.00115.x*
26. Poomsrikaew O, Ryan CJ, Zerwic JJ. Knowledge of heart attack symptoms and risk factors among native Thais: A street-intercept survey method. Int J Nursing Practice 2010; 16(5): 492-498. *https://doi.org/10.1111/j.1440-172X.2010.01874.x*
27. Ghamri RA. Knowledge of cardiovascular diseases and associated risk factors in the general adult population of

Jeddah, Saudi Arabia: A cross-sectional study examining gender disparities. Medicine 2024; 103(24): e38566. *https://doi.org/10.1097/MD.0000000000038566*

28. Awad A, Al-Nafisi H. Public knowledge of cardiovascular disease and its risk factors in Kuwait: A cross-sectional survey. BMC Public Health 2014; 14: 1131. *https://doi.org/10.1186/1471-2458-14-1131*
29. Aminde LN, Takah N, Ngwasiri C, *et al*. Population awareness of cardiovascular disease and its risk factors in Buea, Cameroon. BMC Public Health 2017; 17(1): 545. *https://doi.org/10.1186/s12889-017-4477-3*
30. Vaidya A, Aryal UR, Krettek A. Cardiovascular health knowledge, attitude and practice/behaviour in an urbanising community of Nepal: A population-based cross-sectional study from Jhaukhel-Duwakot health demographic surveillance site. BMJ Open 2013; 3(10): e002976. *https://doi.org/10.1136/bmjopen-2013-002976*
31. Muhihi AJ, Anaeli A, Mpembeni RNM, *et al*. Public knowledge of risk factors and warning signs for cardiovascular disease among young and middle-aged adults in rural Tanzania. BMC Public Health 2020; 20(1): 1832. *https://doi.org/10.1186/s12889-020-09956-z*
32. Ahmed S, Khan A, Ali SI, *et al*. (2018). Differences in symptoms and presentation delay times in myocardial infarction patients with and without diabetes: A cross-sectional study in Pakistan. Indian Heart J 2018; 70(2): 241-245. *https://doi.org/10.1016/j.ihj.2017.07.013*
33. Patel A, Fang J, Gillespie C, *et al*. Awareness of stroke signs and symptoms and calling 9-1-1 among US Adults: National Health Interview Survey 2009 and 2014. Preventing Chronic Disease 2019; 16, E78. *https://doi.org/10.5888/pcd16.180564*
34. Lecouturier J, Rodgers H, Murtagh MJ, *et al*. Systematic review of mass media interventions designed to improve public recognition of stroke symptoms, emergency response and early treatment. BMC Public Health 2010; 10: 784. *https://doi.org/10.1186/1471-2458-10-784*
35. Saadatnia M, Hajiannejad N, Yazdabadi A, *et al*. Public stroke knowledge, awareness, and response to acute stroke in Isfahan Iran: What is less or misinterpreted in developing countries. J Stroke Cerebro Dis 2021; 30(6): 105670. *https://doi.org/10.1016/j.jstrokecerebrovasdis.2021.105670*
36. Kaddumukasa M, Kayima J, Kaddumukasa MN, *et al*. Knowledge, attitudes and perceptions of stroke: a cross-sectional survey in rural and urban Uganda. BMC Res Notes 2015; 8, 819. *https://doi.org/10.1186/s13104-015-1820-6*
37. Metintas S, Arikan I, Kalyoncu C. Awareness of hypertension and other cardiovascular risk factors in rural and urban areas in Turkey. Transact Royal Soc Trop Med Hygiene 2009; 103(8): 812-818. *https://doi.org/10.1016/j.trstmh.2009.02.019*
38. Othman Z, Aleem A, Asmidar N, *et al*. Knowledge, awareness and practices on the risk factors of cardiovascular diseases among community in Gombak, Kuala Lumpur. Malaysian J Med Health Sci 2020; 16.
39. Razzak H, Harbi A, Shelpai W, Qawas A. Prevalence and risk factors of cardiovascular disease in the United Arab Emirates. Hamdan Med J 2018; 11(3): 105-111. *https://doi.org/10.4103/HMJ.HMJ_37_18*
40. Jawed N, Safdar NF, Mehdi A, *et al*. Does lifestyle behaviour trigger cardiovascular risk factors among school-going adolescents In Pakistan ? The J of Pakistan Med Assoc 2023; 73(7): 1393-1398. *https://doi.org/10.47391/JPMA.6735*
41. Kalra A, Jose AP, Prabhakaran P, *et al*. The burgeoning cardiovascular disease epidemic in Indians - perspectives on contextual factors and potential solutions. The Lancet Regional Health. Southeast Asia 2023; 12, 100156. *https://doi.org/10.1016/j.lansea.2023.100156*
42. Zaman MJ, Patel A, Jan S, *et al*. Socio-economic distribution of cardiovascular risk factors and knowledge in rural India. Int J Epidemiol 2012; 41(5): 1302-1314. *https://doi.org/10.1093/ije/dyr226*
43. Cheah Meng Fei. Public perception of the role of pharmacists and willingness to pay for pharmacist-provided dispensing services: A cross-sectional pilot study in the state of Sabah, Malaysia. Malaysian J Pharm Sci 2018; 16(1): 1-21. *https://doi.org/10.21315/mjps2018.16.1.1*