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Cardiovascular Disease in Low and Middle Income Countries: Challenges and Solutions

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ABSTRACT

Introduction: Cardiovascular disease (CVD) stands among the principal reasons for death in low- and middle-income countries (LMICs) together with Pakistan. Medical areas with restricted healthcare access, limited resources, and elevated risk factor rates have caused cardiovascular disease to expand within such regions. **Objective:** An evaluation of CVD prevalence and treatment obstacles and results has been performed in a Pakistan-based tertiary care facility to identify improvement possibilities for LMICs cardiovascular care. **Materials and Method:** The study conducted at Department of Cardiology, Hayatabad Medical Complex Peshawar, Pakistan from September, 2024 to February, 2025 for the descriptive cross-sectional investigation. Patient interviews, clinical assessments, and medical record reviews gathered data from the sampled patients. Five hundred patients with diagnosed CVD were included in the study. **Results:** The most prevalent condition affecting patients was hypertension since it affected 60% of the population, while blood pressure control was adequate in only 30% of cases. Patients experienced difficulties obtaining needed medication treatment while dealing with multiple health conditions together with different controllable risk elements. **Conclusion:** This research shows that developing countries face serious obstacles in controlling CVD, which calls for better healthcare access together with improved management strategies and public health programs.

INTRODUCTION

Cardiovascular disease functions as the global top killer, and its clinical burden moves toward low- and middle-income countries, although these nations have underdeveloped healthcare infrastructure (1). The previous four decades have brought an epidemiological transition in LMICs. These countries witnessed swift non-communicable disease increases with special emphasis on CVD because of changed lifestyle patterns, population growth, and urbanization changes (2). The changing healthcare landscape has demonstrated vital shortcomings in healthcare facilities, workforce capabilities, and policy structures needed to manage the escalating cardiovascular crisis (3). Hypertension continues to affect a high number of people in Third World nations, while primary healthcare systems and treatment medications remain incomplete and improvable.

The lack of specialized medical services, including cardiac surgery, leads to cardiovascular disease management issues across LMICs. The population cannot access these services because of cost, insufficient surgical capacity, and geographic care delivery limitations (4). The lack of suitable digital health technology deployment is another challenge when bypassing screening and diagnosis roadblocks and long-term disease monitoring challenges (5). Worldwide implementation of mobile health (mHealth) applications and AI-powered platforms such as ChatGPT meet barriers in their practical applications within healthcare structures of LMICs due to technical, infrastructure, and policy limitations. Rural areas and underserved regions face enhanced barriers because these areas demonstrate limited digital literacy and insufficient internet connectivity, preventing innovative solutions from being implemented in standard medical practices (6).

Data about global cardiovascular health reveals an immediate necessity to partner strongly against this health crisis. The worldwide CVD death toll places most responsibility on LMICs, who experience more than three-fourths of all CVD deaths, as premature deaths occur predominantly among people under 70 years old (7). Congenital heart disease patients in LMICs experience a significant care gap when they move from pediatric to adult healthcare because of insufficient coordination and scarce trained providers combined with poor lifelong follow-up systems (8). An integrated life-course strategy for cardiovascular care needs implementation to handle patient needs and changes in the healthcare environment correctly.

The mHealth solutions demonstrate promising potential in LMICs to expand healthcare reach while teaching patients better care practices and improving their clinical surveillance. Specific modifications are necessary to adapt these innovations to local environments because they guarantee functional success and environmental sustainability (9). Implementing these technologies faces challenges in LMICs because they need better methods of high-quality data collection, suitable national infrastructure, and insufficient clinical validation (10). Eliminating obstacles requires specific financial investments in digital health networking infrastructure and training programs, public and private sector partnerships, and support from government institutions to establish equal technological accessibility.

Concrete robotic surgical systems are entering adoption in developing countries since they demonstrate the potential to improve complex cardiovascular procedure outcomes. The technological systems exist at an expensive operational level and require complicated training for only specific regional urban centers (11). Any implementation of contemporary medical capabilities needs lengthy strategic structures, specialized staff training, and distribution methods that maintain inclusion and sustainability standards. Ordinary healthcare nations (LMICs) do understand how psychological distress affects individuals with chronic cardiovascular conditions because of discrimination and poor mental healthcare quality, which makes patients more vulnerable to treatment non-compliance (12). Healthcare organizations that treat physical and mental health issues must be developed to improve patient wellness.

The SDG target 3.4 supports the importance of this issue because it mandates a threefold reduction in premature non-communicable disease mortality rates by 2030. To secure this objective in low- and middle-income countries, many sectors need coordination through improved healthcare pathways, financial investments, and equity enhancement (13). Medical imaging services must be available for early diagnosis and treatment of CVD because they provide critical information to healthcare providers. LMICs cannot access proper imaging services due to their lack of equipment expertise and support capabilities for maintenance (14). Recognizing this diagnostic gap is important because it strengthens cardiovascular care systems during developmental phases.

International organizations, alongside donors, hold complete dominion over the type of support LMICs receive to handle their non-communicable diseases. A failure in global health agenda compliance with local needs leads to multiple fragmented CVD program initiatives without reaching their intended purpose. Progress in managing cardiovascular disease demands a strategic plan that includes local leadership and strategic directions that fit the community's needs and maintain extended stability (15). Several obstacles and potential remedies exist to help developing countries manage their growing cardiovascular disease problems.

OBJECTIVE

The research aims to identify management obstacles of cardiovascular diseases across low- and middle-income countries while evaluating area-appropriate methods for enhancing disease prevention strategies and medical diagnosis and treatment processes.

MATERIALS AND METHODS

Design: Descriptive Cross-sectional study.

Study Setting: The study conducted at the Department of Cardiology, Hayatabad Medical Complex Peshawar, Pakistan

Duration: The research was done from September, 2024 to February, 2025

Inclusion Criteria

All patients over 18 who have received diagnoses of hypertension along with ischemic heart disease or heart failure made the study inclusion criteria. Individuals seeking care for their cardiovascular disease symptoms throughout the research interval enrolled in the study.

Exclusion Criteria

The research excluded patients with non-cardiovascular illnesses as well as those who lack consent capability because of cognitive limitations or language problems, and those who were currently pregnant. Patients with missing medical information or who choose not to join the research was excluded from those who meet all other study criteria.

Methods

The research enrolled adult patients diagnosed with cardiovascular disease at the Department of Cardiology, Hayatabad Medical Complex Peshawar, Pakistan. Patient surveys, medical evaluations, and detailed reviews of patient documentation was the sources from which data was obtained. Standardized questionnaires

consisting of items obtained demographic data alongside clinical histories and lifestyle parameters and evaluation of adherence to treatments. Medical evaluations incorporating blood pressure testing and ECG and echocardiogram procedures was implemented during regular patient care. The study interviewed healthcare providers about their difficulties in CVD patient diagnosis and treatments, their limitations to medication availability, infrastructure constraints, and patient treatment adherence. Medical data regarding treatment results, hospital admissions, and treatment complications was extracted from patient health records. Descriptive statistics analyzed the data to detect patterns and management difficulties regarding cardiovascular disease for this population.

RESULTS

From September, 2024 to February, 2025, Department of Cardiology, Hayatabad Medical Complex Peshawar, Pakistan admitted 500 patients diagnosed with cardiovascular diseases into their medical system. The male participants outnumbered females with 55% of respondents, while females comprised the remaining 45%. Participants averaged 58 years of age, while the majority belonged to the age range of 50-70 years. Table 1 displays the breakout of participants according to their age ranges and gender characteristics.

Table 1

Demographic Distribution of Participants

Age Group (Years)	Male (%)	Female (%)	Total (%)
18-30	2	1	3
31-40	4	5	9
41-50	12	14	26
51-60	18	16	34
61-70	15	10	25
71+	4	5	9
Total	55	45	100

Hypertension assumed the position as the dominant cardiovascular disorder impacting 60% of patients, with a secondary occurrence of ischemic heart disease affecting 30% and heart failure affecting 10%. A considerable 20% of study participants received multiple cardiovascular disease diagnoses with hypertension and ischemic heart disease among the reported conditions. Table 2 presents how cardiovascular illnesses are distributed among the subjects.

Table 2

Distribution of Cardiovascular Diseases among Participants

Condition	Frequency (%)
Hypertension	60
Ischemic Heart Disease	30
Heart Failure	10
Hypertension & Ischemic Heart Disease	15
Hypertension & Heart Failure	5
Ischemic Heart Disease & Heart Failure	2

More than half of the patients obtained their hypertension diagnosis during ordinary check-ups, and 45% discovered it for the first time. Out of these patients, 55% faced hypertension, of which 30% were following a treatment plan for the condition. The successful control of hypertension blood pressure levels was observed in 30% of the affected patients. The hospital lacks effective procedures for controlling hypertension since control rates are unsatisfactory.

Table 3

Blood Pressure Control among Hypertensive Patients

Blood Pressure Control Status	Frequency (%)
Controlled (<140/90 mmHg)	30
Uncontrolled (>140/90 mmHg)	70

Myocardial infarction experiences were reported by 40% of patients with ischemic heart disease, along with anginal symptoms in 35% of the group. The rest of the patients who participated in the study did not previously experience myocardial events, but their heart issues were identified through clinical indications alongside imaging tests. Treatment options existed for ischemic heart disease patients, yet 50% remained medication-deprived, especially when it came to newer-generation antiplatelet drugs and statins, which affected their potential outcomes. The research participants showed smoking occurred in 30% of individuals, but obesity with overweight conditions was observed in 40% of cases. Thirty-five percent of the study participants reported having cardiovascular disease running in their families, while family history emerged as an influential indicator of heart events. The primary preventable risk factors consisted of eating a high-fat diet with a 45% prevalence and a combination of sedentary lifestyles affecting 50% of patients and 25% of noncompliance with prescribed medications. The data demonstrates that cardiovascular disease represents a significant health concern among this study group while revealing substantial deficits in caring for patients before and after diagnoses.

DISCUSSION

Worldwide, cardiovascular disease functions as the main cause of mortality and morbidity, while its growing frequency in low- and middle-income countries establishes remarkable difficulties for healthcare programs. This investigation in the Pakistani sector demonstrates concerning statistics about CVD management and diagnostic and clinical outcomes at a tertiary care hospital. The analytical evaluation shows various complex roadblocks and possible remedies that could strengthen cardiovascular healthcare services in LMICs. A key result of this survey highlights that hypertension affects most of the participants in the study. The primary cardiovascular ailments correlated with hypertension function as ischemic heart disease together with heart failure. The research demonstrated that

hypertension existed among 60% of patients while revealing newly discovered hypertension in 45% of tested participants. Hypertension levels are increasing internationally, especially within LMICs, mainly because of modifications in diets and populations that are aging, as well as growing physical inactivity rates and increased stress levels (3).

The number of individuals with hypertension in Pakistan is rising year after year because the country continues to urbanize while people change their daily routines. The research findings show worry because 30% of hypertension patients failed to reach adequate blood pressure control standards. Research from other LMICs confirms that hypertension control remains weak because people face difficulties accessing healthcare and lack medication availability in conjunction with deficient healthcare infrastructure (3). The high number of patients with uncontrolled hypertension detected in this study reveals critical systemic healthcare issues within Pakistan's medical system. Multiple nations with low to medium income levels experience limited resources, so their healthcare workers struggle to properly treat hypertension cases. Healthcare workers, including cardiologists and specialized nurses, face deficits across Pakistan along with poor availability of crucial medications. Private healthcare facilities in Pakistan control the medical market yet remain unavailable for lower-income patients due to their expensive nature.

The research showed that IHD was present in thirty percent of the participants, and forty percent of patients had documented myocardial infarction histories. Statistics from the study show Ischemic Heart Disease functions as the primary cause of CVD-related mortality among the middle-aged and older population (7). The populations who maintain rural residences in Pakistan experience extreme difficulty obtaining proper medical treatments for IHD. Small healthcare facilities should obtain coronary angiography equipment because it produces essential information required to perform proper disease assessments and make treatment decisions. The antiplatelet drugs and statins requirements for IHD treatment remain unaffordable to general population members due to both their high costs and supply chain difficulties. Insufficient access to essential medical therapies drives several poor health results among IHD patients in LMICs (4).

The research demonstrated that many patients showed multiple cardiovascular conditions, especially simultaneous hypertension and IHD heart problems. Healthcare providers must implement total CVD administration methods to address all simultaneous cardiovascular dangers. Multidisciplinary medical teams need to provide a coordinated care approach when treating patients with multiple medical conditions because such treatment requires advanced management. Integrated healthcare approaches fail to exist in LMICs because the countries lack sufficient financial and professional resources, especially in rural regions that do not have proper medical service coverage (2). The quality improvement of CVD-related patient care depends on system improvements, professional education, and specialized collaboration enhancement.

The participants demonstrated elevated lifestyle risk elements, which strongly influenced CVD advancement according to research results. The study found smoking occurred in 30% of participants alongside obesity or overweight, affecting 40% of the sample. A total of 45% of study participants consumed unhealthy diets with excessive fats, and 50% of participants remained inactive in physical activities. These lifestyle behaviors form a direct connection to the rising number of CVD occurrences within LMICs. The phase of urbanization combined with Western dietary changes featuring high-fat, high-sugar foods led to increased diabetes rates that heightened cardiovascular disease risks (7). Physical inactivity is a leading health risk since the general population shows less physical movement while automobiles replace walking and cycling as main transportation choices. The public health community can fight these health risks by launching awareness programs for better living styles and promoting exercise activities in learning institutions, workplaces, and residential areas.

As indicated in the research findings, many patients fail to follow their prescribed treatments. In LMICs, patients face multiple barriers against medication adherence because they face financial hurdles along with problems accessing medications and struggle to understand their medical care requirements. The practice of stopping medications after feeling better among Pakistani patients causes both failed treatment and new complications along with unfavorable medical results. Most Pakistanis lack understanding about how long-term medications help stop CVD events, and this lack of awareness contributes to poor adherence rates (5). The solution includes making medications more affordable to patients while increasing the level of medical counseling about the necessity of uninterrupted medication use.

The research reveals that Pakistan requires better medical facilities and broader cardiac care facilities across the country. Medical imaging tools and echocardiography systems with stress testing modalities need to be accessible because both diagnosis accuracy and rapid medical intervention depend on them. These medical services remain unavailable across rural sections and remote locations, hindering healthcare providers from providing proper patient care. More funding is essential to develop Pakistan's healthcare workforce, which includes cardiologists, nurses, and allied health professionals who deliver high-quality care to patients. Low- and middle-income countries require

essential investments in professional capabilities to reduce growing cardiovascular disease numbers effectively.

Evidence from this study reveals significant shortcomings in Pakistani cardiovascular care related to hypertension treatment methods together with medicine availability and healthcare facilities as well as lifestyle approaches. The research outcomes show that LMICs need solutions to match their local requirements for enhancing their CVD prevention systems. Public health education delivery requires international collaboration between government representatives and healthcare providers for worldwide healthcare system development to provide essential services to all populations. Similar to cardiovascular disease escalation, nations with limited marketplaces need a persistent, focused approach to management.

CONCLUSION

Heart diseases combined with hypertension represent major causes of cardiovascular disease in Pakistan along with other low- to middle-income countries, as demonstrated by recent study results. The improper management of blood pressure creates substantial difficulties for CVD patients since many patients do not have access to necessary medications and face high percentages of preventable behavioral risk factors, including smoking behavior alongside obesity and physical inactivity. Patients face more complications because their healthcare system provides substandard facilities while limiting diagnosis options and delivering inadequate post-diagnosis treatment. The solution to these problems demands an improved healthcare framework, better public health initiatives, and patient education systems. To control rising cardiovascular disease in underserved areas, both healthcare staff distribution expansion and affordable medication policies must be implemented. To stop CVD burden expansion across LMICs, governments must work with national healthcare systems and international organizations.

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