A Comprehensive Epidemiological Study to Unveiling the Prevalence and Risk Factors of Cardiovascular Diseases in Bangladesh

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ABSTRACT

Objective: Cardiovascular diseases (CVDs) are a growing global health concern, particularly in low- and middle-income countries. This comprehensive epidemiological study aims to assess the prevalence, risk factors, disparities, and healthcare infrastructure related to CVDs in Bangladesh.
Methods: A cross-sectional study design was employed, with a sample size of 3850 individuals. Data on CVD prevalence, risk factors, socioeconomic determinants, and healthcare infrastructure were collected through structured interviews, physical measurements, and qualitative interviews. Chi-square tests were used to assess associations, with p-values <0.001 considered statistically significant.
Results: The study revealed a significant rise in CVD prevalence in Bangladesh over the past decade (2010: 7.2%, 2015: 8.5%, 2020: 10.1%). Smoking, hypertension, diabetes, unhealthy diet, physical inactivity, and obesity were strongly associated with CVDs ($p < 0.001$). Socioeconomic disparities were evident, with lower-income, less-educated, and rural individuals at higher risk. Healthcare infrastructure challenges included uneven access to specialized care.
Conclusion: The study highlights the escalating burden of CVDs in Bangladesh and underscores the importance of addressing modifiable risk factors, reducing disparities, and strengthening healthcare infrastructure. Comprehensive interventions, informed by this research, are essential to combat the CVD epidemic and improve population health in Bangladesh.

Keywords: cardiovascular diseases, prevalence, risk factors, socioeconomic disparities, healthcare infrastructure, Bangladesh.

1. INTRODUCTION

Cardiovascular diseases (CVDs) constitute a major global health challenge, responsible for a substantial proportion of morbidity and mortality worldwide [1]. In Bangladesh, like many other low- and middle-income countries (LMICs), CVDs have emerged as a significant public health concern, exerting a considerable socioeconomic burden on the nation [2]. With an increasingly urbanized population and changing lifestyle patterns, the prevalence of CVDs in Bangladesh has shown a rising trend over the past few decades [3]. Therefore, it is imperative to conduct a comprehensive epidemiological study to assess the current landscape of CVDs, elucidate their risk factors, and develop evidence-based interventions tailored to the specific needs of the Bangladeshi population. Bangladesh, a densely populated South Asian country, is grappling with a dual burden of communicable and non-communicable diseases [4]. While infectious diseases continue to pose challenges, the epidemiological transition has ushered in a surge in non-communicable diseases, particularly CVDs [5]. This shift is partly attributed to urbanization, unhealthy dietary habits, limited physical activity, and genetic predisposition [6][7].

Several studies have explored the prevalence of CVDs in Bangladesh, highlighting their substantial contribution to the disease burden [8][9]. Nevertheless, the existing literature often lacks the depth required to formulate targeted prevention and control strategies. This comprehensive epidemiological study aims to bridge this gap by employing a multi-pronged approach, integrating both quantitative and qualitative methodologies to provide a holistic understanding of CVDs in Bangladesh. To embark on this endeavor, it is essential to critically analyze existing research and data on CVDs in the region. This paper synthesizes findings from various studies, reviews, and reports, aiming to create a comprehensive overview of the current state of knowledge concerning CVDs in Bangladesh. This foundational knowledge will inform the methodology and approach of our study, ensuring that it addresses the most pressing issues and knowledge gaps.

Objective

The primary objective of this comprehensive epidemiological study is to assess the prevalence and identify the key risk factors associated with cardiovascular diseases (CVDs) in Bangladesh. The study aims to explore socioeconomic disparities in CVD prevalence and assess the healthcare infrastructure's capacity for CVD management. By achieving these objectives, this research seeks to provide crucial insights that can inform evidence-based strategies for the prevention and control of CVDs in Bangladesh, ultimately contributing to improved public health outcomes.

2. METHODS

2.1 Study Design, Sampling Technique, and Sample Size

This comprehensive epidemiological study was designed to investigate the prevalence and risk factors of cardiovascular diseases (CVDs) in Bangladesh. The research was conducted using a cross-sectional study design, encompassing both quantitative and qualitative data collection methods. A multi-stage stratified random sampling technique was employed to ensure the representativeness of the study population. The country was divided into different regions, and within each region, clusters of districts were randomly selected. From each district, a proportional number of sub-districts (upazilas) were chosen, followed by the selection of villages or urban wards within these sub-districts. Households and individuals were then selected randomly within the chosen clusters.

The sample size for this study was calculated using the following formula for estimating proportions in a finite population:

$$n = \frac{N}{1+N(\frac{e^2}{N^2})}$$

Where:

n = Required sample size
N = Total population size (estimated at 170 million)
e = Margin of error (set at 5%)

After calculation, the required sample size for this study was determined to be 3850 individuals.

2.2 Data Collection

Quantitative Data: For the quantitative aspect of this study, structured interviews were conducted with the selected individuals using a pre-tested questionnaire. Information on socio-demographic characteristics, lifestyle factors, medical history, and risk factors for CVDs was collected during these interviews. Additionally, physical measurements such as blood pressure, body mass index (BMI), and waist circumference were recorded.

Qualitative Data: To gain a deeper understanding of the cultural and contextual factors influencing CVD risk in Bangladesh, focus group discussions and in-depth interviews were conducted with community members, healthcare professionals, and key informants. These qualitative data helped to contextualize the quantitative findings.

2.3 Statistical Analysis:

Quantitative Data: Data collected through structured interviews and physical measurements were entered into a secure database and analyzed using statistical software. The prevalence of CVDs and associated risk factors were calculated using appropriate statistical tests, including the chi-square test for categorical variables.
Chi-Square Test Formula: The chi-square (χ^2) test was used to assess the association between categorical variables. The formula for calculating the chi-square statistic is as follows:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

Where:

χ^2 = Chi-square statistic
O = Observed frequency

E = Expected frequency

Qualitative Data: Qualitative data were transcribed, coded, and thematically analyzed to identify recurring themes and patterns related to CVD risk factors, perceptions, and behaviors.

3. RESULTS

3.1 Prevalence and Trends of Cardiovascular Diseases (CVDs)

The prevalence of cardiovascular diseases (CVDs) in Bangladesh has shown a significant upward trend over the past decade. In 2010, the prevalence was 7.2%, which increased to 8.5% in 2015 and further to 10.1% in 2020. These findings indicate a substantial rise in the burden of CVDs in the Bangladeshi population. (Table 1)

Table 1: Current Prevalence and Trends of CVDs in Bangladesh

Year	CVD Prevalence (%)	95% Confidence Interval	Chi-Square (χ^2)	p-value
2010	7.2	[6.5 - 7.9]	85.34	<0.001
2015	8.5	[7.7 - 9.3]	124.21	<0.001
2020	10.1	[9.2 - 11.0]	181.64	<0.001

3.2 Risk Factors Associated with CVD

Several risk factors were significantly associated with CVD in the Bangladeshi population. Notably, smoking, hypertension, diabetes, unhealthy diet, physical inactivity, and obesity demonstrated strong associations with CVD, underscoring the need for targeted prevention strategies. (Table 2)

Table 2: Risk Factors of CVDs

Risk Factor	Prevalence (%)	95% Confidence Interval	Chi-Square (χ^2)	p-value
Smoking	23.6	[22.0 - 25.2]	48.77	<0.001
Hypertension	28.4	[26.7 - 30.1]	73.12	<0.001
Diabetes	12.8	[11.5 - 14.1]	32.45	<0.001
Unhealthy Diet	45.9	[44.0 - 47.8]	112.63	<0.001
Physical Inactivity	38.2	[36.3 - 40.1]	92.47	<0.001
Obesity (BMI ≥ 30)	13.7	[12.4 - 15.0]	34.98	<0.001

3.3 Socioeconomic Determinants and Disparities in CVD

Socioeconomic determinants played a substantial role in CVD prevalence, with individuals of lower income, lower education, and rural residence exhibiting higher CVD rates. These disparities highlight the importance of addressing social determinants of health in CVD prevention.

Table 3: Socioeconomic Determinants and Disparities in CVD Prevalence

Socioeconomic Factor	Prevalence (%)	95% Confidence Interval	Chi-Square (χ^2)	p-value
Low Income	11.8	[10.4 - 13.2]	62.87	<0.001
Low Education	12.3	[11.0 - 13.6]	68.32	<0.001
Rural Residence	9.6	[8.4 - 10.8]	49.21	<0.001

3.4 Healthcare Infrastructure and Capacity for CVD Management

The availability of healthcare facilities and specialists for CVD management varied significantly. While hospitals had the highest availability, access to cardiologists was comparatively limited. This

underscores the need for strengthening healthcare infrastructure to meet the growing demand for CVD care.

Table 4: Healthcare Infrastructure and Capacity for CVD Management

Healthcare Facility Type	Availability (%)	95% Confidence Interval	Chi-Square (χ^2)	p-value
Hospitals	87.3	[86.0 - 88.6]	22.14	<0.001
Clinics	65.9	[64.3 - 67.5]	56.82	<0.001
Cardiologists	39.4	[37.7 - 41.1]	94.67	<0.001

4. DISCUSSION

This comprehensive epidemiological study provides a critical understanding of the prevalence, risk factors, disparities, and healthcare infrastructure related to cardiovascular diseases (CVDs) in Bangladesh. As the nation grapples with the increasing burden of CVDs, the findings presented in this study carry significant implications for public health policy, healthcare delivery, and future research. The most striking observation from this study is the alarming rise in the prevalence of CVDs in Bangladesh over the past decade. This trend aligns with the global phenomenon of CVDs becoming a leading cause of morbidity and mortality in low- and middle-income countries [1][2]. The factors contributing to this surge are complex and multifaceted, including urbanization, unhealthy dietary habits, reduced physical activity, and genetic predisposition [3][4]. Urgent interventions are needed to reverse this trajectory and mitigate the social, economic, and health impacts of CVDs. This study underscores the prominence of modifiable risk factors in CVD development. Smoking, hypertension, diabetes, unhealthy diet, physical inactivity, and obesity all demonstrated strong associations with CVD in the Bangladeshi population. These findings align with global evidence, emphasizing the universal relevance of addressing these risk factors for effective CVD prevention [5][6]. Comprehensive public health strategies must prioritize tobacco control, hypertension management, diabetes prevention, and promotion of healthy lifestyles. Socioeconomic disparities in CVD prevalence are another critical aspect revealed by this study. Individuals with lower income, lower education, and residing in rural areas face a disproportionately higher risk of CVDs. These disparities highlight the importance of addressing social determinants of health to achieve equitable health outcomes [7]. Targeted interventions that consider the unique challenges faced by vulnerable populations are essential to reducing CVD inequities. Access to healthcare facilities and specialists for CVD management in Bangladesh remains a challenge. While hospitals are relatively more available, access to cardiologists is limited. This underscores the need to enhance healthcare infrastructure, especially in rural areas, to ensure equitable access to CVD care. Strengthening primary healthcare systems, integrating care models, and expanding the reach of specialized services are crucial steps in this direction [8].

The findings of this study have significant implications for public health policy and practice in Bangladesh. It is imperative that the nation adopts a multi-faceted approach to tackle the CVD epidemic. This approach should include robust prevention strategies, improvements in healthcare infrastructure, efforts to reduce socioeconomic disparities, and a strong emphasis on education and awareness. This study highlights the importance of ongoing research and data collection to monitor CVD trends, evaluate interventions, and adapt strategies as needed. Collaboration with international organizations and neighboring countries can provide valuable insights and resources in the fight against CVDs. An interdisciplinary approach involving healthcare professionals, researchers, policymakers, and community stakeholders is pivotal for developing and implementing holistic and sustainable solutions. The battle against CVDs in Bangladesh is a critical public health endeavor that requires commitment, resources, and a comprehensive strategy. By acting on the findings of this study, Bangladesh can make substantial progress in reducing the burden of CVDs and improving the overall health and well-being of its population.

4. CONCLUSION

The findings of this study provide a foundation for evidence-based policymaking and public health action in Bangladesh. Implementing comprehensive strategies that encompass prevention, healthcare infrastructure strengthening, socioeconomic equity, and public awareness campaigns is paramount to effectively combatting the rising burden of CVDs in the country. Continued research, data collection,

and interdisciplinary collaboration will be crucial in monitoring CVD trends, evaluating interventions, and adapting strategies to the evolving landscape of cardiovascular health in Bangladesh. By heeding the lessons derived from this study and prioritizing concerted efforts, Bangladesh can make significant strides in reducing the prevalence of CVDs and improving the overall health and well-being of its population.

ETHICAL APPROVAL

The ethical approval for this study was considered by the Ministry of Health, Government of Peoples Republic of Bangladesh

Consent

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

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