



## Outcome of Magnitude and Spectrum of Cardiovascular Disease - A Hospital- Based Retrospective, Cross-Sectional Study

Mohammad Moyazzam Hossain<sup>1</sup>, Faruk Ahommed<sup>2</sup> and Mohammad Ibrahim Khalilullah<sup>3</sup>

<sup>1</sup>Senior Consultant (Cardiology), Sadar Hospital, Rajbari, Dhaka, Bangladesh

<sup>2</sup>Senior Consultant (Cardiology), OSD, DGHS, Deputed to CME, Dhaka, Bangladesh

<sup>3</sup>Associate Professor, Department of Anatomy, Diabetic Association Medical College, Faridpur, Bangladesh

\*Corresponding Author: Mohammad Moyazzam Hossain, Senior Consultant (Cardiology), Sadar Hospital, Rajbari, Dhaka, Bangladesh.

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### Abstract

**Introduction:** The association between depression and cardiovascular disease is well established and is suggested to be bidirectional. Depression in cardiac disease is common, persistent, under recognized, and deadly. The impacts of non-communicable diseases (NCDs) are particularly devastating in poor and vulnerable populations. Over the past 20 years, research has found that not only is depression more common in cardiac patients than in the general population, but depression is also a risk factor for cardiac morbidity and mortality, independent of traditional risk factors.

**Objective:** To assess the Assessment of magnitude and spectrum of cardiovascular disease admissions and Outcomes.

**Materials and Methods:** A hospital-based retrospective, cross-sectional study was conducted at Cardiology Department, Sadar Hospital, Rajbari, Dhaka, Bangladesh from January to December 2022. A total of 88 patients with cardiovascular diagnosis among all the annual medical admissions of 291 patients were evaluated during the specified study period. The exclusion criteria were patients whose medical records were incomplete or patients who were died before adequate diagnosis was made.

**Results:** Out of 291 annual medical admissions, the prevalence of cardiovascular diseases (CVD) was 30.8%. About 60% (53) of patients had advanced congestive heart failure of diverse causes. Hypertensive heart disease (HHD) was the next predominant diagnosis (40.9% (36)), and also the leading cause of cardiac diseases followed by rheumatic valvular heart disease (RVHD) (18.2% (16)) and Ischemic heart disease (IHD) (12.5% (11)), respectively. Young age, rural residence and female sex were associated with RVHD ( $p = 0.001$ ). Stroke also accounted for 20% of CVD admission (hemorrhagic stroke-17% vs ischemic stroke-83%). Hypertension was the predominate risk factor for CVD and present in 46.4% (138) of patients. The mean hospital stay was 12 days and in-hospital mortality rate was 24.3% with septic shock being the commonest immediate cause of death followed by fatal arrhythmia, brain herniation, and massive PTE.

**Conclusion:** Cardiovascular diseases were common in the study area causing significant morbidity and mortality. Therefore, comprehensive approach is imperative to timely screen for cardiovascular risk reduction, disease control and complication prevention. Strategies should also be designed to increase public awareness regarding the cardiovascular risk reduction, drug adherence, and possible complications. The traditional nonischemic and the emerging ischemic CVD risk factors within the subregion, are required to stem the scourge of these largely preventable cardiac diseases.

**Keywords:** Outcome; Magnitude; Complications; Spectrum of Cardiovascular Disease

## Introduction

The association between depression and cardiovascular disease is well established and is suggested to be bidirectional. Depression in cardiac disease is common, persistent, under recognized, and deadly. The impacts of non-communicable diseases (NCDs) are particularly devastating in poor and vulnerable populations [1]. NCDs currently cause more deaths than all other causes combined and is projected to increase from 38 million in 2012 to 52 million by 2030 [2]. Nearly three quarters of all NCD deaths occur in low- and middle-income countries. NCD deaths will increase by 17% over the next ten years and the greatest increase will be seen in the African region [2]. Over the past 20 years, research has found that not only is depression more common in cardiac patients than in the general population, but depression is also a risk factor for cardiac morbidity and mortality, independent of traditional risk factors. This link between depression and cardiac morbidity likely involves both physiologic and behavioral effects of depression. In this paper, we will review the epidemiology, course, impact and pathogenesis of depression in patients with cardiovascular disease (CVD). Cardiovascular disease remains the leading NCDs related cause of death in the world. Approximately 80% of all cardiovascular-related deaths occur in low and middle income countries and at a younger age in comparison to high-income countries [3]. Africa is home to for over 1 billion people, and is a major contributor to the global burden of CVD [4,5]. The understanding of adults about CVD and its risk factors including hypertension and diabetes is low in developing countries. More than half of adults in sub-Saharan Africa have poor knowledge of CVD [6-9]. Patient noncompliance is also one of the most difficult challenges in the healthcare sector and therefore, it is vital to enhance patients' awareness and knowledge about the complications and benefits of cardiovascular medications [10]. However, there is an increasing trend of hypertensive heart disease in the subsequent periods replacing the place of valvular heart diseases. In this study, hypertensive heart disease has markedly surpassed rheumatic heart disease as the leading heart disease which might be due to the high proportion of hypertension (62.3%) among the CVD patients in the area [11]. In another African studies hypertension was also the main causes of heart failure (21.3%), followed by rheumatic heart diseases (20.1%), cardiomyopathy (16.8%), coronary artery disease (10%), and congenital heart disease (9.8%) [12]. Different studies have demonstrated that much of the population risk of

CVD is attributable to modifiable traditional risk factors, including hypertension, diabetes mellitus, dyslipidemia, smoking, lack of physical activity, and psychosocial factors [3,13].

## Materials and Methods

A hospital-based retrospective, cross-sectional study was conducted at Cardiology Department, Sadar Hospital, Rajbari, Dhaka, Bangladesh from January to December 2022. Total 88 patients with cardiovascular diagnosis among all the annual medical admissions of 291 patients were evaluated during the specified study period. The exclusion criteria were patients whose medical records were incomplete or patients who were died before adequate diagnosis was made. A total of 10 patients with CVD diagnosis on the HMIS registry were excluded due to incomplete medical records. Admission and discharge diagnosis was captured from the registry to further retrieve the chart of the patient for detailed review of demographic data, major investigations, comorbidities, underlying background risk factors and control, admission/discharge diagnosis of cardiovascular diseases, duration of hospital stay and outcomes.

Relevant patient information was retrieved from the HMIS registry as well as medical records. Cardiovascular diseases included diseases that affect the heart and blood vessels. The main blocks of WHO International Classification of Diseases (ICD)-10th version for Mortality and Morbidity Statistics (MMS) (Version: 04 / 2019) was utilized to sort out the final diagnoses [14]. The unit of analysis was the hospital discharge and/or admission, not the patient and therefore, a patients admitted more than once in a year were counted each time as a separate -admission|| to the hospital. In situations with more than one cardiovascular diagnosis in the same case, the different disease conditions were counted separately.

## Operational definition

Cardiovascular diseases comprise various diseases affecting the heart and blood vessels. Hypertensive heart disease (HHD) was diagnosed in patients with hypertension presenting with symptoms and signs of heart failure, with or without leftventricular (LV) hypertrophy and left atrial enlargement on two-dimensional echocardiography or Doppler evidence of LV diastolic dysfunction in the absence of significant valvular heart disease or regional

wall motion abnormality [15]. For those who have no documented 2-dimensional echocardiography, ECG evidence of left ventricular hypertrophy (LVH) was used. Dilated cardiomyopathy (DCMP) was diagnosed in patients with marked LV dilatation and dysfunction in the absence of significant valvular, structural, or congenital heart disease or arterial hypertension [15]. Ischaemic heart disease (IHD) included any of the three entities: 1. Angina pectoris which is short lived, relieved with termination of the provoking factor or rest and had no typical ECG features of infarction, 2. Acute myocardial infarction which was defined by the presence of elevated cardiac biomarker together with acute onset chest pain, and/or typical ECG changes, 3. Prior myocardial infarction including patients who present with or without heart failure in whom echocardiography detected regional wall motion abnormality in the absence of a history of acute coronary syndrome [15]. Pathologic Q waves on ECG were used to predict the possibility of ischaemia as a cause of the regional wall motion abnormality in a dilated left ventricle with reduced ejection fraction.

**Pulmonary heart disease (PHD)**

Right heart failure, also known as cor pulmonale due to altered structure and/or function of the right ventricle evidenced by 2-dimensional echocardiography. Blood pressure control: Controlled BP when the mean BP < 140/90 mmHg in hypertensive patients of all ages [16]. Uncontrolled BP when the mean BP ≥ 140/90 mmHg in hypertensive diabetic patients of all ages [16]. Blood Sugar control: Good glycemic control when the mean Fasting blood sugar ≤ 130 mg/dL and/or HbA1C < 7% and Poor glycemic control when mean Fasting blood sugar > 130 mg/dL and/or HbA1C > 7% [17].

**Data collection and instrument**

In order to ensure the accuracy, completeness, and comparability of data, four senior medical residents were trained to complete data collection format. Data collection was made by the pretested structured check lists to document all the pertinent profiles of the study subjects.

**Data processing and statistical analysis**

After checking for completeness, data was coded, entered, and analyzed using SPSS version 20 software. Descriptive statistics was used to calculate rates. Chi-square was used to estimate the

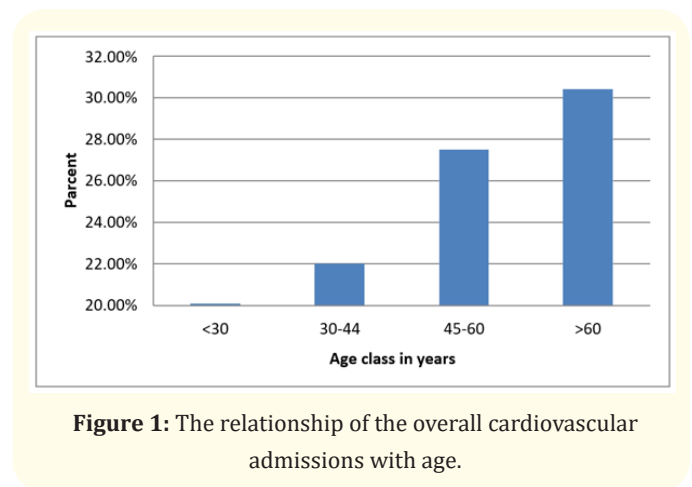
associations between selected predictor variables. A p-value < 0.05 was taken as statistically significant.

**Results**

Total 291 patients follow up to Hospital and cardiovascular admission constituted 30.2% (88). Majority of the study subjects were male 60.2% (53) and about half of the patients were urban area. The minimum age among the cardiovascular admissions was 15 years and the maximum age was 86 years with the mean age of 48.9 years, and the median age was 50 years. The overall cardiovascular illness increased almost steeply with increasing age (p = 0.001) (Table 1). However, further disease stratification showed that Rheumatic valvular heart diseases (CRVHD) and vascular diseases including DVT, PTE and CVT were more common in the younger age and proportionally decreased as age advanced (p = 0.001) (Figure 2).

Socio-demography	Categories	Number(n)	Percentage (%)
Sex	Male	53	60.2
	Female	35	39.8
Residence	Urban	58	65.9%
	Rural	30	34.01%
Age	<30	18	20.7%
	30-44	19	21.6%
	45-60	24	27.3%
	>60	27	30.7%

**Table 1:** Socio-demographic characteristics of cardiovascular admissions Patients.



**Figure 1:** The relationship of the overall cardiovascular admissions with age.

The spectrum of major cardiovascular diseases was scrutinized according to the ICD-10 classification of diseases and most of the patients had two or more cardiovascular diagnosis. From all cardiovascular admissions, about 60.2% (53) of patients had advanced congestive heart failure (NYHA class III and class IV) of diverse causes. The advanced congestive heart failure (CHF) had multiple underlying etiologies, and also multiple precipitating factors including hypertension 34%(18), lung infection 34%(18), drug discontinuation 24.5% (13), and arrhythmia 22.6% (12) predominantly being atrial fibrillation with fast ventricular response (Afib with FVR). Hypertensive heart disease (HHD) constituted for 40.9% (36) of the total admission diagnosis as well as the leading cause of heart failure and its prevalence increased with increasing age (p<0.001). Valvular heart diseases (both rheumatic and degenerative valvular heart diseases) accounted for about 34.5% of all advanced cardiac failure cases and 20.5% (73) of all the cardiovascular admissions as shown in the Table 2 below. Echocardiography proven isolated MS and MS with MR constituted 26%(19) and 27.5%(20) of all valvular heart diseases, respectively. There were 20.5% of isolated MR cases and 13.5% of mixed MS,MR, and AR of all valvular heart diseases, with the rest comprising 12%. The proportion of degenerative valvular heart diseases increased with advancing ages (p = 0.01) whereas the proportion of rheumatic heart diseases decreased as age increasing (p = 0.01).

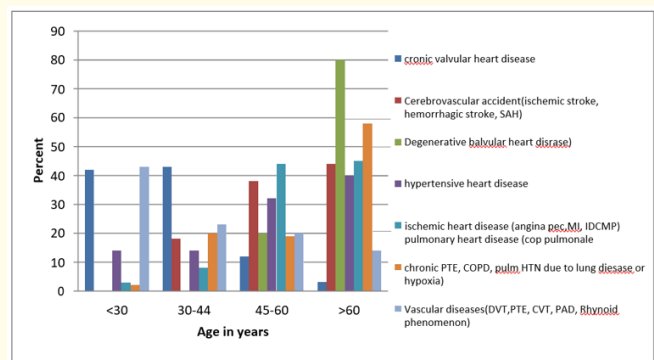
CVD spectrum	Frequency(n)	Percentage (%)
CHF	53	60.2
HHD	36	40.9
CRVHD	16	18.2
IHD	11	12.5
PHD	10	11.4
DCMP	8	9.1
DVHD	2	2.3
Vascular Diseases Δ	21	23.9
CVA	17	19.3
ARRYTH	17	19.3
SBE	2	2.3
OTHERS*	7	8.0

**Table 2:** Spectrum of major cardiovascular diseases.

\*Thyocardiac disease, Intra-cavitary masses, High output Heart failure, ΔPAD, DVT, PE, CVT.

Ischemic heart disease (IHD) accounted for 12.5% (11) of all CVD admissions and the prevalence has significantly increased with age and males had significantly higher proportion than females (p = 0.001) (Table 3). IHD was more common in residents of Addis Ababa than those who came from out of Addis Ababa but the difference was not significant (p = 0.2). IHD is associated with hypertension and diabetes (p = 0.001). From all IHD patients, 90.24% had hypertension with 13.5% had good hypertension control, 59.5% had poor hypertension control, and 27% were newly diagnosed for hypertension or not on treatment.

Similarly, 41.5% of IHD patients had T2DM with 41.5% had good glycemic control, 35.3% had poor glycemic control and 17.0% were newly diagnosed for T2DM. Over 42% of pulmonary heart disease (PHD) was attributed to COPD related causes and the remaining was due to chronic PTE and secondary to post-tuberculosis fibrosis. PHD was more common in patients who came from Addis Ababa than those who came from out of Addis Ababa but it was not significant (p = 0.053). Females constituted over two-third of dilated cardiomyopathy and peripartal cardiomyopathy accounted for 26.5% (p = 0.01).



**Figure 2:** The associations of major cardiovascular diseases with increasing age (p < 0.001).

Vascular diseases (VasD) were the most common cause of cardiovascular diseases next to CHF and HHD. It accounted for about a quarter of cardiovascular diagnosis and females constituted about two-third of the cases. DVT was the leading vascular cause accounting for 40% (8) followed by PTE of about 30% (6). Peripheral arterial disease (PAD) and cerebral venous thrombosis (CVT) accounted for 15.0% (3) and 5% (1)

of vascular disease admission, respectively. Pregnancy related conditions including caesarian section and puerperium (30.0% (6)), major surgery and prolonged immobilization for medical illnesses (25.0% (5)) as well as active cancers (10.0% (2)) were the major risk contributors of venous thrombo-embolism (VTE). Residence of the patients did not have effect on the distribution of vascular diseases ( $P = 0.1$ ). Hypertension and diabetes were significantly associated with PAD ( $p = 0.001$ ). Hypertension was documented as a risk factor in about 85% of patients with PAD followed by Type-2 diabetes mellitus and chronic kidney disease, each of which were implicated as a risk factor in 25% of cases of PAD. The cumulative vascular diseases significantly decrease as the age of the patients increased ( $p = 0.01$ ) (Figure 2). Cerebrovascular accident (Ischemic stroke and hemorrhagic stroke) accounted for about 20.5% (18) of total annual cardiovascular admission with hemorrhagic stroke constituted about 17% and ischemic stroke for the remaining 83% of the total stroke patients. Of all ischemic strokes, cardio embolic stroke amounted for 32.2%. From all the atherothrombotic ischemic stroke groups, 7.5% had hemorrhagic transformation during the course of disease progression. There was no variation of stroke distribution between males and females (male = 39.8% and female = 60.2%,  $p = 0.09$ ).

Major risk factors	N	%
Uncontrolled HTN	9	50.0%
Untreated HTN	5	27.8%
DM	3	16.7%
Atrial fibrillation	4	22.2%
CRVHD	2	11.1%
DCMP	1	5.6%

**Table 3:** Major risk factors of stroke among admitted patients.

All patients with hemorrhagic stroke had hypertension and 75% of them had long standing uncontrolled hypertension whereas the remaining 25% had untreated hypertension; either newly diagnosed hypertension or known hypertension on life style modification self-deferring the pharmacologic therapy. About one-third of atherothrombotic ischemic stroke (non-cardio-embolic) patients had type-2 diabetes. Atrial fibrillation accounted for 73.9% of cardio embolic stroke admissions followed by CRVHD (36.4%) and DCMP (26.1%), respectively. About 71.6% of CRVHD patients and 60.2% of DCMP patients had atrial fibrillation.

### Hypertension and Diabetes control among the cardiovascular admissions

Of all the 88 annual cardiovascular admissions, 47.7% (42) patients had history of hypertension. Hypertension is significantly prevalent in patients from Addis Ababa than patients who come out of Addis Ababa (64.3% (27) Vs 36.3% (61),  $p = 0.001$ ). The minimum duration of hypertension ranged from newly diagnosed hypertension up to the maximum years of hypertension history of 30 years. Only 20% of patients reported to have good hypertension control (BP < 140/90 mmHg) with adherence to the medications and have frequent follow up whereas 46.6% of patients had poor hypertension control (BP  $\geq$  140/90 mmHg) who were either not adherent to or discontinued their pharmacologic therapy by themselves and came with end organ damage. About 35% of hypertensive patients were not on any sort of therapy or diagnosed to have hypertension after hospital presentation for their current respective complaints. The proportion of diabetes mellitus (DM) among the cardiovascular admissions were 17.0% (15) and significantly prevalent in patients who came from out of (73.3% (11) Vs 26.7% (4),  $p = 0.001$ ). The duration of DM history ranged from newly diagnosed T2DM after hospital admission up to 25 years. About 40% of DM patients had "good" DM control with FBS  $\leq$  130 mg/dl and/or A1C < 7% whereas 46.8% had "poor" DM control (FBS > 130 mg/dl and/or A1C > 7%) having erratic adherence to the medication, the initial single drug as well as the dose never changed and had no follow up. Most of the patients had no documented HbA1c. The control of diabetes in patients from Addis Ababa was significantly better than control in patients coming from Addis Ababa ( $p = 0.001$ ).

	N	%
Improved	50	56.8%
Death	21	23.9%
The Same	9	10.2%
Transfer	4	4.5%
LAMA	3	3.4%
Absconded	1	1.1%

**Table 4:** The outcomes of cardiovascular admission in patients.

**Outcomes of cardiovascular disease admissions**

Among patients with CVD admissions, the minimum hospital stay was one day and the maximum hospital stay was 80 days with the average hospital stay was 12days. About 56.8% (50) of cardiovascular admission patients were discharged from the hospital with improvement but in hospital mortality rate among the cardiovascular admission was 23.9% (21). The immediate causes of death were sepsis with septic shock (23.8%), fatal arrhythmia (19.0%), brain herniation (14.3%), massive PTE (14.3%), and cardiogenic shock (9.5%) (Table 4).

Causes of death	Frequency	Percentage
Septic shock	5	23.8%
Fatal arrhythmia	4	19.0%
Brain herniation	3	14.3%
Massive PTE	3	14.3%
Cardiogenic shock	2	9.5%
Unexplained Sudden cardiac arrest	2	9.5%
Cause of death no documented	1	4.8%
Massive aspiration	1	4.8%

**Table 5:** Major causes of death of cardiovascular admissions.

**Discussion**

The epidemic of cardiovascular disease (CVD) is a global phenomenon, and the magnitude of its burden is alarmingly increasing in the developing world. The cardiovascular disease remains the leading cause of death in the world and approximately 80% of all CVD- related deaths occur in low and middle income countries [3]. Total 291 patients follow up to Hospital and cardiovascular admission constituted 30.2% (88). Majority of the study subjects were male (60.2% (53) and about half of the patients were urban area. The minimum age among the cardiovascular admissions was 15 years and the maximum age was 86years with the mean age of 48.9 years, and the median age was 50years. The overall cardiovascular illness increased almost steeply with increasing age (p = 0.001) (Table 1). However, further disease stratification showed that Rheumatic valvular heart diseases (CRVHD) and vascular diseases including DVT, PTE and CVT were more common in the younger age and proportionally decreased as age advanced (p = 0.001) (Figure 2). The present

burden of cardiovascular cause of medical admission was in agreement with the previous study conducted in the same hospital in which the CVD prevalence was found to be 32% among the total medical admission [18]. However, the previous study considered hypertension as a separate exclusive CVD diagnosis but in this study hypertension was considered as a CVD risk factor and hypertensive heart disease was an exclusive diagnosis as per the International Disease Classification (ICD-10) [14]. This higher rate in our study might be due to large proportion of urban residency dominated by cardiovascular risk factors including hypertension and diabetes unlike the former study catchment area where infectious cause of admission accounted for close to 50% of hospital admission [19]. Most of the patients (60%) were admitted with the clinical diagnosis of advanced congestive heart failure (CHF) (NYHA class III and IV) having multiple causes and with chief complaint of worsening of shortness of breath, orthopnea, PND and body swelling. This high rate of CHF in the current study is in agreement with other study [18,20]. Surprisingly, over a quarter of CHF patients had associated history of drug discontinuation as a precipitating factor eventually worsening their heart failure condition. Therefore, healthcare providers should also equally focus on health education including adherence to the medical managements in addition to prescribing the pharmacologic therapy based on the appropriate diagnosis. Hypertensive heart disease (HHD) was the second predominant admission diagnosis constituting for 40.9% of overall cardiovascular admission and also the leading cause of heart failure followed by rheumatic valvular heart disease (RVHD) which constituted for about 18.2% of all CVD. In most previous studies involving both inpatient medical patients and outpatient follow up clinics, VHD was considered to be the leading cause of CVD in general and cardiac diseases in particular [11,18-22]. This might be due to the increasing prevalence of hypertension, as supported by the high proportion (about 48%) of hypertension among CVD patients found in our study. HHD in the current study was predominant in urban residents than the rural dwellers (p = 0.01). It may be an indication of increasing urbanization and westernization of diet in the present metropolitan area coupled with better health care availability in the current urban area disfavoring the risk factors for rheumatic valvular heart disease (RVHD). RVHD in the current study is dominant in patients coming from rural area than the residents (p = 0.001). Rural predominance of RVHD is consistent with previous studies [11,15,21]. Ischemic

heart disease (IHD) and dilated cardiomyopathy(DCMP) were other causes of cardiac diseases constituting for 12.2% and 9.6% of annual CVD admissions, respectively and the burden increased with increasing age( $p = 0.01$ ). These findings are in agreement with other national studies [11,15,20]. The ischemic heart disease has increased when the current rate of 12.2% (12,200 per 1000,000) among the CVD patients and the 2014 IHD rate of 7,400 per 100,000 [23] is compared with reports of 640 per 100,000 in 1993 [24] and 88 per 100,000 in 1988 [25]. Hypertension and Diabetes mellitus were highly associated with the development of IHD ( $p = 0.001$ ) and is in agreement with similar study [23]. Cerebrovascular accident (CVA) including both ischemic and hemorrhagic stroke accounted for 20% of annual CVD admissions with ischemic stroke dominated by 83% whereas hemorrhagic stroke taking the remaining 17%. A study done by Abdissa, *et al.* [23] at Tikur Anbessa hospital showed that Hemorrhagic stroke accounted for about 37.5% and ischemic stroke for 55% of total stroke patients.

Since most of the stroke studies conducted so far were in the admitted patients in the hospitals, the findings may not be representative of the actual relative proportions of the sub-types of stroke as it is routine phenomenon that most patients with mild or moderate ischemic stroke do not necessarily come to hospital attention or might have been early discharged from ER with no admission once the acute phase is over or due to their late presentation after the acute phase [26]. In this study, hypertension was present in 74% of patients with stroke. All hemorrhagic stroke patients had hypertension and 75% of them had long standing uncontrolled hypertension whereas the remaining 25% had untreated hypertension. This finding is in agreement with similar studies [27-29]. Furthermore, 97.5% of atherothrombotic (non- cardioembolic) ischemic stroke patients had hypertension as a major risk factor where 61% of them had uncontrolled hypertension and 38% of them had newly diagnosed or untreated hypertension. The finding is also in conformity to other studies [27-29]. Hypertension, in the current study, was found to be one of the dominant risk factors for cardiovascular diseases where about 48% of CVD patients had hypertension. However, this finding is higher than some of the previous reports of hypertension burden among the CVD patients [15,19]. The high burden of VTE including massive PTE as one of the major immediate causes of death (Table 4) may be partly due to lack of comprehensive guideline based

venous thromboembolism(VTE) prophylaxis consistent with the degree of risk factors. The tradition of prolonged bed rest during puerperium might have also exacerbated the existing procoagulant risks. Hypertension was documented as a risk factor in about 85% of patients with PAD followed by Type-2 diabetes mellitus implicated in 25% of cases of PAD. This is consistent with the association of uncontrolled hypertension and diabetes with atherosclerotic CVD diseases including PAD [30]. The mean duration of total hospital stay in the current study was 12 days with the minimum hospital stay was one day and the maximum hospital stay was 80 days. This result is comparable to the average of 12.33 days of hospital stay for medical admission at St. Paul hospital [17] stroke admissions of 11.14 days [31] but much less than the 14.4 days of total hospital stay at Asella referral hospital [18]. There were 57% of CVD patients discharged with improvement and in hospital mortality rate was 24.3%. Sepsis with septic shock was the leading immediate cause of death attributable for about a quarter of deaths among CVD admissions, followed by fatal arrhythmia, brain herniation, massive PTE and cardiogenic shock in 20%, 15% and 14%, respectively. Infectious disease was also the leading cause of mortality among medical admissions studied previously [18,19]. Therefore, comprehensive work is ahead both at institution level and national level to lower the CVD risks, disease progression, fatality rate and the duration of hospital stay.

## Conclusion

Cardiovascular diseases were common in the study area causing significant morbidity and mortality. Therefore, comprehensive approach is imperative to timely screen for cardiovascular risk reduction, disease control and complication prevention. Strategies should also be designed to increase public awareness regarding the cardiovascular risk reduction, drug adherence, and possible complications. The traditional nonischemic and the emerging ischemic CVD risk factors within the subregion, are required to stem the scourge of these largely preventable cardiac diseases.

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