

Cardiovascular Disease Trends in Nepal - An Analysis of Global Burden of Disease Data 2017

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Research article

Keywords: Cardiovascular disease, burden, risk, Nepal, health system, ischemic heart disease and stroke, premature deaths, mortality, incidence, prevalence

Posted Date: March 2nd, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-15645/v1>

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Version of Record: A version of this preprint was published on July 31st, 2020. See the published version at <https://doi.org/10.1016/j.ijcha.2020.100602>.

Abstract

Background Cardiovascular diseases (CVDs) are the leading cause of death and disease burden globally, disproportionately affecting low and middle-income countries. The continued scarcity of literature on CVDs burden in Nepal has thwarted efforts to develop population-specific prevention and management strategies. This article reports the burden of CVDs in Nepal including, prevalence, incidence, and disability basis as well as trends over the past two decades by age and gender. The findings from this study provide a base for public health priorities and for creating evidence-informed policies.

Methods We used the Institute of Health Metrics and Evaluation (IHME)'s Global Burden of Diseases (GBD) database on cardiovascular disease mortality rates, prevalence, incidence, disability-adjusted life-years (DALYs), years of life lost (YLLs) and years lived with disability (YLDs) from Nepal to describe the most recent data available (2017) and trends by age, gender and year from 1990 to 2017. Tables, graphs and histograms are used to compare patterns and trends across all metrics. Data are presented as percentages or as rates per 100,000 population.

Results In 2017, CVDs contributed to 26.9% of total deaths and 12.8% of total DALYs in Nepal. Ischemic heart disease and stroke were the predominant CVDs, contributing 16.4% and 7.5% to total deaths and 7.5% and 3.5% to total DALYs, respectively. Cardiovascular disease incidence and mortality rates have increased from 1990 to 2017, with the burden greater among males and among older age groups. The leading risk factors for CVDs were determined to be high systolic blood pressure, high low density lipoprotein (LDL) cholesterol, smoking, air pollution, a diet low in whole grains, and a diet low in fruit.

Conclusion CVDs are a major public health problem in Nepal contributing to the high DALYs with unacceptable numbers of premature deaths. There is an urgent need to address the increasing burden of CVDs and their associated risk factors, particularly high blood pressure, body mass index (BMI) and unhealthy diet.

Background

Cardiovascular diseases (CVDs) are the leading cause of premature death and disease burden globally ¹, disproportionately affecting low and middle-income countries (LMICs) ². Eighty percent of CVDs deaths occur in LMICs ³. The South East Asia Region (SEAR) (including India, Pakistan, Bhutan, Bangladesh, Sri Lanka, and Nepal) is home to 20% of the world's population and has one of the highest burden of CVDs in the world ⁴. The estimated economic loss due to CVDs in LMICs was 3.7 trillion US dollars in 2010, approximately 2% of the Gross Domestic Product of all LMICs ⁵.

Like many other LMICs, Nepal's existing national health system is not well prepared to address the growing burden of CVD ⁶. The rural health facilities in Nepal do not provide non communicable disease (NCD) related preventive and clinical services. These services are concentrated in cities, increasing disparities in access to health services ⁷. In 2013, nearly 26% of the population had elevated blood pressure, 4% had elevated blood sugar, 21% were overweight or obese, and 23% had high cholesterol ⁸. The prevalence of smoking was 19% and almost everyone (99%) consumed less than five servings of fruits and vegetables on an average day ⁸. Further, Nepal lacks access to the technological advances in early detection and management of CVD that contributed to the reduction of mortality in high income countries (HICs) ⁹. The continued poor access to CVD care and management services ⁸ and the high prevalence of CVD risk factors is expected to substantially increase the CVD burden in the coming years if appropriate action is not taken ⁸. To address the increasing burden of NCDs, Nepal has endorsed a multisector action plan for prevention and control of NCDs ¹⁰,

and also introduced a package to prevent and treat NCDs, but implementation of the plan has remained challenging and the health promotional activities have remained inadequate ¹¹.

Few studies have assessed the CVD burden in Nepal. The prevalence of coronary artery disease was reported to be 5% in a study conducted in six hospitals of Kathmandu in 2003 ¹², and 5.7% in a population-based study in eastern Nepal in 2009 ¹³. The prevalence of rheumatic heart disease was 0.9 per thousand among 5–15 years old children in Kathmandu in 2013 ¹⁴. National level data on CVDs, including incidence of myocardial infarction and stroke, are not available. The continued dearth of literature on the burden of CVD in Nepal has thwarted efforts to develop population-specific prevention and management strategies. A comprehensive analysis of the types of CVDs most common in the population, their major risk factors, trends, age and gender distribution has been overdue. In this article, we report the burden of CVD in Nepal including prevalence, incidence, and several estimates of disability over time, by age and gender. The findings from this analysis of CVD mortality and morbidity data could provide a base for setting public health priorities and creating evidence-informed policies.

Methods

We used the Institute for Health Metrics and Evaluation (IHME)'s Global Burden of Diseases (GBD) database ¹⁵ to download cardiovascular disease mortality rates, prevalence, incidence, disability adjusted life years (DALYs), years of life lost (YLLs) and years lived with disability (YLDs) data from Nepal and other comparator countries including India, Bangladesh, Pakistan, Bhutan, Maldives, Sri Lanka and the USA by age, gender and year from 1990 to 2017. We downloaded the data in excel format and used descriptive statistics (rates and proportions) to compare patterns and trends in mortality, incidence and prevalence rates, DALYs, YLDs, and YLLs for CVDs in Nepal by age and gender using tables, graphs and histograms. The source data i.e. GBD study uses a standardized analytical approach for estimating incidence, prevalence, and YLDs by age, sex, cause, year, and location. The description of metrics, data collection procedures, and analytical approaches used for GBD 2017 are reported elsewhere ¹⁶. The GBD 2017 used several input sources from surveillance and survey data, published, and unpublished papers, vital registration, hospital data to generate the data for 354 causes from 195 countries ¹⁶, including Nepal. We direct interested readers to the Data Input Sources Tool, which lists all the publications and papers used for Nepal GBD 2017¹⁷. Here, we present the prevalence, and mortality rates, and DALYs due to CVD from 1990 to 2017. We also report the contribution of major risk factors to CVD DALYs in 2017.

Results

In 2017, CVDs contributed to 26.9% (CI 29.5–24.4) of total deaths and 12.8% (CI 14.6–11.0) of total DALYs in Nepal (Table 1). Ischemic heart disease and stroke were the predominant CVDs, contributing 16.4% (CI 18.2–14.6) and 7.5% (CI 8.6–6.7) to total deaths and 7.5% (CI 8.7–6.3) and 3.5% (CI 4.0–3.0) of total DALYs, respectively. The proportion of death and DALYs from Ischemic heart disease and stroke was higher in men than in women. Hypertensive heart disease and rheumatic heart disease each contributed to about 0.8% of total deaths.

Table 1
Percentage of total deaths and DALYs due to CVDs by gender in Nepal (all ages, 2017)

	Percentage of total deaths (95% CI)			Percentage of total DALYs (95% CI)		
	Both	Male	Female	Both	Male	Female
Ischemic heart disease	16.4 (18.2–14.6)	20.5 (22.7–18.03)	11.1 (13.0–9.4)	7.6 (8.7–6.2)	10.3 (11.9–8.3)	4.5 (5.5–3.7)
Stroke	7.5 (8.6–6.7)	8.6 (9.8–7.4)	6.2 (7.7–4.9)	3.49 (4.0–2.9)	4.2 (5.0–3.5)	2.6 (3.3–2.2)
Hypertensive heart disease	0.82 (1.0–0.6)	0.73 (0.9 – 0.5)	0.93 (1.4–0.6)	0.4 (0.4 – 0.3)	0.3 (0.4 – 0.3)	0.3 (0.5 – 0.2)
Rheumatic heart disease	0.8 (1.0–0.5)	0.6 (1.0–0.5)	0.9 (1.2–0.6)	0.6 (0.7 – 0.4)	0.5 (0.7 – 0.4)	0.6 (0.8 – 0.4)
Non-rheumatic valvular heart disease	0.1 (0.1 – 0.08)	0.1 (0.2 – 0.08)	0.09 (0.1 – 0.07)	0.05 (0.06 – 0.04)	0.06 (0.08 – 0.04)	0.04 (0.05 – 0.03)
Atrial Fibrillation and flutter	0.2 (0.2 – 0.1)	0.19 (0.3 – 0.1)	0.2 (0.3 – 0.2)	0.1 (0.2 – 0.10)	0.1 (0.2 – 0.1)	0.1 (0.1 – 0.09)
Aortic aneurysm	0.2 (0.2 – 0.1)	0.2 (0.3 – 0.2)	0.08 (0.1 – 0.05)	0.06 (0.09 – 0.05)	0.1 (0.1 – 0.07)	0.03 (0.04 – 0.02)
Peripheral artery disease	0.01 (0.01–0.00)	0.01 (0.01–0.00)	0.00 (0.02–0.00)	0.02 (0.03 – 0.01)	0.02 (0.03–0.10)	0.02 (0.03 – 0.01)
Endocarditis	0.04 (0.06 – 0.03)	0.04 (0.07 – 0.03)	0.04 (0.06 – 0.03)	0.03 (0.04 – 0.02)	0.03 (0.05 – 0.02)	0.02 (0.03 – 0.02)
Cardiomyopathy and myocarditis	0.2 (0.38 – 0.18)	0.35 (0.51 – 0.20)	0.19 (0.24 – 0.14)	0.17 (0.24 – 0.12)	0.23 (0.34 – 0.14)	0.11 (0.14 – 0.09)
Other cardiovascular and circulatory diseases	0.5 (0.8 – 0.4)	0.6 (1.1–0.4)	0.46 (0.7 – 0.3)	0.4 (0.5 – 0.3)	0.5 (0.7 – 0.4)	0.3 (0.4 – 0.2)
Total Cardiovascular diseases	26.9 (29.5–24.4)	32.1 (34.8–29.2)	20.3 (24.8–16.2)	12.8 (14.5–10.9)	16.4 (18.7–13.8)	8.87 (10.5–7.3)

The trends in CVD mortality and incidence by gender from 1990 to 2017 in Nepal is shown in Fig. 1. The incidence rates have increased between 1990 to 2017. In 2017, the CVD incidence among males was 569.5 per 100,000 population (CI 594.0–546.5) and females was 479.1 per 100,000 population (CI 501.1–459.1). The CVD mortality rate in Nepal increased from 124.1 per 100,000 population (CI 142.8–108.1) in 1990 to 164.7 per 100,000 population (CI 185.5–142.7) in 2017. In 2017, the CVD mortality rates among males was estimated to be 230.7 (CI 260.1–188.7) and among females it was 104.3 (CI 127.0–84.7).

Table 2 shows CVD mortality rates in Nepal by age group and gender in 2017. In 2017, the overall CVD mortality rate was 260.8 per 100,000 population with the rates being higher among older age groups. In all age groups, the CVD mortality rate was higher among males compared to females, with the greatest difference in the 60 to 64 years age group (953.1 per 100,000 for male vs 374.0 per 100,000 for female). Compared to other age groups the death rate from CVD was highest among 80 years and above (4274.7 CI 4807.6-3777.9); however, the proportion of total deaths from CVD was highest among those in age groups 65 to 69 years (36.2 CI 40.2–32.5).

Table 2
Deaths from CVDs in Nepal by age groups and gender in 2017.

Age groups (yrs)	Death per 100,000 (95%CI)			Percentage of total deaths (95%CI)		
	Both	Male	Female	Both	Male	Female
1 to 4	0.4 (0.7 - 0.2)	0.6 (1.0-0.3)	0.3 (0.5 - 0.1)	0.4 (0.7 - 0.2)	0.6 (0.9 - 0.3)	0.3 (0.5 - 0.1)
5 to 9	0.3 (0.5 - 0.2)	0.4 (0.6 - 0.2)	0.3 (0.5 - 0.2)	0.7 (1.0-0.4)	0.7 (1.0-0.4)	0.7 (1.0-0.4)
10 to 14	0.7 (0.9 - 0.4)	0.8 (1.2-0.5)	0.5 (0.8 - 0.3)	1.6 (2.2-1.1)	1.7 (2.5-1.1)	1.4 (2.1-0.8)
15 to 19	3.9 (5.1-2.7)	5.8 (8.2-3.9)	2.0 (2.8-1.3)	4.8 (6.2-3.4)	5.7 (7.9-3.9)	3.2 (4.5-2.2)
20 to 24	7.2 (9.8-4.9)	11.7 (17.2-7.4)	3.2 (4.6-2.2)	6.6 (8.8-4.6)	8.2 (11.3-5.3)	4.1 (5.7-2.9)
25 to 29	9.6 (13.5-5.1)	15.4 (23.4-7.0)	5.1 (7.2-2.8)	8.4 (11.2-4.4)	10.9 (7.5-3.0)	5.4 (7.5-3.0)
30 to 34	15.8 (22.9-4.7)	23.0 (37.2-3.0)	10.3 (14.7-4.8)	10.8 (14.8-3.3)	13.8 (20.9-1.9)	7.9 (10.9-3.7)
35 to 39	28.3 (39.6-10.3)	38.4 (59.7-5.0)	20.4 (29.0-12.3)	13.7 (18.5-5.0)	16.9 (25.1-2.1)	10.8 (14.3-7)
40 to 44	63.0 (82.6-34.4)	83.6 (121.4-26.9)	46.1 (63.1-34.4)	20.4 (25.2-11.3)	24.2 (31.9-8.7)	16.4 (20.5-12.3)
45 to 49	124.1 (156.8-86.1)	168.9 (234.5-102.2)	84.2 (110.8-60.5)	25.9 (30.6-19.4)	30.7 (37.6-20.3)	20.3 (24.7-16.2)
50 to 54	237.0 (287.3-187.9)	338.2 (432.2-244.1)	140.7 (186.1-104.4)	31.0 (35.1-26.1)	37.3 (42.9-30.0)	22.3 (27.1-18.0)
55 to 59	405.1 (475.8-328.6)	578.4 (703.4-440.2)	238.7 (312.6-178.0)	34.1 (37.8-30.2)	39.3 (44.0-34.1)	26.1 (30.8-20.9)
60 to 64	653.7 (756.1-539.5)	953.1 (1131.4-738.4)	374.0 (476.8-284.5)	34.9 (38.7-30.9)	40.4 (45.1-35.5)	26.5 (31.5-21.3)
65 to 69	1038.6 (1190.2-878.5)	1503.6 (1742.5-1199.7)	617.0 (797.6-474.5)	36.2 (40.3-32.5)	41.6 (46.2-37.0)	28.2 (33.8-22.8)
70 to 74	1557.5 (1782.2-1323.2)	2254.4 (2570.3-1822.2)	892.7 (1148.4-661.9)	34.6 (38.3-30.7)	40.7 (45.1-36.0)	25.4 (31.5-19.4)
75 to 79	2442.9 (2771.2-2118.6)	3407.0 (3854.0-2807.5)	1537.0 (1964.4-1135.3)	35.0 (38.8-31.4)	40.5 (45.0-36.0)	27.2 (33.5-20.8)

Age groups (yrs)	Death per 100,000 (95%CI)			Percentage of total deaths (95%CI)		
	Both	Male	Female	Both	Male	Female
80 above	4274.7 (4807.6-3777.9)	5938.5 (6636.2-5075.9)	2994.7 (3760.7-2345.3)	30.6 (34.2-27.7)	37.3 (41.0-33.4)	24.0 (29.4-19.6)
Total	260.8 (292.3-227.6)	372.0 (414.6-309.7)	165.4 (200.8-134.6)	27.0 (29.5-24.4)	32.1 (34.8-29.2)	20.3 (23.4-17.4)

The burden of CVD in terms of DALYs, YLDs and YLLs in 2017 was higher among older age groups and higher in males compared to females (Fig. 2).

Figure 3 shows the risk factors that contributed to DALYs due to CVDs in Nepal in 2017. The leading risk factors associated with the highest DALYs were high systolic blood pressure 2624.0 (CI 2867.7-2373.1), high low density lipoprotein (LDL) cholesterol 1242.4 (CI 1472.0-1031.5), high body mass index 1058.2 (CI 1452.1-694.1), a diet low in whole grains 920.2 (CI 1217.6-641.7), high fasting plasma glucose 877.3 (CI 1196.6-663.4), smoking 872.9 (CI 915.9-835.9), a diet low in fruits 682.4 (CI 995.0-408.7), and a diet low in nuts and seeds 557.8 (CI 767.9-357.3). High systolic blood pressure, lead exposure, and a diet high in sodium were common risk factors across all the CVDs.

Table 3 compares incidence, prevalence, death rates and DALYs in Nepal to global, regional, and country-specific rates in South Asia. Although Nepal's prevalence of CVD was lower than global estimates, the burden of burden of CVDs measured by DALYs was higher than the global rates while slightly lower than South Asia. The incidence of CVD for Nepal was lower than the global rate but higher than rates in South Asia, while the death rate was higher than the global rate, yet lower than South Asia. In comparison to other countries in the region, Nepal burden of CVD was lower than Bangladesh, Pakistan and India and higher than Bhutan, Sri Lanka and Maldives. The prevalence and incidence rates of the United States were higher than of Nepal, global, South Asia and other countries in the region but the death rates and DALYs were lower.

Table 3
Comparing CVD-related incidence, prevalence, death and DALYs between countries and region.

Age standardised Rates per 100,000 populations				
	Incidence	Deaths	Prevalence	DALYs
Nepal	717.8 (748.6-689.7)	260.8 (292.3-227.6)	5679.8 (5954.0-5437.6)	5242.2(5901.8-4512.9)
Global	922.3 (954.3-893.1)	233.1 (236.4-229.7)	6081.6 (6320.8-5860.8)	4597.9 (4734.2-4463.7)
South Asia	698.7 (724.8-674.4)	294.6 (305.4-279.1)	5432.7 (5674.0-5213.3)	6006.7 (6222.4-5746.4)
Bangladesh	729.1 (757.1-703.8)	298.0 (326.2-269.6)	6296.3 (6576.5-6037.1)	5975.2 (6534.7-5415.7)
India	679.2 (705.5-655.3)	282.3 (293.3-265.0)	5214.2 (5447.6-5000.4)	5804.3 (6015.2-5532.3)
Pakistan	858.4 (888.4-829.7)	423.0 (483.8-364.8)	6566.2 (6877.5-6285.0)	8222.9 (9506.4-7003.7)
Bhutan	644.6 (670.4-621.3)	217.1 (255.0-182.5)	5506.8 (5760.8-5261.6)	4285.0 (5000.9-3544.3)
Sri Lanka	720.2 (750-690.9)	197.1 (220.2-171.6)	5600.3 (5904.0-5326.7)	3717.4 (4204.1-3246.3)
Maldives	689.4 (719.7-662.8)	164.9 (175.6-154.3)	5615.6 (5873.0-5366.5)	3162.2 (3371.4-2924.0)
USA	1588.2 (1637.0-1537.7)	151.1 (153.9-148.1)	7275.8 (7565.4-7012.2)	3029.7 (3168.0-2900.9)

Discussion

The GBD data we extracted and described here show that the total deaths from CVDs has almost doubled from 1990 to 2017, making CVDs the most significant cause of death and DALYs lost in Nepal. Cardiovascular diseases contributed to 27% of total deaths and 13% of total DALYs in 2017. Ischemic heart disease and stroke were the predominant CVDs followed by hypertensive heart disease and rheumatic heart disease. The CVD incidence, prevalence and mortality rates and DALYs increased in Nepal from 1990 to 2017. Males and older age groups were more affected compared with female and younger age groups. In South Asia, Nepal ranked third in prevalence, and the CVD related DALY rates were higher in Nepal than the global average.

Nearly half of all CVD deaths in Nepal in 2017 occurred among those 70 years and younger. Similarly, high numbers of deaths from CVDs were observed in those under 70 years in SEAR (25% of total deaths)¹⁸. Fifty two percent of CVD deaths in LMICs occur below the age of 70 years compared to only 23% in high income countries¹⁹. The high incidence and declining mortality rates due to CVD in the U.S. and other industrialized countries are a result of rapid progress in prevention and treatment of CVDs and better management of risk factors such as hypertension and cholesterol²⁰⁻²². In the past two decades, Nepal's health system has been focused primarily on combating communicable diseases, maternal child health and nutritional deficiencies⁶. Therefore, there is inadequate attention to quality care, screening, and diagnostics to prevent and manage CVDs. The CVD management in Nepal has focused on treatment, concentrated

in the cities out of reach of the majority of the rural population, and lacked preventive health care and education⁶. The high rates of premature death from CVDs can also be attributed to the health system's inability to provide effective interventions¹⁹ that include longitudinal and continuous systems of care for CVDs at the community level⁹.

The incidence, prevalence and DALYs due to CVD have substantially increased in Nepal since 1990. The percent of total DALYs contributed by CVDs was higher among men than in women, a trend similarly observed in India, with higher rates of DALYs among males (15.8% vs 12.2%)²³. After the age of 35 years, the gap between men and women in DALYs increased significantly. This rising CVD burden can be attributed to the country's epidemiological and demographic transitions²⁴. The life expectancy in Nepal has increased from 54 years in 1990 to 70 years in 2015,^{25,26} thus leading to an increase in the proportion of aging population that corresponds to increases in incidence, prevalence and mortality associated with CVD since 1990 in Nepal. Urbanization and lifestyle changes also have given rise to metabolic (high blood pressure, blood sugar and cholesterol), behavioral (tobacco, physical inactivity and unhealthy diet) and psychosocial (anxiety, depression and lack of social support) risk factors for CVDs^{27,28}.

Dietary risks, including diets low in whole grains, fruits, nuts, seeds, and seafoods containing omega-3 fatty acid, high systolic blood pressure and high LDL cholesterol were the leading risk factors contributing to DALYs from CVDs in Nepal. Dietary habits influence a wide range of cardiometabolic risk factors through multiple pathways, including energy intake and expenditure, body fat composition, blood pressure, lipoprotein concentration and cardiac function²⁹. The traditional Nepali diet remains high in refined grains and low in fruits, vegetables, nuts, and seeds³⁰. High systolic blood pressure, and high total cholesterol often remain underdiagnosed and access to medication for these conditions is limited in Nepal^{31,32}.

The growing burden of CVDs worldwide is already beginning to have serious financial implications. In LMICs, both the direct cost of annual care and the cost for seeking care for an acute episode of CVD exceeded the per capita health expenditure³³. The costs per episode for CVDs were estimated as between \$500 and \$1500; and about \$5000 for a stroke episode³³. The monthly cost for hypertension treatment are estimated to be around \$22³³. The majority of the Nepali population cannot afford the exorbitant cost of managing CVDs when 52% of total health care expenditure is out-of-pocket³⁴. Only 8.9% of the total health care expenditures, both government and private is spent on CVDs management³⁴. Households in Nepal incur catastrophic expenditures on health. For 2% of households, 25% of their total household expenditures were on health, and for the next 11% of households, 10% of their total household expenditure were on health, pushing an additional 2% of people below the poverty line of \$1.9 per day in 2015/16³⁴. Thus families face a huge financial barrier to the prevention and management of CVDs in Nepal. In India, 10% of families who have a member with CVD are driven into poverty and the total income loss due to CVDs was about two billion dollars per year,³⁵. Other major barriers to CVD management in Nepal are unequal distribution of health workers, untrained health care workers and lack of essential drugs at the primary care level for providing CVD services³⁵.

Several comprehensive programs focused on CVD management in both high, low- and middle-income countries have demonstrated success, including those aimed at modes of community empowerment, creating enabling environments through policy change and health promotion efforts^{36,37}. Effective strategies help to minimize the development of increased risk, as well as to detect and prevent progression of CVD throughout the life course^{28,38}. Such efforts should include population-wide approaches implemented throughout all tiers of the health system, including community settings to address tobacco use and hypertension, promoting physical activity and advocacy for healthy diets (e.g., adequate whole grains, fruits and vegetables and less salt and unhealthy fat). Health systems working in synergy with individual approaches have the potential to detect early and effectively control the risk among high risk groups and those already diagnosed with CVDs^{28,38}.

This is the first study to report on trends and distribution of the CVD burden at a national level in Nepal. We extracted data from the GBD database, which uses standardized methods to estimate metrics creating comparable data within South Asian countries and globally. The main limitation of these data is the lack of primary data sources from Nepal. Nepal does not have a cause of death surveillance system or other national, validated forms of verbal or social autopsy to document CVD. Thus, data were imputed using statistical models. However, in a resource-constrained setting such as Nepal, where reliable health statistics on CVDs are limited, findings from the GBD data provide a basis for setting public health priorities and creating evidence-informed policies. Other limitations of CVD estimates of GBD 2017 include misclassification and bias due to miscoding of death certificates³⁹⁻⁴¹.

Conclusion

Cardiovascular diseases is the topmost cause of disability adjusted life years in Nepal. It contributes to about a third of total deaths; with half of the CVD deaths occurring among 70 years or younger in Nepal. Ischemic heart disease and stroke were the most predominant CVDs. The cardiovascular disease burden in Nepal is particularly attributable to high blood pressure and unhealthy diet.

Abbreviations

CVDs Cardiovascular diseases

DALYs Disability-adjusted life-years

GBD Global Burden of Diseases

HICs High income countries

IHME Institute of Health Metrics and Evaluation

LDL Low density lipoprotein

LMIC Low and middle-income countries

NCD Non communicable disease

SEAR South East Asia Region

YLLs Years of life lost

YLDs Years lived with disability

Declarations

Ethics approval and consent to participate: Not applicable

Consent to publish: Not applicable

Availability of data and materials: Institute of Health Metrics and Evaluation's Global Burden of Diseases data are freely

available to public from this link

<http://ghdx.healthdata.org/gbd-results-tool>

Competing interests: One of the authors Meghnath Dhimal is an Associate Editor of BMC, Public Health.

Funding: Research reported in this publication was supported in part by the National Heart, Lung, and Blood Institute of the National Institutes of Health under award number U24HL136789.

The views expressed in this paper are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute, the National Institutes of Health, or the U.S. Department of Health and Human Services.

The Global Burden of Data effort is funded by the Bill and Melinda Gates Foundation, USA. The authors' efforts are funded by National Heart, Lung, and Blood Institute, USA.

Authors' Contributions: SB prepared data sets, analyzed, interpreted, prepared the first draft and finalized the manuscript. AA and MP developed the initial ideas for the analysis and presentation of the findings. SBa, PB, DC, HC, MD, AF, AKJ, NJ, BMK, RK, RM, NO, PP, BPS, RS, SS, DS and AV provided input to the initial concept, analysis plan and feedback on the report and its presentation and AS was involved through out the process from developing the study plan to analysis and support in writing and finalizing the manuscript. All authors read and approved the final manuscript.

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Figures



Figure 1

Trend in CVD Mortality and Incidence Rates by Gender (all ages, 1990 to 2017)

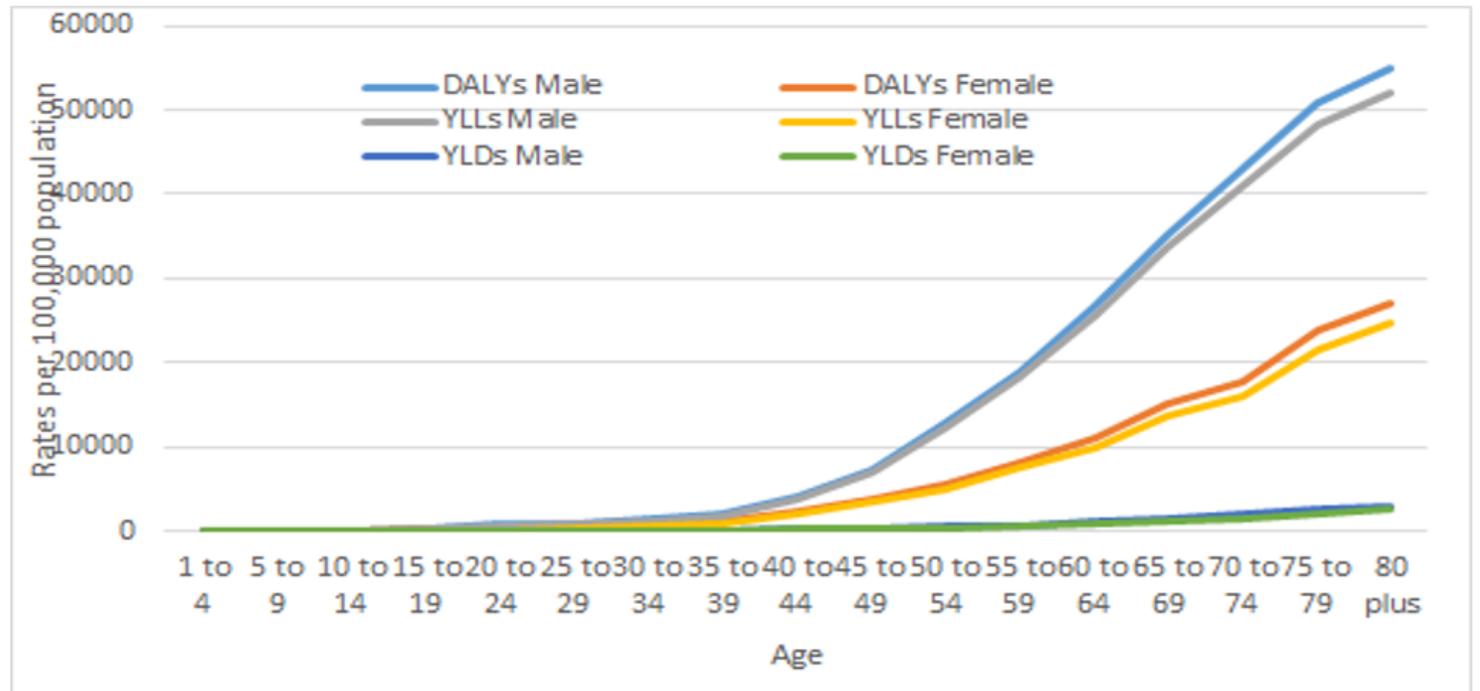


Figure 2

CVD related DALYs, YLLs and YLDs by age and gender in 2017

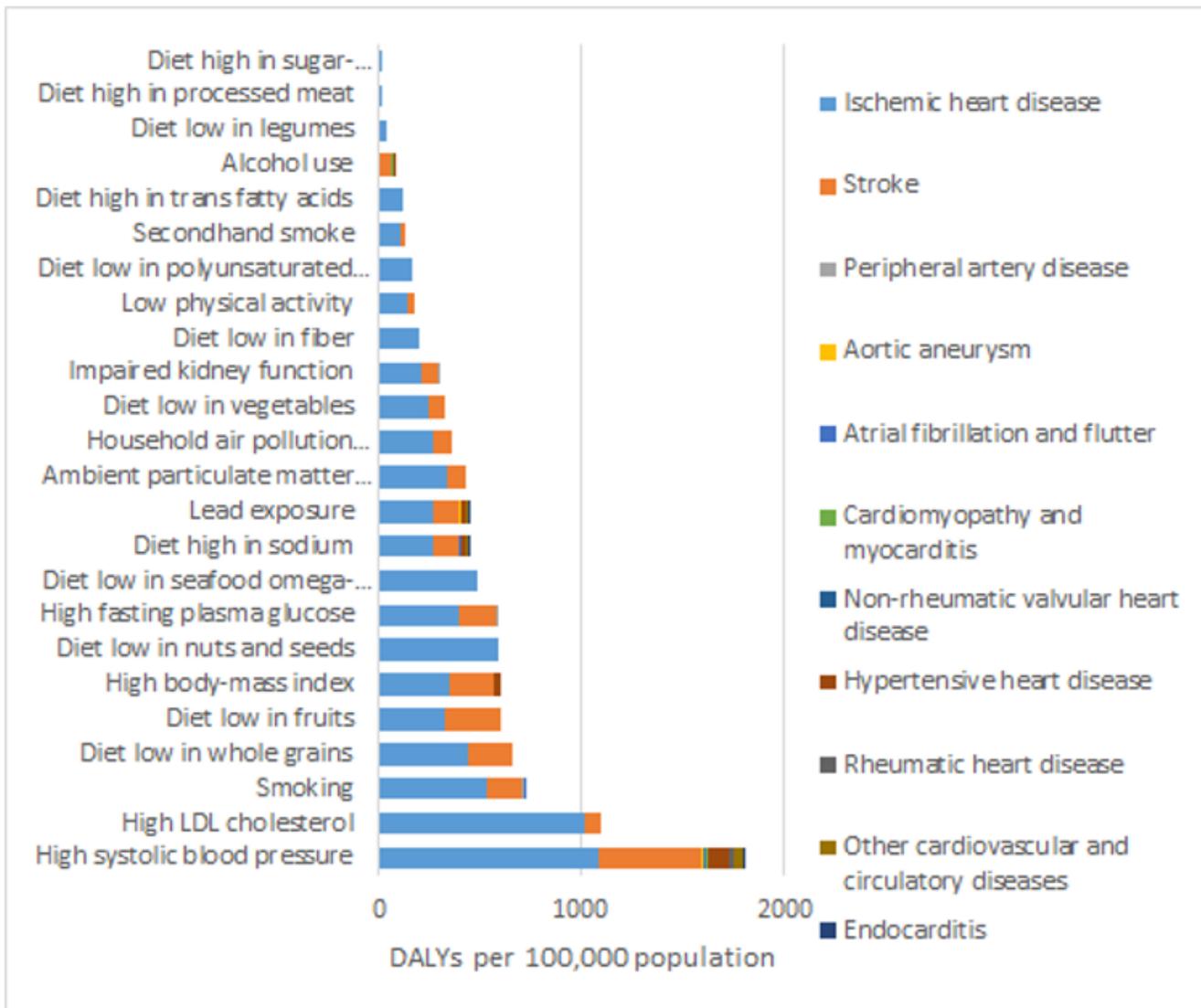


Figure 3

CVD risk factors contributing to DALYs for specific CVD diseases (all ages, 2017)