

# STUDY OF PREVALENCE OF ISCHAEMIC HEART DISEASE/CORONARY ARTERY DISEASE: INDIAN AND GLOBAL SCENARIO

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**Abstract:** *IHD/CAD (Ischaemic heart disease/Coronary artery disease) is the result of the accumulation of atheromatous plaques (atherosclerosis) within the walls of coronary arteries supplying oxygen to the heart. It continues to be a leading public health risk, being responsible for a major proportion of mortality and morbidity in India as well as worldwide. It is a preventable non-communicable disease that is frequently associated with diets low in fruit, vegetables and whole grains but high in salt and fat. It is the consequence of demographic changes, sedentary lifestyle and smoking along with increased rates of urbanization. This serious illness evolves over years but unfortunately remains undiagnosed until it presents life-threatening situations. In order to align health status with the population, we first need to understand the prevalence of a given disease shifting over time. A number of studies have been conducted time and again for the detailed assessment of prevalence pattern of IHD/CAD. This review article aims to collate all the data published from 1990 onwards and provides a comprehensive set of findings for the prevalence of IHD/CAD including both death and disability across Indian and Global scenario. It also represents a crucial input that enables health systems to target interventions against the biggest killer IHD/CAD.*

**Index Terms:** *IHD, Atherosclerosis, Non-communicable diseases, DALYs, CAD, prevalence*

**Abbreviations:** *CVDs, Cardiovascular diseases; IHD, Ischaemic heart disease; CAD, Coronary artery disease; DALYs, Disability adjusted life years; CMNNDs, Communicable, maternal, neonatal and nutritional diseases; NCDs, Non-communicable diseases; GBD, Global burden of disease; YLLs, Years of life lost; YLDs, Years lived with Disability*

## INTRODUCTION

Total loss of life due to both death and disability is attributable to following three aspects: CMNNDs (Communicable, maternal, neonatal and nutritional diseases), NCDs (Non-communicable diseases) and injuries (Road accidents, self harm etc.). Non-communicable diseases now account for more than one-half of the global burden of disease [1]. According to ICMR, PHFI and IHME (2017) report the proportion of all deaths in India due to NCDs increased from 37.9% in 1990 to 61.8% in 2016, those due to CMNNDs reduced from 53.6% to 27.5% and those due to injuries changed from 8.5% to 10.7% (Figure 1) [2]. Moreover the burden of CVDs (Cardiovascular diseases) predominates over all NCDs accounting for about one-half of NCDs deaths [1]. World Health Organization estimated that 17 million people died from CVDs in 2005, representing 30% of all global deaths and of these nearly 80% of deaths took place in low and middle income countries [3]. According to the World Heart Federation, 35% of all CVD deaths in India occur in those aged 35-64 years [4]. IHD (Ischaemic heart disease) is the commonest CVD accounting for 90-95% of all cases and deaths [5]. In 2016, three of the five (Ischaemic heart disease, Chronic obstructive pulmonary disease, Diarrhoeal diseases, Lower respiratory infections, and Cerebrovascular disease) leading individual causes of disease burden in India were non-communicable, with Ischaemic heart disease and chronic obstructive pulmonary disease as the top two causes and stroke as the fifth leading cause [2].

## PREVALENCE OF IHD IN INDIA

Changing life style, socio-economic development along with increased rates of urbanization has placed India at a position where it is facing a growing burden of cardiovascular diseases with IHD/CAD being predominant. A quarter of all mortality is attributable to CVDs in India [6]. In comparison with the people of European ancestry, CVD affects Indians at least a decade earlier and in their most productive midlife years [7]. For example, in western populations only 23% of CVD deaths occur before the age of 70 years while this number is 52% in India [8]. GBD (Global burden of disease) 2010 estimated the age standardized CVD death rate of 272 per 1, 00,000 population in India, which is higher than the global average of 235 per 1, 00,000 population (Table No 1) [9]. Among all CVDs, Ischaemic heart disease constitute the majority of death rate (144) as well as DALYs (2917) per 1,00,000 population in India, which is higher than the global death rate (106) and DALYs (1972) per 1,00,000 population (Table No 1) [9]. Institute for Health Metrics and Evaluation; GBD Profile: India, estimated that together, IHD and stroke are responsible for more than one-fifth (21.1%) of all deaths and one-tenth of the YLLs (Years of life lost: years of life lost is a measure that quantifies premature mortality by weighting younger deaths more than older deaths) in India [10]. From 1990 to 2010 the years of life lost attributable to CVD in India increased by 59% (23.2 million to 37 million) [10]. Of the top ten individual causes of death in India in 2016, deaths due to all NCDs increased between 1990 and 2016; the all-age death rate increased significantly for ischaemic heart disease was 54.5% (95% uncertainty interval [UI], 44.1 to 66.4%) and the age-standardised death rate increased for ischaemic heart disease was 12.0% (4.5 to 21.3%) [11]. The five leading individual causes of DALYs in India in 2016 were ischaemic heart disease, chronic obstructive pulmonary disease,

diarrhoeal diseases, lower respiratory infections, and cerebrovascular disease. Of the total DALYs in India, 67.2% were YLLs and 32.8% were YLDs in 2016, whereas in 1990, 82.5% were YLLs and 17.5% were YLDs [11].

### GLOBAL PREVALENCE OF IHD

IHD/CAD is the leading cause of death globally [12]. In 2001, IHD accounted for 7.1 million deaths worldwide, 5.7 million (80%) of which were in low-income countries [7,13]. In 2015, there were 17.9 million (95% uncertainty interval [UI], 17.6-18.3 million) death globally due to CVD and 8.9 million (95% UI, 8.8- 9.1 million) of these death were attributable to IHD [14]. According to the World Health Organization January 2017 report, there were 56.4 million deaths worldwide in 2015, and more than half (54%) of the overall death were by only 10 causes [15]. Ischaemic heart disease and stroke killed 15 million people in 2015 –these two diseases have remained the biggest killers globally in the last 15 years (2000-2015) (Figure 2) [15]. In 2015, estimation of leading causes of death by country income group revealed that burden of death due to IHD remain at the top in lower-middle (14.9% death), upper-middle (18.3% death) and high income (16.9% death) countries. IHD lag (5.7% death) only in low-income countries where more than half (52%) of all deaths were caused by communicable diseases, maternal causes and nutritional deficiencies (Figure 3) [15].

### PROJECTIONS OF IHD/CAD MORBIDITY AND MORTALITY FROM 2000 TO 2030

Future trend analysis of burden of diseases indicated that the proportion of deaths due to noncommunicable disease is projected to rise from 59% in 2002 to 69% in 2030 [16]. IHD/CAD is the leading cause of death in economically developed countries and is rapidly assuming serious dimensions in developing countries [5]. Between 1990 and 2020, the burden of IHD is expected to increase by 120% in women and 137% in men in the developing countries, compared with 30–60% in developed countries [7,17]. Further, IHD is expected to be the single most important burden among 15 leading causes of death for both males and females as projected for 2030 globally (Table No 2). This summarizes the changes in rank order of deaths between 2002 and 2030. Lower-respiratory infections, perinatal conditions, diarrhoeal diseases and malaria are all projected to decline substantially. On the other hand diabetes mellitus, lung cancer, stomach cancer, liver cancer and colorectal cancer are all projected to move up three or more places in the rankings. Among all, ischaemic heart disease is projected to remain at the first rank (no change in rank) from 2002 to 2030 [16]. Among the ten leading causes of death, according to the income groups of countries, IHD is projected to remain at the top as the leading cause of the death in all scenarios in 2030 (Table No 3) [16]. Total years of life lost (YLLs) due to CVD among the Indian populations aged 35–64 has been estimated to be higher than comparable countries such as Brazil, South Africa, China, U.S. and Portugal [18]. It has been estimated that the total number of years of productive life lost for the five study countries will increase from 20.6 million in 2000 to 33.7 million in 2030 (Table No 4) [18]. Compared to 2000, the number of years of productive life lost due to CVD will increase in 2030 by only 20% in the U.S. and by 30% in Portugal. For Brazil the figure is 64%, for China 57%, and for India, an incredible 95% [18]. Thus India will face a tremendous loss of productivity due to increased prevalence of CVD and/ IHD.

### DISCUSSION

The health status and the factors of the health loss vary between different parts of the country and between the states as their ecology, economy, and demography varies. All of these impact health outcomes. The trajectory of the prevalence rate for IHD/CAD has been on the rise since 1990 to 2016, particularly in younger population owing to the changes in their lifestyle and food habits. In 2000, India lost 9.2 million years of productive life (age group 35 to 64). As CVD rates increase, this estimate will increase to 17.9 million by 2030 [19]. The growing incidence of IHD consequences increased economic burden at both national and international status. The economic impact was estimated to be 9 billion dollars in national income from premature deaths due to heart disease, stroke, and diabetes in 2005 alone, with projected estimates of 237 billion dollars by 2015 [20]. The epidemic of IHD/CAD is ominous and poses a great challenge to the health system that requires urgent attention towards effective primary preventive approach against CAD associated mortality & morbidity. Global focus on NCD prevention and control was highlighted by the United Nations High Level Meeting on NCDs in 2011 in which member states voluntarily agreed to work to reduce the risk of premature (defined by the World Health Organization as occurring from ages 30 to 70 years) death from CVD, cancer, chronic lung disease, and diabetes mellitus, by 25% around 2025 [21, 22]. The National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke was launched in India in 2010 [23]. The NITI Aayog has articulated a progressive action agenda for improving health in the country from 2017 to 2020, which includes data-driven and decentralized health planning that is focused on the specific needs of each state [24].

### CONCLUSION

A detailed understanding of the global distribution of IHD has become essential as recent figures suggest that IHD has major share of loss of life cause by death across the world impacting the most productive years of an individual's life. Also, future forecasts predict a continuing trend in the coming decades, where IHD will lead to major loss of the human resource imposing a huge socioeconomic burden. Keeping in view innovative strategies are needed to achieve steeper declines in the progression of the IHD.

### CONFLICT OF INTEREST

The authors stated that there is no conflict of interest with respect to this manuscript.

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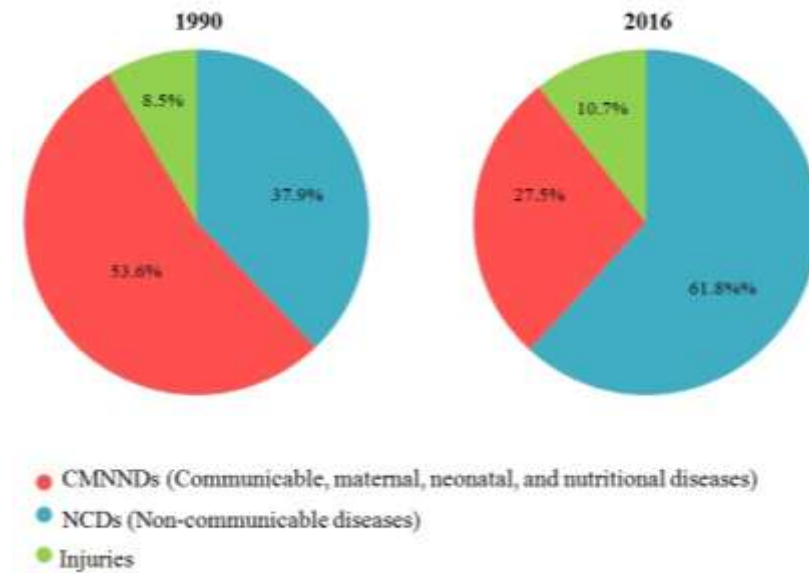


Figure 1: Contribution of major disease groups to total deaths in India, 1990 and 2016 (ICMR, PHFI, and IHME; 2017)

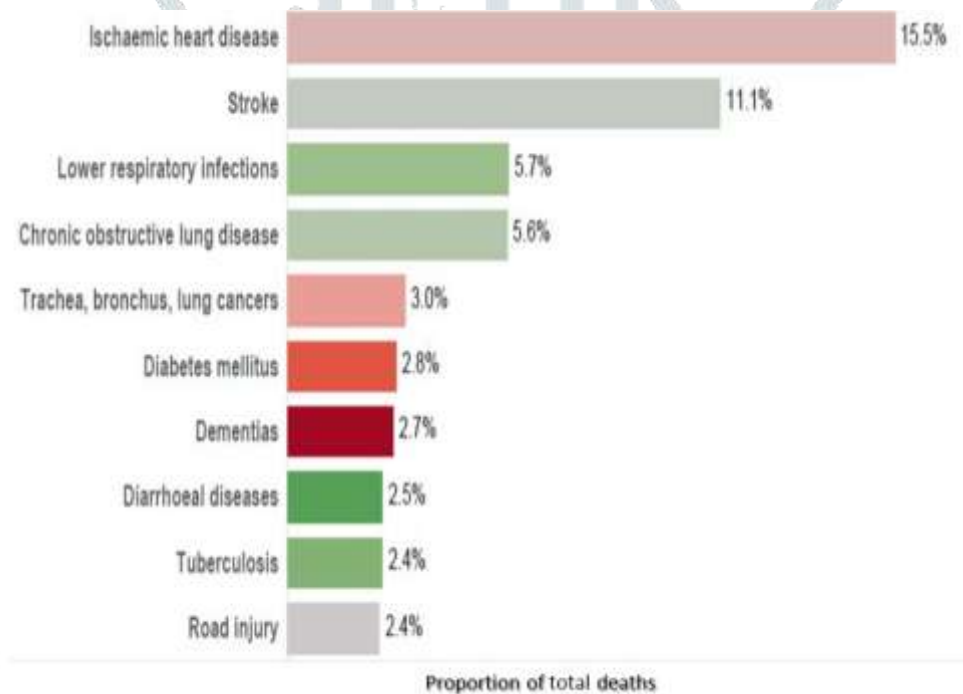


Figure 2: The ten leading causes of death in the world, 2015 (Mathers *et al.*, 2017)

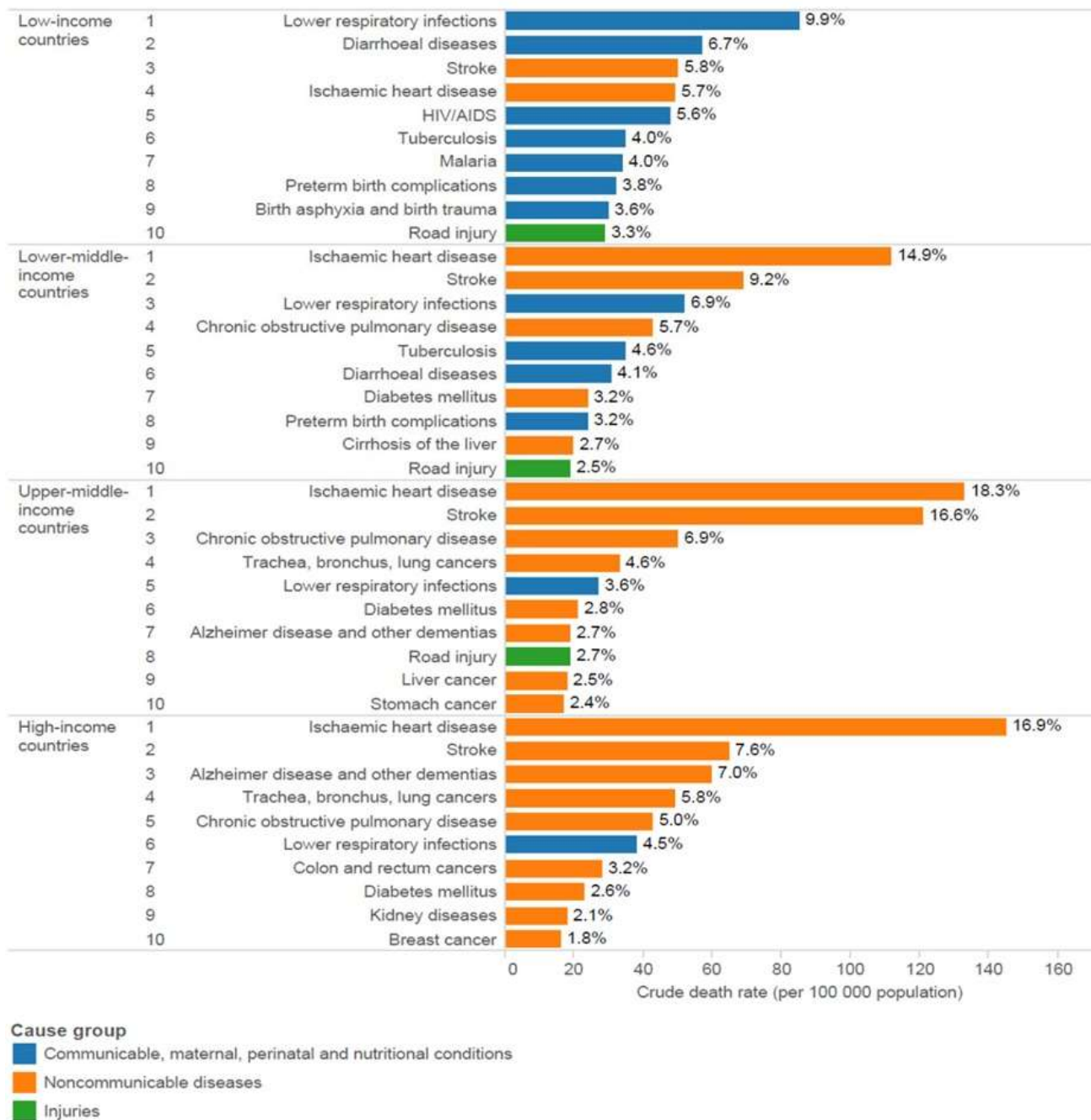


Figure 3: Leading causes of death by country income group, 2015 (Mathers *et al.*, 2017)

Table No 1: Age Standardized Death and Disability Rates of CVD in Indian vs. Global scenario (Global Burden of Disease 2010 Estimates)

| Diseases                        | Death per 1,00,000 Population |          |           | DALYs per 1,00,000 Population |             |             |
|---------------------------------|-------------------------------|----------|-----------|-------------------------------|-------------|-------------|
|                                 | Male                          | Female   | Total     | Male                          | Female      | Total       |
| Ischaemic heart disease         | 178 (128)                     | 112 (85) | 144 (106) | 3783 (2577)                   | 2053 (1406) | 2917 (1972) |
| Cerebrovascular disease         | 90 (99)                       | 75 (79)  | 82 (88)   | 1605 (1838)                   | 1240 (1295) | 1420 (1554) |
| Rheumatic heart disease         | 11 (5)                        | 10 (5)   | 10 (5)    | 300 (148)                     | 269 (155)   | 285 (151)   |
| Hypertensive heart disease      | 18 (14)                       | 15 (13)  | 17 (13)   | 343 (252)                     | 270 (215)   | 306 (233)   |
| Cardiomyopathy and myocarditis  | 10 (8)                        | 5 (4)    | 8 (6)     | 266 (221)                     | 126 (112)   | 197 (166)   |
| Atrial fibrillation and flutter | 1 (2)                         | 1 (2)    | 1 (2)     | 49 (65)                       | 36 (46)     | 42 (55)     |
| Aortic aneurysms                | 2 (4)                         | 1 (2)    | 2 (3)     | 44 (70)                       | 25 (29)     | 35 (48)     |
| Peripheral vascular disease     | <1 (1)                        | <1 (1)   | <1 (1)    | 10 (16)                       | 8 (14)      | 9 (15)      |
| Endocarditis                    | 1 (1)                         | 1 (1)    | 1 (1)     | 18 (27)                       | 18 (19)     | 18 (23)     |

|                               |           |           |                  |             |             |             |
|-------------------------------|-----------|-----------|------------------|-------------|-------------|-------------|
| Others                        | 10 (12)   | 5 (9)     | 7 (10)           | 229 (272)   | 196 (239)   | 210 (254)   |
| Total cardiovascular diseases | 321 (273) | 225 (200) | <b>272 (235)</b> | 6648 (5486) | 4241 (3530) | 5438 (4471) |

Numbers in parentheses are the global average.

**Table No 2:** changes in Ranking for 15 leading Causes of Death, 2002 and 2030

| Category              | Disease or Injury               | 2002 Rank | 2030 Rank | Change in Rank |
|-----------------------|---------------------------------|-----------|-----------|----------------|
| <b>Within top 15</b>  | Ischaemic heart disease         | 1         | 1         | 0              |
|                       | Cerebrovascular disease         | 2         | 2         | 0              |
|                       | Lower respiratory infections    | 3         | 5         | -2             |
|                       | HIV/AIDS                        | 4         | 3         | +1             |
|                       | COPD                            | 5         | 4         | +1             |
|                       | Perinatal conditions            | 6         | 9         | -3             |
|                       | Diarrhoeal diseases             | 7         | 16        | -9             |
|                       | Tuberculosis                    | 8         | 23        | -15            |
|                       | Trachea, bronchus, lung cancers | 9         | 6         | +3             |
|                       | Road traffic accidents          | 10        | 8         | +2             |
|                       | Diabetes mellitus               | 11        | 7         | +4             |
|                       | Malaria                         | 12        | 22        | -10            |
|                       | Hypertensive heart disease      | 13        | 11        | +2             |
|                       | Self-inflicted injuries         | 14        | 12        | +2             |
|                       | Stomach cancer                  | 15        | 10        | +5             |
| <b>Outside top 15</b> | Nephritis and nephrosis         | 17        | 13        | +4             |
|                       | Colon and rectum cancers        | 18        | 15        | +3             |
|                       | Liver cancers                   | 19        | 14        | +5             |

**Table No 3:** Ten Leading Causes of Death, by Income Group, 2030

| Income Group            | Rank | Disease or Injury               | Percent of Total Deaths |
|-------------------------|------|---------------------------------|-------------------------|
| World                   | 1    | Ischaemic heart disease         | 13.4                    |
|                         | 2    | Cerebrovascular disease         | 10.6                    |
|                         | 3    | HIV/AIDS                        | 8.9                     |
|                         | 4    | COPD                            | 7.8                     |
|                         | 5    | Lower respiratory infections    | 3.5                     |
|                         | 6    | Trachea, bronchus, lung cancers | 3.1                     |
|                         | 7    | Diabetes mellitus               | 3.0                     |
|                         | 8    | Road traffic accidents          | 2.9                     |
|                         | 9    | Perinatal conditions            | 2.2                     |
|                         | 10   | Stomach cancer                  | 1.9                     |
| High-income countries   | 1    | Ischaemic heart disease         | 15.8                    |
|                         | 2    | Cerebrovascular disease         | 9.0                     |
|                         | 3    | Trachea, bronchus, lung cancers | 5.1                     |
|                         | 4    | Diabetes mellitus               | 4.8                     |
|                         | 5    | COPD                            | 4.1                     |
|                         | 6    | Lower respiratory infections    | 3.6                     |
|                         | 7    | Alzheimer and other dementias   | 3.6                     |
|                         | 8    | Colon and rectum cancer         | 3.3                     |
|                         | 9    | Stomach cancer                  | 1.9                     |
|                         | 10   | Prostate cancer                 | 1.8                     |
| Middle-income countries | 1    | Ischaemic heart disease         | 14.4                    |
|                         | 2    | Cerebrovascular disease         | 12.7                    |
|                         | 3    | COPD                            | 12.0                    |
|                         | 4    | HIV/AIDS                        | 6.2                     |
|                         | 5    | Trachea, bronchus, lung cancers | 4.3                     |
|                         | 6    | Diabetes mellitus               | 3.7                     |
|                         | 7    | Stomach cancer                  | 3.4                     |
|                         | 8    | Hypertensive heart disease      | 2.7                     |
|                         | 9    | Road traffic accidents          | 2.5                     |
|                         | 10   | Liver cancer                    | 2.2                     |

|                      |    |                              |      |
|----------------------|----|------------------------------|------|
| Low-income countries | 1  | Ischaemic heart disease      | 13.4 |
|                      | 2  | HIV/AIDS                     | 13.2 |
|                      | 3  | Cerebrovascular disease      | 8.2  |
|                      | 4  | COPD                         | 5.5  |
|                      | 5  | Lower respiratory infections | 5.1  |
|                      | 6  | Perinatal conditions         | 3.9  |
|                      | 7  | Road traffic accidents       | 3.7  |
|                      | 8  | Diarrhoeal diseases          | 2.3  |
|                      | 9  | Diabetes mellitus            | 2.1  |
|                      | 10 | Malaria                      | 1.8  |

**Table No 4:** Estimates of total years of life lost due to CVD for the five study and two comparator countries in 2000 and 2030

| COUNTRY          | 2000                     |                   | 2030                     |                   |
|------------------|--------------------------|-------------------|--------------------------|-------------------|
|                  | Total years of life lost | Rates per 100,000 | Total years of life lost | Rates per 100,000 |
| BRAZIL           | 1,060,840                | 2121              | 1,741,620                | 1957              |
| SOUTH AFRICA     | 302,265                  | 2753              | 391,980                  | 2667              |
| RUSSIA           | 3,314,014                | 5684              | 3,208,265                | 5887              |
| CHINA            | 6,666,990                | 1595              | 10,460,030               | 1863              |
| INDIA            | 9,221,165                | 3572              | 17,937,070               | 3707              |
| <b>SUB-TOTAL</b> | <b>20,565,274</b>        |                   | <b>33,738,965</b>        |                   |
| U.S.             | 1,631,825                | 1267              | 1,972,215                | 1661              |
| PORTUGAL         | 40,880                   | 1103              | 53,125                   | 1317              |
| <b>SUB-TOTAL</b> | <b>1,672,705</b>         |                   | <b>2,025,340</b>         |                   |

