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Review article

Cardiovascular disease risk factors in Asian Indian population: A systematic review

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ABSTRACT

Background: Cardiovascular diseases (CVDs) are the number one cause of death globally and are the leading cause of death in India also. Several surveys conducted across the country over the past few decades have shown a rising prevalence of major risk factors for CVD in Asian Indian population. The problem of increasing risk factors for CVD in India is because of lack of surveillance system and lack of proper diagnosis. This study will help to point out the need of research so that some advanced diagnosis system may be developed for proper diagnosis of CVDs and to reduce the growing burden of CVDs in the country.

Methods: We did a literature search for the period from 1968 to 2012 using PUBMED search to identify all relevant studies of cardiovascular diseases. Besides PUBMED searching, manual searching has also been done. This article provides a review of current understanding of the epidemiology of cardiovascular disease, particularly, coronary heart disease (CHD), stroke and related risk factors in Asian Indian population.

Results: Hypertension and diabetes are highly prevalent among Asian Indian population, which may explain their high rate of stroke and heart attack in India. The increasing rate of CVD may be explained by the high rates of other risk factors including adverse lipid profile. The etiology of cardiovascular diseases (CVD) is multifactorial and no single factor is an absolute cause.

Conclusion: The cardiovascular diseases and its risk factors are increasing with a rapid pace in Asian Indian population. Though the prevalence of CVD risk factors is found higher in urban population, yet it is increasing at an alarming rate in rural population also, which is a serious threatening to the nation. Since majority of the Indians live in rural area, CVD may lead to epidemic proportions. We need health promotion programs and reorientation of primary health care to improve CVD detection in earlier stage and its management.

1. Introduction

In according to the World Health Organization, CVD will be the number one cause of morbidity and mortality in the world by the year 2015 (WHO 2000); and it is assumed that Indians would be the most affected amongst all ethnic population.[1] There are various factors involved for rapid increasing of the CVDs. However, its complete etiology and mechanisms are yet to be understood (Tables 1 and 2).

It may be said that not only developed countries will be affected by cardiovascular disease (CVD), the developing countries will also equally, even more, will be affected.[2,3] The rate of increase of CVD in developing countries is almost double in comparison to developed countries.[4] Specially, younger generations will be more affected in developing countries: for example, about 52% of deaths from CVDs in India occur before 70 yrs of age, compared with 23% in established-market economies.[5] In view of this large and upcoming disease burden, proper strategies to improve population health in India require consistent efforts to identify and address the real causes of this rapid rise of CVD.

It is seen in a survey conducted in 45 rural villages in India, 32% of all deaths were due to CVD. On the other hand, infectious diseases were responsible for 13%. It proves that the epidemic has reached its advanced stage even in rural India.[6] Neglect of this scenario, particularly ignoring the socioeconomic context will further fuel the rapid rising of CVD among Indians.

Although prevalence of conventional risk factors such as smoking, hypertension, and hypercholesterolemia is not higher in South Asians than in other ethnic groups, yet, it is seen that some

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Table 1
CVD risk factors in World population (other than Asian Indians).

First author	Year	Area of study	Nature of study	Major findings
Gaziano TA[4]	2005	Sub Saharan, Africa	Epidemiological study	A global CVD epidemic is rapidly evolving, with the burden of disease shifting. Twice as many deaths due to CVD now occur in developing countries as in developed countries. The vast majority of CVD can be attributed to conventional risk factors.
McKeigue PM[13]	1991	London, UK.	Population survey	In comparison with the European group, the South Asian group had a higher prevalence of diabetes, higher blood pressures, higher fasting and post-glucose serum insulin concentrations, higher plasma triglyceride and lower HDL cholesterol concentrations. Mean waist-hip girth ratios and trunk skin folds were higher in the South Asian than in the European group.
Giardina EG[26]	2000	New York, USA	Population survey	Cardiovascular disease has claimed the lives of more females than males. Although women develop heart disease about 10 years later than men, they are likely to fare worse after a heart attack. Approximately 35% of heart attacks in women are believed to go unnoticed or unreported.
Ghaffar A[34]	2004	South Asia	Systematic review	The health burdens of non-communicable diseases are high in South Asia, though there are differences among countries and within urban and rural areas of each country.
Negus BH[42]	1994	Dallas, USA	Epidemiological study	Asymptomatic survivors of myocardial infarction who are 40 years of age or less rarely have left-main or 3-vessel coronary artery disease, and their long-term prognosis with conservative therapy is good. Routine catheterization in these patients is not warranted and should be reserved for those who manifest spontaneous or provocable post-infarction ischemia.
Mckeigue PM[63]	1985	London, UK	Population survey	Asian immigrants to England and Wales have high mortality from coronary heart disease. Compared with the British population, the Asians consumed less saturated (S) fat and cholesterol and more polyunsaturated(P) fat and vegetable fibre. The plasma total cholesterol and high-density lipoprotein cholesterol of Asian men was similar to that of a British comparison group; the concentrations in Asian women were much lower than in British women. Smoking rates were low in both Asian men and Asian women.
Bhatnagar D[65]	1995	West London, UK and Punjab, India	Community-based cross-sectional study	Subjects from the Indian subcontinent of Punjabi origin living in West London have higher coronary risk factors than the counterparts living in the Punjab in India.

risk factors for atherosclerosis are particularly prevalent among them, including high triglyceride concentration, increased level of total cholesterol to high-density lipoprotein cholesterol ratio, type 2 diabetes mellitus (T2DM) and central or visceral obesity.[7–10] Throughout the Asia–Pacific region, there are differences in obesity prevalence as well as in body fat distribution.[11]

It is noteworthy to mention that in Asian Indians, morbidity and mortality from CVD is occurring in people with lower body mass index (BMI) and smaller waist circumference (WC). Thus intra-abdominal visceral fat is accumulated in Asian Indians without developing generalized obesity.[12] South Asians (e.g. Indians) have a more centralized distribution of body fat and remarkably higher mean waist-hip ratio (WHR) for a given level of BMI compared with Europeans or Americans.[11,13] The metabolic syndrome (MS), which can be defined as the constellation of CVD risk factors, is one of the growing public health burden in the Asia–Pacific region,[12] although they are no more overweight than Europeans and Americans.[11,14–16] The question is now whether there existed a single etiological factor for the CVD risk factor clustering in this region. *Principal component factor analyses* (PCFA) suggest that there exists no single

Table 2
CVD risk factors in Asian Indian population.

First author	Year	Area of study	Nature of study	Major findings
Mohan V[30]	2001	Chennai in South India	Epidemiological study	Prevalence of CAD increased with an increase in total cholesterol, low-density lipoprotein cholesterol, triglycerides and total cholesterol/high-density lipoprotein ratio.
Das M[31]	2011	Inhabitants of Kolkata under the Kolkata Metropolitan Development Authority (KMDA) area	Community-based cross-sectional study	People with changing lifestyles due to growing urbanization are associated with adverse CVD risk factors irrespective of their habitat.
Mammi MVI[41]	1991	Kerala, India	Retrospective study	A striking increase in the percentage of acute myocardial infarction was observed. There was also an increase in the occurrence of myocardial infarction in the young.
Begom R[62]	1995	Southern India	Epidemiological study	In comparison with North Indians, the prevalence of CAD was higher in South Indians.
Gupta R[64]	1994	A cluster of three villages in rural Rajasthan, western India	Total community cross-sectional survey	Uneducated and less educated people in rural India have a higher prevalence of coronary heart disease.
Shah B[71]	2010	Indian population	Review of articles	A cluster of major risk factors govern the occurrence of CVDs much before these are firmly established as diseases.
Gupta R[80]	2010	Jaipur	Epidemiological study	Low and middle educational status urban subjects in India have greater cardiovascular risk.
Chadha SL[81]	1997	Delhi, India	A community-based epidemiological survey	The overall prevalence of coronary heart disease among adults was higher in the urban population than the rural population. Prevalence of a family history of coronary heart disease, hypertension, obesity and diabetes mellitus were also significantly higher in the urban than in the rural population.

or central etiological factor for clustering of CVD risk.[10,15,17] It is assumed that several underlying physiological mechanisms are involved.

Several surveys on CVDs were conducted across the country during the past few decades. But to the best of the knowledge of the authors actual picture had not been reflected due to unavailability of sufficient data, even most of the surveys were carried out in urban area. The objective of the study is to find out the detailed picture of CVDs in Asian Indian Population, particularly, in rural area of the country. This study will help to point out the need of research so that some advanced diagnosis system may be developed for proper diagnosis of CVDs and to reduce the growing burden of CVDs in the country.

We did a literature search for the period from 1968 to 2012 using PUBMED search to identify all relevant studies of cardiovascular diseases. These articles were also used for collecting further articles from their reference listings. The internet search keywords used were 'cardiovascular diseases', 'cardiovascular diseases in India', 'cardiovascular diseases risk factors', 'cardiovascular disease risk factors among rural area of India', 'surveillance of cardiovascular diseases risk factors', 'urban–rural trends of cardiovascular diseases in India', 'cardiovascular diseases and coronary artery disease'. First, article titles and abstracts resulting from the search were reviewed for topic significance, and potential relevant full-text articles (or abstracts where full-text articles were unavailable) were extracted. Pertinent abstracts where full-text articles were not obtainable were excluded from the review. Then, additional relevant citations from reviewed articles (extracted from the electronic search stated above) were obtained. Besides PUBMED searching, manual searching has also been done.

2. Global perspective of cardiovascular diseases

Cardiovascular disease (CVD) is the reason for a large proportion of all deaths and disability worldwide. CVDs are the number one cause of death globally. As per the report of Global Burden of Disease (GBD) Study, in the year 1990, there were 5.2 million deaths from CVD in economically developed countries and 9.1 million deaths from the same cause in developing countries.[18] It has been predicted that by the year 2020, there will be an increase by almost 75% in global CVD prevalence, and almost all of this increase will occur in developing countries.[19] It was reported[20] that mortality from CVD was projected to decline in developed countries from 1970 to 2015, whereas it was projected to almost double in the developing countries.

Maximum people die annually from CVDs than from any other cause. An estimated 17.3 million people died from CVDs in 2008, representing about 30% of all global deaths. Of these deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke. Low- and middle-income countries are mostly affected. Over 80% of CVD deaths take place in low- and middle-income countries and occur almost equally in men and women. By 2030, almost 23.6 million people will die from CVDs, mainly from heart disease and stroke. These will be the single leading causes of death. The prevalence rates among younger adults (age group of 40 years and above) are also likely to increase. Prevalence rates among women will keep pace with those of men across all age groups. From the Statistical data of World Health Organization it has been concluded that CVD itself contributes 31% as compared to other diseases.

Percentage of CVD is found to be increasing age wise i.e. at the age between 20 and 39 the average percentage of CVD is 11.8%, between 40 and 59 the average percentage of CVD is 38.55%, between 60 and 79 the average percentage of CVD is 73.3% and at the age above 80 the average percentage of CVD is 81.75%. Also age wise death due to CVD is high as compared to Cancer. In total, death due to CVD is 681 thousand in comparison to 540 thousand due to Cancer. CVD cases in the year 2010 is found to be around 500 lakh and is estimated to be around 650 lakh in the year 2015.[21] In 2008, five out of the top ten causes for mortality worldwide, other than injuries, were non-communicable diseases; this will go up to seven out of ten by the year 2030. By then, about 76% of the deaths in the world will be due to non-communicable diseases (NCDs).[22] Cardiovascular diseases (CVDs), also on the rise, comprise a major portion of non-communicable diseases. Over the past few decades there has been a change in the landscape of non-communicable diseases across the world. In the developed nations, determined government policies and action, improved standards of medical care, and advances in medical technology have helped cut the death rates from cardiovascular diseases by more than 50% since the 1970s. At the same time, an increasing number of people from developing countries suffer from NCDs. By 2030, four fifths of all NCD related mortality is projected to take place in developing nations.[23] For CVDs, specifically, in 2005, the age standardized mortality rate for developing nations like India, China, and Brazil was between 300 and 450 per 100,000, whereas it was around 100–200 per 100,000 for developed countries like USA and Japan.[24] By 2020, 85% of the global cardiovascular disease burden is expected to be borne by developing nations, and the increase in CAD mortality in developing countries between 1990 and 2020 is projected to be 120% in women and 137% in men.[5,25] Every year, CVD claims the lives of females more than males. Heart disease affects more than 450,000 women annually, and 250,000 die for coronary artery disease.[26]

3. Indian scenario of cardiovascular diseases

Cardiovascular disease (CVD) is the leading cause of death in India,[27] and its contribution to mortality is rising; deaths due to CVDs are expected to double between 1985–2015.[5,20,28] Cardiovascular mortality in Asian Indian population is likely to climb up 103% in men and 90% in women by 2015.[5] In fact, CHD has been predicted to rank first among the causes of death in Indian population by 2015.[20] The growth of cardiovascular diseases in India has been particularly pronounced in urban areas but many vascular deaths also occur in rural regions and this is still where the majority of the population lives. While there is some limited information about the causes and management of cardiovascular disease in urban regions, corresponding data for rural regions is scant.[29,30] It seems reasonable to argue that people with changing lifestyles due to growing urbanization are associated with adverse CVD risk factors irrespective of their habitat (rural vs. urban).[31] This in turn warranted a comprehensive risk stratification protocol at the national level for the effective management of CVD risk factors in this part of the world.

Cardiovascular diseases have assumed epidemic proportions in India as well. According to the World Health Report 2002, cardiovascular diseases (CVDs) will be the largest cause of death and disability in India by 2020. According to the World Health Report of 2002, deaths due to CHD in India rose from 1.17 million in 1991 to 1.59 million in 2000 and 2.03 million in 2010.[32] A total of nearly 64 million cases of CVD are likely in the year 2015, of which nearly 61 million would be CHD cases (the remaining would include stroke, rheumatic heart disease and congenital heart diseases). Deaths from this group of diseases are likely to amount to be a staggering 3.4 million.[33]

In a response to a systematic review by Ghaffar et al in 2004, Gupta projected a more than two-fold increase in CHD mortality by the year 2020 as compared to the numbers in 1990 (the projected mortality in 2020 is 2584000 as compared to 1,175,000 deaths in

1990).[34] Murray and Lopez in their Global Burden of Disease study project 4.8 million CVD deaths by the year 2020 AD, with majority of deaths occurring in middle age (47.7% of all CVD deaths). India will have lost 43.5 million DALYs by the year 2020 due to CVD.[35]

India is predicted to bear the greatest CAD burden, according to the estimates from the Global Burden of Disease Study.[36] Of the more than 9 million deaths due to CAD in 1990 in developing countries, 2.4 million (25%) occurred in India.[5,36] In the same year, mortality rates in India due to acute myocardial infarction (MI) were 141 per 100,000 in males and 136 per 100,000 in females, which were much higher than in China (66 per 100,000 in males and 69 per 100,000 in females) and Latin American countries (81 per 100,000 in males and 76 per 100,000 in females). A matter of serious concern is that 52% of the CAD deaths in India occurred in people aged below 70 years, while the same was just 22% in developed countries.[5,37] A meta-analysis of the CAD prevalence based on the surveys conducted since 1990 suggested that the increase in prevalence of CAD in the urban and rural population were nine-fold and two-fold, respectively.[29] Thus, in the next 15 years, a phenomenal increase in the prevalence of CAD is expected in India, adding to the health burden due to CAD among Indians.[29,37]

Reports on CAD in Indians from different parts of the world have shown that Asian Indians are at 3–4 times higher risk of CAD than white Americans, 6 times higher than Chinese, and 20 times higher than Japanese.[34,38–40] The incidence of CAD in the young has been reported to be 12%–16% in Indians.[41,42] Half of the CVD-related deaths (ie, 52% of CVDs) in India occur below the age of 50 years, and about 25% of acute myocardial infarction (MI) in India occurs under the age of 40 years.[43,44] The INTERHEART study showed that hypertension and diabetes were more important risk factors in younger Indian women than men. These studies indicate that abnormalities in lipid metabolism play an important role in development of CAD in young Indians. Also, compared with women,[45,46] young Indian male patients have a slightly lower prevalence of hypertension and diabetes.[47–49] The INTERHEART study also observed that smoking was a greater risk factor in younger men than in women.[50] Because coronary heart disease-related mortality is less in younger women than in men, it is widely believed that CAD is a men's disease. In fact, CAD is the leading cause of death in many parts of the world even in women younger than 65 years. In India, diseases of the circulatory system were among the top three causes of death in rural women in 1994.[51,52] One of the leading causes of morbidity in urban Indian women in 1993 was high blood pressure and heart ailments.[52] As the prognosis in women is worse than that in men, these facts underline the need for giving special attention to women and heart disease.

Improved healthcare in India has increased the average life expectancy from 48.8 years in 1970 to 64.1 years in 2009,[53] resulting in a growing aging population which faces an increased risk of heart diseases. Higher income levels and globalization have induced a nutritional shift resulting in the rise of unhealthy food and decreased intake of fruits and vegetables. India's rapid urbanization, with 31.8% of Indians living in urban areas and the decadal growth rate for urban areas almost three times the rate in rural areas,[54] has led to a number of issues like reduced physical activity, unhygienic and overcrowded living conditions, growing levels of stress, and higher exposure to pollution. The nutritional shift has moved a number of people to unhealthy eating habits. Between 1983 and 2004, while the per capita consumption of protein went down, the amount of fats intake increased by more than 25%, both in urban and rural areas.[55] This, coupled with reduced physical activity, gives rise to intermediate risk factors such as hypertension and obesity. Smoking, another key risk factor, has also increased significantly. Around 14% of Indians smoke daily and increasingly younger people are taking up smoking. Smoking is a major cause of atherosclerosis, and doubles the chances of mortality from heart diseases.[56] India is not just the diabetes capital of the world with more than 50 million patients, it also has the highest prevalence of metabolic syndrome and obesity – 20 million Indians are obese today with 70 million projected by 2025; 20% of Indians suffer from hypertension.[57] These factors together have paced the growth of cardiovascular diseases in India as well as the mortality levels from these diseases.

Regular physical activity reduces the risk of obesity, blood lipid abnormalities, hypertension, and non-insulin dependent diabetes mellitus[58,59] and substantially the risk of coronary heart disease (CHD). Conversely, measures of sedentary lifestyles or physical inactivity have been associated with a 1.5- to 2.4-fold elevation in CHD risk.[58] Rastogi et al, in their review published in 2004,[60] reported that a strong and dose-dependent inverse association between leisure-time exercise and non-fatal CHD is observed in urban population of Indian men and women. Risk for CHD decreased across levels of leisure-time exercise, with people exercising the equivalent of 36 min of brisk walking per day having less than half the risk of non-exercisers. It was also found an association between increased sedentary activity and CHD risk, the equivalent of 3.6 h per day of sedentary activities such as television viewing was associated with nearly a 90% increase in risk. As well, it was observed that increased duration of standing at work was associated with an elevation in risk.

Studies In Indian rural and urban subjects[61] showed lower saturated fat consumption (4.9% and 9.2%) and low serum cholesterol levels [167 mg/dl (4.3 mmol/L) and 203 mg/dl (5.2 mmol/L)], respectively which were associated with a significantly increased prevalence of CAD in urban (8–13%) compared to rural (3%) population.[13,62,63] These studies indicate the possibility of an Indian paradox, and that the concept of normal saturated fat intake and normal cholesterol level may have little meaning among Indians. On a population basis, the risk of CAD rises progressively with increases in saturated fat intake >5% kcal/day and in serum cholesterol level >150 mg/dl (3.89 mmol/L). However there is some controversy regarding the role of dietary fat intake and serum cholesterol level in the etiology of CAD in Indians.[13,63–65] It is possible that developing population are in a better situation to demonstrate the relation of rapid changes in diet and lifestyle and increased prevalence of CAD and coronary risk factors because dietary changes among them are of more recent origin and there are wide differences between rural and urban and between poor and rich classes.

The Indian Lifestyle and Heart Study shows that CAD and coronary risk factors were significantly associated with the level of saturated fat consumption in a cross-sectional study of a cohort of urban North Indians. High and low saturated fat intakes were associated with a higher prevalence of CAD. The relation of saturated fat consumption with CAD remained significant after adjustment of age but decreased after addition of other risk factors in a multivariate analysis. Hypertension, hypercholesterolemia, obesity and sedentary lifestyle were also more common among subjects consuming high (10% en/day) and low (7–10% en/day) saturated fat compared to those taking very low (0.7%, en/day) amounts of dietary saturated fat. While the prevalence of smoking was comparable for subjects in the three saturated fat intake categories, a greater proportion of subjects in the high saturated fat intake group was inactive compared with those in the low and very low saturated fat groups. In addition to the independent risk associated with low saturated fat intake and sedentary lifestyle, the interaction between these variables may further increase the CAD risk in urban Indians. In India, saturated fat intake in rural, North Indian urban and South Indian urban population were 4.9%, 9.2% and 14.2% and the prevalence of CAD were 3%, 8.6% and 13.9%,

respectively.[61,62] The respective serum cholesterol levels in these population were 4.3, 5.2 and 5.4 mmol/L indicating that low saturated fat intake may be associated with lower serum cholesterol level but a significant public health problem of CAD. In the Indian Lifestyle and Heart Study, the prevalence of CAD in subjects consuming low saturated fat (7–10% en/day) was 10.6% in men and 6.2% in women and the mean serum cholesterol levels were 5.01 and 5.02 mmol/L respectively. These findings suggest that the prevalence of CAD even on low saturated fat intake is of sufficient magnitude that it should be considered a public health problem in the urban population of India. The Indian Lifestyle and Heart Study also showed that CAD was less common among unskilled workers and in no education and poor socioeconomic groups. The majority of subjects in these subgroups had very low consumption of saturated fat (7% kcal/day) and higher physical activity. Only a few Indian studies have analyzed data according to social class. These studies showed that CAD was more common in the higher income groups and less common among unskilled workers engaged in physically demanding work.[66–68] In India, the higher and middle social class which is more affluent and educated, especially in the urban areas, consumes clarified butter (ghee), butter, snacks cooked in hydrogenated fat or clarified butter and more animal foods. The low social class people are poor and illiterate or less educated and are usually engaged in unskilled physically demanding work. They consume either traditional mustard oil or hydrogenated fat and animal foods in amounts too low (total fat intake 15% kcal/day) to predispose CAD.

4. Rural urban trend of cardiovascular diseases

It is seen that although the Prevalence rate of CVD in rural population will remain lower than that of urban population, they will continue to increase, reaching around 13.5% of the rural population in the age group of 60–69 years by 2015. According to a study,[69] the mortality rate due to Acute Coronary Syndrome (ACS) was 5.5% for the rich, while that for the poor was 8.2%. The urban poor and the rural people fall into a vicious cycle; already suffering from long-term material deprivation, unhealthy living conditions, and high levels of stress, they have more affinity to risky behavior like smoking and drinking. Levels of smoking and drinking are the highest amongst the lowest income quintile in India.[70] This leads to the early onset of cardiac diseases amongst this segment of the population. They tend to ignore the disease due to poor access to healthcare, high cost of treatment, social stigma, and low awareness. Seeking treatment would also mean missing wages and reduced productivity, and for those in rural settings, often an additional cost of transport to reach the nearest health facility. When they do choose to go for medical treatment, it involves large out-of-pocket (OOP) payments, and they are further pushed back into poverty. Such expenditure, referred to as “catastrophic expenditure”, pushes 39 million Indians into poverty every year. Heart diseases are no longer a cause of concern for only the rich. If anything, the poor are impacted more by it, and the control of the disease in the poor population should be a high priority.

Several surveys conducted across the country over the past few decades have shown a rising prevalence of major risk factors for CVD in urban and rural population. The problem of increasing risk factor for CVD in India is because of lack of surveillance system and lack of proper diagnosis. These surveys are limited only to some parts of the country mostly developed and hence an action plan has to be initiated to improve its range in rural areas also. In 1990, cardiovascular diseases (CVD) accounted for 63% of all deaths and India contributed to 17% to the worldwide mortality.[71] There was lack of an organized national system for monitoring these risk factors over time so as to inform policy and program for appropriate interventions and research.

The ICMR-WHO study on Burden of Disease reviewed literature till 2003 on NCDs.[72] The weighted average prevalence for ischemic heart disease was estimated to be 6.4% in urban areas and 2.5% in rural areas. The meta-analysis of eight studies carried out between 1995 and 2002 in urban areas gives a pooled prevalence rate of hypertension as 164 per thousand, and 157 per thousand in rural areas. The combined urban and rural pooled estimate of prevalence rate of hypertension among adults (>20 yr) was 159 per thousand. An increase of 17.5% in the number of stroke cases in India occurred during the last one and a half decade. Mortality due to strokes has increased by 7.8% from 1998 to 2004. Available evidence yielded that over 9 million stroke cases and about 6.4 million have been lost due to disability during 2004.[33]

Gupta et al, in their review of published studies in 1996, reported an increase in the prevalence of coronary heart disease (CHD) from 1% in 1960 to 9.6% in the year 1995 among urban Indian residents. Similarly, the prevalence in rural residents rose from 2% in 1974 to 3.74% in 1995.[29] In their latest systematic review,[73] they report the prevalence of CHD obtained mainly through cross-sectional surveys to be 3–4% in rural areas and 8–10% in urban areas among individuals aged above 20 years. Based on these data they estimate that there were approximately 29.8 million patients with CHD in the year 2003. Of these 14.1 million resided in urban areas, while the remaining 15.7 million were rural residents. With an estimated 10% attrition and event rates they projected an annual new event or death to occur in 2.9 million persons per year with nearly 1.5 million people dying due to CHD every year.[73]

Coronary heart disease is more prevalent in Indian urban population and there is a clear declining gradient in its prevalence from semi-urban to rural population. In 2003, the prevalence of CHD in India was estimated to be 3–4% in rural areas (two-fold higher compared with 40 yr ago), and 8–10% in urban areas (six-fold higher compared with 40 yr ago), with a total of 29.8 million affected (14.1 million in urban areas, and 15.7 million in rural areas) according to population-based cross-sectional surveys.[19,74] This estimate is comparable to the figure of 31.8 million affected, derived from extrapolations of the Global Burden of Diseases study. The Indian subcontinent has a higher prevalence of diabetes mellitus than any other region in the world, and 2–3 times the reported prevalence in Western countries.[75] In India alone, an estimated 19.3 million people had diabetes in 1995, and this is expected to almost triple to 57.2 million in 2025.[76] The Indian Council of Medical Research (ICMR) estimates that the prevalence of diabetes is 3.8% in rural areas, compared with 11.8% in urban areas.[77] Hypertension is even more prevalent (20–40% among urban and 12–17% among rural adults),[78] and was affecting an estimated 118 million inhabitants in India in 2000; this number is projected to almost double to 214 million in 2025.[79]

Low and middle educational status urban subjects in India have greater cardiovascular risk.[80] Uneducated and less educated people in rural India major coronary risk factors such as smoking and hypertension are more prevalent. This may make these people prone to coronary heart disease.[64]

It was further observed that the prevalence of high blood pressure was as high as 70.6% in urban females compared to 55.1% in rural females. However, the prevalence of low HDLc was remarkably high in females of both rural and urban areas. The prevalence of MS was significantly higher in urban females (57.8%) than in their rural counterparts (34.8%).

Urban population had higher prevalence of CVDs as compared to rural population. Risk factor prevalence from slum/peri-urban areas lay somewhere in between the urban and rural population, but more inclined towards urban trends.

The prevalence of risk factors for coronary heart disease, such as hypertension, obesity, diabetes, family history, etc was significantly higher in the urban than in the rural study population, while smoking was commoner among rural men and women.[81] These variations may be explained partly by differences in lifestyle. Rural men and women work in agriculture, involving heavy physical activity, while most urban men and women have sedentary habits. An urban-rural epidemiological survey of coronary heart disease was conducted by Gupta & Malhotra. The prevalence of the disease was almost 2.5 times commoner in both sexes in urban than in rural areas.[82]

5. Conclusion

From the above review it may be concluded that the cardiovascular diseases and its risk factors are increasing with a rapid pace in Asian Indian population. Though the prevalence of CVD risk factors is found higher in urban population, yet it is increasing at an alarming rate in rural population also, which is a serious threatening to the nation. It is seen that rural population are gradually declining to the urbanization and are consequently affected due to acquiring sedentary and modern lifestyles. So it seems reasonable to argue that habitat is irrespective. Since majority of the Indians live in rural area, CVD may lead to epidemic proportions and that is why it must be taken into account seriously. The limitation of this review is unavailability of sufficient data from all region of the country and it covers the study mostly of developed parts of the country. Hence, a comprehensive review covering almost all parts of the nation, particularly, rural area is very much required for the reflection of actual picture among the population of the country and in formulation of effective health promotion and intervention programme, which will certainly help to reduce CVDs in India.

Conflicts of interest

All authors have none to declare.

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