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## A Critical Review of the Prevalence of Coronary Heart Disease in South Asians (Indians)

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**Corresponding Author:**

Mr. Nilesh M Prashad,  
Medical Student, Windsor University School of Medicine - Canada

**Submitting Author:**

Mr. Nilesh M Prashad,  
MD Candidate 2018, Windsor University School of Medicine - Canada

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# A Critical Review of the Prevalence of Coronary Heart Disease in South Asians (Indians)

**Author(s):** Prashad NM

## Abstract

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The prevalence of coronary heart disease (CHD) in South Asian (Indians) populations continues to be greater than the prevalence observed in people of European descent. The death rate attributed to CHD is also greatest in India. Through a combination of unique risk factors, potential causes for this observed difference in prevalence and potential changes in management are explored. In conclusion it is believed that differences in genetic, environmental and anatomical factors contribute the greatest to the high prevalence of CHD in South Asians (Indians).

## Introduction

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Coronary heart disease (CHD) continues to remain a major factor leading to death worldwide. Over the past half century the development of greater screening options and treatment have reduced the overall death attributed to complications from CHD. However, while the overall rate of CHD leading to death has dropped, there are still variations in the prevalence of this disease relating to ethnicity (Bhatt *et al.*, 2017). Specifically, one fifth of global deaths involving CHD occur in people of Indian descent (Referring to those directly from India or migrants of Indian heritage). The number of CHD related deaths has doubled in India since the 1990s and is expected to increase by as much as 50% by 2030 (Tan *et al.*, 2014). Some factors believed to contribute to this increased prevalence of CHD in this group include an increased rate of type 2 diabetes, insulin resistance and metabolic complications. However current research does not meaningfully support these factors as the major determinants for the increase in CVD in this group. While there are probably several minor risk factors that contribute to an increased rate of CHD in this subpopulation, the remainder of this article will focus on the major risk factors that have been shown to increase the odds of developing CHD, possible reasons for the excess amounts of premature CHD in the Indian Asian population and potential techniques to manage this condition.

## Genetics

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Although the vast majority of the human genome for every ethnicity is identical, several minute differences can be a factor for differences in the prevalence of CHD. When compared to Europeans, Indian-Asians were found to have as many as 50 single nuclear polymorphisms (SNPs) that could potentially increase the odds of developing CHD. In addition to these findings, genetic studies have also identified population specific variation (In the form of a 25 base pair deletion for the gene encoding cardiac myosin binding protein C), seen exclusively in approximately 5% of the Indian population that puts them at a 7 times greater risk than Europeans for developing cardiovascular disease (Tan *et al.*, 2014). In addition to genetic variation, certain genetic polymorphisms that are known to be major risk factors for developing CHD and other cardiovascular diseases are found at slightly higher rates in Indian Asians. Some of these polymorphisms include the genes for homocysteine and lipoprotein a. Both of these genes strongly influence the formation of plaque within small arteries such as the coronaries. Other relatively new polymorphisms found that influence CHD development include C-reactive protein, apolipoprotein B, myeloperoxidase and F2-Isoprostanes although the severity of each gene polymorphism is still uncertain (Gupta *et al.*, 2013). Additionally studies suggest that improvements in lifestyle choices can only mildly improve the development of this disease when afflicted with genetic predisposition (Anand *et al.*, 2016). This further illustrates the significant weight that genetics and family history hold in the development of CHD.

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## Social Determinants

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Dyslipidemia is a well-established risk factor for developing CHD and is also thought to be one of the major causes for the increasing incidence of premature CHD in younger individuals. In a retrospective study involving Indians under the age of 40 it was found that approximately 70% of participants

had low HDL and 42% of participants had hypertriglyceridemia (Dalal *et al.*, 2016). The combination of these two findings in relatively young individuals directly leads to the early development of fatty streaks in the coronary arteries, eventually leading to premature CHD. There are many factors that contribute to dyslipidemia with the majority involving lifestyle management. A diet composed of highly saturated fatty acids and cholesterol combined with decreased physical activity is thought to be main contributing factors to the increases seen in the rates of dyslipidemia. In addition to these factors studies have also found that additional standard risk factors including smoking, hypertension, diabetes, high waist-hip ratio, psychosocial stress, and lack of consumption of fruits and vegetables explained more than 90% of acute CHD events in South Asians (Rambihar *et al.*, 2010). These risk factors were similar to those in other populations but developed at a younger age in South Asians (Chandra *et al.*, 2014). It has been hypothesized that a combination of common risk factors in the South Asian population such as low birth weight, hypertension, increased plasma glucose concentrations, insulin resistance, abnormal fibrinogen/factor VII, and apolipoprotein levels are the main causes of the early development of CHD, however more research is needed on the topic to definitively understand the reason for this development (Hussain *et al.*, 2013).

Additionally access to standard medical treatment continues to be a problem across India. Inequalities in socioeconomic status, geographical location, travelling from small villages to cities and gender combined with a high out of pocket price for general health care greatly limit the accessibility of healthcare for the majority of the population. This lack of medical care includes preventative care, access to pharmaceuticals and availability of in-patient and out-patient clinics to a large percentage of the Indian population (Balarajan *et al.*, 2011). With the increasing industrialization and urbanization of India, a subsequent increase in tobacco and alcohol consumption, processed foods is expected accompanied with a decrease in physical activity. Additionally this increase in urbanization is predicted to also increase the number and size of impoverished areas in India, thus further widening the socioeconomic gap and increasing the incidence of this disease moving forward (Nair *et al.*, 2012).

## Anatomy

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CHD occurs when plaque builds up inside a coronary artery, thus causing a blockade for blood to reach and

perfuse myocardial tissue. While the risk factors for developing CHD are similar to all racial populations, the effects and impact of these factors are often seen in the Indian population in greater severity and at an earlier age than cases in western countries. A potential overlooked factor that has led to this trend is the difference in the diameter of the coronary arteries. When the diameters of the coronary arteries are smaller, it takes a smaller plaque to impede blood flow. A study measuring the average diameter of coronary arteries in different racial groups found that when compared to individuals from European and Middle Eastern countries, the diameter of the major coronary arteries (LAD, LMCA, LCx, RCA) were smaller, as arteries in Indians are smaller than other races (Shukri *et al.*, 2014). This factor may potentially be one of the main reasons why CHD is common, severe and earlier occurring in Indian Asians as early plaque formation (traditionally seen in younger patients) impedes a greater percentage of the coronary artery.

## Future Goals

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CHD continues to remain a silent killer amongst all populations globally. However due to a combination of multiple risk factors, CHD has a higher prevalence and a younger age of onset in the Indian Asian subpopulation (Chandra *et al.*, 2014). The lack of a definitive cause in the development of this disease requires a greater effort to bring awareness of it especially in at risk populations. With greater public awareness and greater access to general healthcare and pharmaceuticals, the severity and overall deaths attributed to CHD could be greatly reduced. However, achieving this is easier said than done as many factors such as socioeconomic status, location and price of care continue to delay achieving a greater distribution of quality healthcare (Balarajan *et al.*, 2011). Until this goal can be achieved research into new screening methods and markers to detect CHD at early stages benefits everyone tremendously. Treatment and risk reduction should be targeted more aggressively, with risk scores modified for ethnicity (Rambihar *et al.*, 2010). In addition to these changes in dietary habit and exercise habits accompanied with greater management of diabetes and hypertension would also greatly benefit those at risk of developing CHD (Dalal *et al.*, 2016). Finally, development of personalized medication continues to be an area of great interest in medicine. While general pharmaceutical medication plans work for the majority of the population, differences in efficacy are noted amongst race

(Tierney *et al.*, 2013). However like the goal of achieving more accessible health care, the implementation of personalized medication offers promise for the future continues to be a solution for a somewhat distant future. The need for earlier screening methods may potentially reduce the amount of deaths attributed to CHD in young or middle aged adults.

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