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Public Health

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## Original Research

# Cardiovascular disease and diabetes mortality, and their relation to socio-economical, environmental, and health behavioural factors in worldwide view



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## ARTICLE INFO

## Article history:

Received 2 April 2014

Received in revised form

7 January 2015

Accepted 17 January 2015

Available online 25 February 2015

## Keywords:

Non communicable diseases

Cardiovascular disease

Diabetes

Mortality

Ecological study

## ABSTRACT

**Background:** Today, non-communicable diseases, mainly cardiovascular diseases and diabetes, represent a leading threat to human health and development. This study observed mortality trends in all income group countries in relation to a wide variety of related factors like economical and environmental factors, health behaviour and health risk factors.

**Study design:** Ecological study.

**Method:** Data were analysed for 72 countries using the ecological study method. Data were collected from various sources including WHO, World Bank and previous studies. Cardiovascular disease and diabetes mortality rates for males and females were used as the dependent variables. GDP, GINI, literacy rate, urbanization, health expenditure, the number of physicians and the number of beds, BMI, western diet, blood glucose, blood pressure, serum cholesterol, physical inactivity, alcohol, and smoking were used as the independent variables initially. The final model was decided on the basis of availability of complete data and result of co-linearity test. Correlation test and linear regression were employed to identify the affecting factors for the dependent variables.

**Result:** Analysis showed that cardiovascular disease and diabetes mortality was more concentrated in middle- and low-income countries and was negatively associated with GDP, GINI, and western diet. Countries with high average blood pressure had higher mortality rates showing a positive relationship.

**Conclusion:** Non-communicable disease mortality rate is strongly associated with many economical, social, environmental, and behavioural factors. More comprehensive preventive and diagnostic strategies are needed to decrease mortality especially in low- and middle-income countries.

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<http://dx.doi.org/10.1016/j.puhe.2015.01.013>

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## Introduction

Today, non-communicable diseases (NCDs) represent a leading threat to human health and development. These diseases are the world's biggest killers, causing an estimated 35 million deaths each year and 60% of all deaths globally.<sup>1</sup> Out of all these NCDs, cardiovascular disease (CVD) and diabetes mortality is an alarming sign throughout the world. The leading cause of NCD deaths in 2008 was CVD (17 million deaths, or 48% of NCD deaths). Diabetes caused an additional 1.3 million deaths.<sup>2</sup> By 2020, CVD will claim 25 million lives each year and will surpass infectious diseases as the world's leading cause of death and disability.<sup>3</sup>

In the past few centuries, CVD and diabetes were major killers in developed countries but now it is becoming a global issue with a marked rise in mortality and morbidity rates in developing countries. The burden of disease, prevalence, and DALY for CVD and diabetes have been well documented and studied worldwide with a major focus on high income countries. Unlike developed countries, the emergence of CVD epidemic in developing countries during the past two to three decades has attracted less comment and little public health response, even within these countries. It is not widely realized that at present, developing countries contribute a greater share to the global burden of CVD than do the developed countries.<sup>4,5</sup> Even less is known about how these associations have changed over time with the availability of new public health and clinical programs and with the globalization of medicines and foods.<sup>6,7</sup>

As mentioned earlier, the incidence, prevalence, DALY, and burden of disease for diabetes and CVD have been well documented, but there is little information on chronic disease mortality rates in low- and middle-income countries. Mortality data are important in the measurement of impact of disease and consequently health in the planning of public health care. Studying trends in mortality over time helps to understand how the health status of the population is changing and assists in the evaluation of the health system.<sup>8</sup> Although the associations between CVD and diabetes and health risk factors like diet, smoking, alcohol, physical inactivity and socio-economic status have been studied within countries,<sup>9</sup> few studies have assessed the cross-country association of CVD risk factors with national macroeconomic variables.<sup>10,11</sup> Due to increasing urbanization and industrialization, risk factors are no more focused at individual level but are related to environmental, social, and economic factors. An ideology argues that modern industrial society rather than the individuals living in that society creates the conditions that lead to increased development of chronic diseases. Tobacco advertising, processed high fat, high salt food, easy availability of alcohol, societal stress, an urbanized–suburbanized existence that substitutes automobile travel for exercise, and a markedly unequal distribution of wealth are the substrates upon which modern epidemics of chronic diseases have flourished. Such a world view leads to an emphasis on societal rather than individual strategies for chronic disease control.<sup>12</sup> So, keeping all these factors in view, an ecological study pattern with focus on all the related factors to disease mortality was

developed. Although ecological study has limitations but individual-level studies that provide evidence on causal effects cannot assess population-level patterns and dynamics.

In order to achieve reduction in mortality rates of CVD and diabetes and to combat their adverse effects globally, the causes and related factors must be well known not only in high- but also in low- and middle-income countries. Therefore in this study, a comprehensive approach was made and the mortality rate of CVD and diabetes, and its relationship with various related factors like health infrastructure, health behaviour, economical differences, and risk factors to health in 72 countries of the world including not only high- but also low- and middle-income countries were studied.

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## Methods

### *Design and data source*

In order to achieve these research aims an ecological study was conducted, the total sample size of which was 72 countries (see [Table 1](#)). Previous studies analysed the impact of various health behaviours like diet and smoking,<sup>9,13–15</sup> socio-economical factors like income and urbanization,<sup>6,16</sup> environmental factors like air pollution,<sup>17</sup> risk factors like hypertension and BMI<sup>13,16,18,19</sup> and psychological factors<sup>18</sup> on CVD and diabetes. In reference to previous studies a model of four categories including health behaviour, health infrastructure, socio-economical differences and risk factors to health was made to evaluate their relation with CVD and diabetes mortality. Countries were selected on the basis of availability of complete data (see [Table 1](#)). Aggregate country level data was collected from several databases (see [Table 2](#)).

### *Dependent variable*

The dependent variable was CVD and diabetes mortality per 100,000 individuals and was collected from the WHO database (Global Health Observatory). Mortality rates were age standardized and WHO standard population was used for its calculation.<sup>20</sup> CVD covered all codes of circulatory system (ICD-10 codes I00 to I99) including hypertensive heart disease, ischaemic heart disease, cerebrovascular diseases and others, while diabetes included E10 to E14 codes covering type 1 and type 2 diabetes and other unspecified types.<sup>21</sup> A combination of CVD and diabetes mortality was used in this study because most of the diabetic patients die due to cardiovascular accidents occurring as a complication of diabetes and diabetes itself is not the primary cause of mortality.

The GHO data repository provides access to over 50 datasets on priority health topics including mortality and burden of diseases.<sup>22</sup> Countries were selected on the basis of availability of mortality data. The most recent data available for the year 2008 was selected for this study. Cause-of-death distributions are estimated from various death registration databases and for populations without death-registration data, cause-of-death models together with data from population-

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