SPATIAL DISTRIBUTION OF CARDIOVASCULAR DISEASES IN MAHARASHTRA STATE

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ABSTRACT:

Good health is important for human happiness and well-being. Healthy population is more productive and contributes to economic growth. Cardiovascular disease is a group of diseases caused by inadequate blood supply to the heart as well as other cardiovascular diseases. Cardiovascular disease affects physical, socio-economic, behavioral and organizational factors. The objectives of this study is to analyze the spatial patterns of mortality caused due to cardiovascular diseases in Maharashtra state. Proportional mortality index and cardiovascular risk index methods are used for this analysis of spatial distribution of cardiovascular diseases in Maharashtra state. Ratnagiri, Nashik and Buldhana districts in the state of Maharashtra have the highest proportional cardiovascular mortality rate and the Nandurbar, Raigad, Ratnagiri districts of Maharashtra have the highest cardiovascular disease risk.

Keywords: Health, Cardiovascular Diseases, Proportional mortality rate, cardiovascular risk index

INTRODUCTION:

Health is a stage in the overall physical, mental and social well-being of a human being.(WHO, 2011). Good health is important for human happiness and well-being. Healthy population is more productive and contributes to economic growth. Human health also plays a very important role in nation building.

The world's health and disease patterns have changed in the last century. The incidence of infectious diseases is low in the world and the incidence of non-communicable diseases especially cardiovascular disease has increased from 36%

in 1990 to 57% in 2020.(Mansorian, 2010)Cardiovascular disease is a group of diseases caused by inadequate blood supply to the heart as well as other cardiovascular diseases.(Public health department, 2020)In the cardiovascular system, the heart, blood, and blood vessels work together to carry oxygen and nutrients to the body's organs and tissues. The heart is the most important and strongest muscle in the human body and is the engine of the system. The group of cardiovascular disorders is called cardiovascular disease. (Saini, 2014)Factors such as smoking, high blood pressure, high cholesterol, a healthy diet, lack of exercise and obesity can increase the risk of cardiovascular disease.

About 82% of deaths due to cardiovascular disease occur in low- and middle-income countries. Cardiovascular disease affects physical, socio-economic, behavioural and organizational factors.(WHO, 2011)In the last four decades, the incidence of heart disease in India has doubled in rural areas and quadrupled in urban areas. (Public Health Department, Government of Maharashtra)India has a large disparity in the distribution of cardiovascular diseases. Punjab (49.2%), Goa (41.8%), Tamil Nadu (35.7%) and Andhra Pradesh (31.4%) have the highest rates of death due to cardiovascular disease, followed by Meghalaya (10%), Nagaland (11%) and Himachal Pradesh (12.3%) and Sikkim (16.4%) have the lowest incidence of cardiovascular disease.(Gupta, 2006)

The total number of deaths due to cardiovascular disease in the state of Maharashtra from 2016 to 2020 is around 134131. Districts Pune, Satara, Nashik, Aurangabad in the state of Maharashtra have the highest number of deaths due to cardiovascular diseases.

Cardiovascular disease is a public health problem. The incidence of heart disease is high in urban areas and the incidence of heart disease among the poor and rural people is increasing day by day. Therefore, it is necessary to study the group of cardiovascular diseases and the risk factors associated with them according to the geographical features of the region.

The present study is important for understanding the spatial pattern of cardiovascular disease in the state of Maharashtra. This study is also important to identify areas at risk of cardiovascular disease in the state of Maharashtra.

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The findings of the study are useful for formulating location-specific policies in health services.

OBJECTIVES:

1. To analyze the spatial patterns of mortality caused due to cardiovascular diseases in Maharashtra state

DATA SOURCES AND METHODOLOGY:

For the present research work, data is collected from secondary sources. Data related to milch animals, health care resources, and Industrial units is collected from socio-economic review of all districts in Maharashtra state. Proportional Mortality Index, Cardiovascular Risk Index is used for the analysis of spatial distribution of cardiovascular mortality.

Proportional mortality index = Number of deaths from cardiovascular mortality / Number of all deaths *100(Saini, 2014)

- Cardiovascular Risk Index (CRI) = 1/4 (MCI+HSI+IUI+ASI)

    a. MCI: Milch Cattle Index = x-min (x) / max(x) – min (x)

    Where x is number of milch cattle per person

    b. HSI: Health Service Index= x-min (x) / max(x) – min (x)

    Where x is population served per health institution

    c. IUI: Industrial Unit Index= x-min (x) / max(x) – min (x)

    Where x is density of industrial units

    d. ASI: Average Slope Index = max (x) - x / max(x) – min (x),

    Where x is average slope in degrees

RESULT AND DISCUSSION:

Proportional Mortality Rate:

District-wise proportional mortality rate of cardiovascular diseases, the entire Maharashtra state can be divided into following five categories. (Table 1)

Ratnagiri, Nashik and Buldhana districts of Maharashtra have the highest proportional mortality rate (more than 20%) of the total mortality. 10% of the total deaths in these districts are related to cardiovascular diseases out of total cardiovascular deaths in Maharashtra. In Hingoli, Solapur, Latur, Satara,

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Mumbai Suburban, Sindhudurg districts the cardiovascular mortality rate is in between 15 to 20 percent. Out of the total deaths in this district, 44% deaths are due to cardiovascular diseases. Beed, Gondia, Osmanabad, Gadchiroli, Jalna, Aurangabad, Chandrapur, Jalgaon, Pune, Akola, Washim, Bhandara districts have proportional mortality rate between 10 to 15 percent. However, proportional mortality rate is lower (Below 10%) in Raigad, Kolhapur, Wardha, Nandurbar, Thane, Nagpur and Ahmednagardistricts. (Table 1)

Cardiovascular Risk Index:

The Cardiovascular Risk Index (CRI) is calculated on the basis of Milch Cattle Index, Health Services Index, Industrial Units Index and Average Slope Index.

o Milch Cattle Index (MCI):

Milch Cattle Index (MCI) is to be used to indicate the availability of milk and milk products in the region. However, due to non-availability of data on milk and milk products, the number of milch cattle per person has been calculated using the Milch Cattle Index. According to MCI, higher the number of milch cattle per person, higher will be the risk of developing cardiovascular ailment due to great fat consumption.

o Health Services Index (HSI):

The indicator of population served per health institution is used to calculate the Health Services Index (HSI). Lower the population served per health institution in an area, lower is the risk to cardiovascular health.

o Industrial Units Index (IUI):

The density of industries per square km is used to calculate the Industrial Units Index (IUI). Therefore, higher the number of industrial units per sq.km, higher is the risk to cardiovascular health.

o Average Slope Index (ASI):

According to the available literature, physical activities are more prevalent in the highlands. Therefore, the higher the average slope of an area, the lower will be the risk of acquiring cardiovascular diseases. The

district wise average slope of Maharashtra has been calculated by processing Cartosat DEM in ArcGIS software.

Nandurbar, Raigad, Ratnagiri districts of Maharashtra have the highest cardiovascular risk index (more than 2.5) and Thane, Sidhudurg, Satara districts have the cardiovascular risk index between 2.0 and 2.5. Also Sangli, Chandrapur, Hingoli, Buldhana, Dhule, Ahmadnagar, Gondia, Yavatmal, Kolhapur, Beed, Washim, Amaravati, Gadchiroli, Nashik, Pune districts have cardiovascular risk index between 1.5 to 2.0 and Jalna, Solapur, Wardha, Nagpur, Mumbai, Latur, Parbhani, Akola, Mumbai City, Jalgaon, Bhandara, Osmanabad, Nanded, Aurangabad districts have the lowest (1.0 to 1.5) cardiovascular risk index. (Table 2)

Table 1 : Spatial Distribution of Proportional Mortality Rate of Cardiovascular Diseases in Maharashtra State (2015-2020)

| Class	No. of District	Name of the district
Areas with very high cardiovascular mortality (more than 20%)	03 (8.33)	Ratnagiri, Nashik, Buldhana
Areas with high cardiovascular mortality (15 to 20%)	06 (16.66)	Hingoli, Solapur, Latur, Satara, Mumbai Suburban, Sindhudurg
Areas with moderate cardiovascular mortality (10 to 15%)	12 (33.33)	Beed, Gondia, Osmanabad, Gadchiroli, Jalna, Aurangabad, Chandrapur, Jalgaon, Pune, Akola, Washim, Bhandara
Areas with low cardiovascular mortality (5 to 10%)	06 (16.66)	Mumbai City, Nanded, Dhule, Amravati, Yavatmal, Parbhani
Areas with very low cardiovascular mortality (less than 5%)	07 (19.44)	Raigad, Kolhapur, Wardha, Nandurbar, Thane, Nagpur, Ahmednagar

Source: Calculated by author

Note - Figures in brackets show percentages

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Table 2 :Cardiovascular Risk Index in Maharashtra state (2015-2020)

Class	No. of District	Name of the district
Areas with very high cardiovascular risk index (more than 2.5)	03 (8.57)	Nandurbar, Raigad, Ratnagiri
Areas with high cardiovascular risk index (2.0 to 2.5)	03 (8.57)	Thane, Sidhudurg, Satara
Areas with moderate cardiovascular risk index (1.5 to 2.0)	15 (42.9)	Sangli, Chandrapur, Hingoli, Buldhana, Dhule, Ahmadnagar, Gondia, Yavatmal, Kolhapur, Beed, Washim, Amaravati, Gadchiroli, Nashik, Pune
Areas with low cardiovascular risk index (1.0 to 1.5)	14 (40.0)	Jalna, Solapur, Wardha, Nagpur, Mumbai, Latur, Parbhani, Akola,Mumbai City, Jalgaon, Bhandara, Osmanabad, Nanded, Aurangabad

Source: Calculated by author

Note - Figures in brackets show percentages

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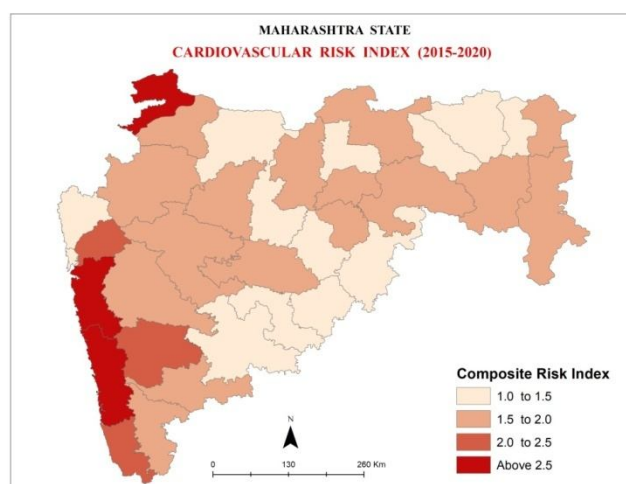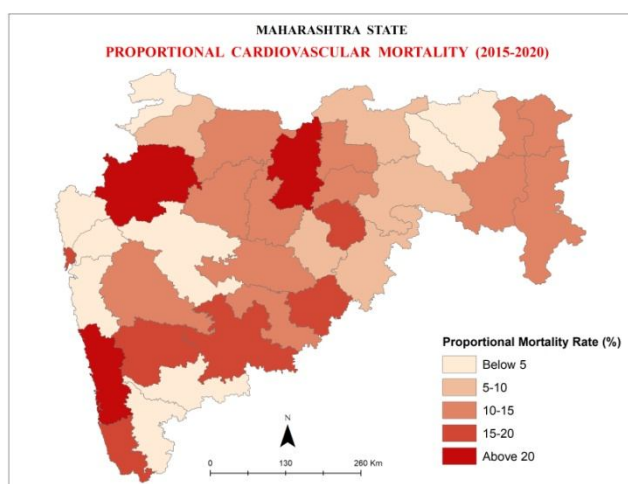
CONCLUSION:

- Ratnagiri, Nashik and Buldhana districts in the state of Maharashtra have the highest proportional mortality rate among the total mortality and 10% of the total deaths are related to cardiovascular diseases. Raigad, Kolhapur, Wardha, Nandurbar, Thane, Nagpur and Ahmednagar districts have lower proportional cardiovascular mortality rates.

- Nandurbar, Raigad, Ratnagiri districts of Maharashtra have the highest cardiovascular disease risk and Jalna, Solapur, Wardha, Nagpur, Mumbai, Latur, Parbhani, Akola, Mumbai City, Jalgaon, Bhandara, Osmanabad, Nanded, Aurangabad districts have the lowestcardiovascular disease risk.

SUGGESTIONS:

- In districts where the risk of cardiovascular disease is high, it is necessary to reduce the intake of fatty foods.

- Citizens living in flat terrain need to increase physical activity.

- There is a need to increase the number of health centers and sub-centers in areas with high cardiovascular disease.

- Citizens should stay away from addictions like alcohol and smoking.

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