Socioeconomic status and risk factors for cardiovascular disease (CVD) among the residents of Jammu Division (J&K-India) - A Geo Medical Analysis

Sheraz Ah. Lone, M. Sabar, Ishtiaq Ah. Mayer

Department of Geography, University of Kashmir, Hazaratbal, Srinagar, Jammu and Kashmir [190006], India

Abstract

The main focus of this paper is to examine the relationship between CVD risk factors and socioeconomic variables in Jammu division of Jammu and Kashmir. Cardiovascular disease (CVD) related deaths is not only the prime cause of mortality in the world, it has also continued to increase in the low and middle income countries. The study area was divided into ten districts (administrative units) in GIS environment. linear regression, binary logistic regression model, Kendal's ranking coefficient method were employed to show the incidence, spatial variation and impact of different socioeconomic variables on CVD. The results reveals that the incidence of CVD has increased by 7.31 percent from 2008 to 2016. Samba district was having maximum change of incidence (33.24 percent), however, negative change in incidence rate was found in Udhampur district (-2.41 percent). Consumption of tobacco and alcohol are significant related to cardiovascular diseases.

Keywords: CVD, Jammu, Socioeconomic, Vulnerability

1 Introduction

Cardiovascular diseases (CVDs) include disorders of heart and blood vessels, and are usually associated with atherosclerosis, heart attacks, strokes, valvular diseases, congenital heart diseases and arrhythmia [1]. Mortality resulting from CVDs reached 17.7 million globally in 2015, which represented 31% of all global deaths. Of the CVD deaths, more than three quarters took place in low- and middle-income countries (LMICs) [2]. Cardiovascular diseases, which are typically viewed as diseases of the wealthy, have dramatically infiltrated those living in abject poverty in LMICs [3]. Diseases are intimately related with the socio-economic environment [4]. Different diseases have varied causes which have their roots in the social and economic domains of the societies or areas [5]. Cardiovascular disease (CVD) is the main cause of death in the world [6,7]. However, whereas the adult CVD death rate in developed economies has declined since the 1970's [8] it has risen in the low and middle income countries [9]. Low and middle income countries contributed the highest percentage of CVD deaths worldwide, which rose from 14.4 million in 1990 to 16.5 million in 2005 [10]. Cardiovascular disease (CVD) is no longer limited to developed countries, it is widespread in developing countries [11,12] and the rate of increase in CVD in developing countries is twice as high as in developed countries [13] (Gaziano, 2005). CVD occurs at a younger age in developing countries, about 52 per cent of deaths from such disorders in India occur before 70 year of age, compared with 23 per cent in established-market economies [14]. In the context of this large and growing disease burden, strategies to improve population health in India require consistent efforts to identify and address the real causes of this rapid rise in CVD [15]. In developed countries socio-economic mortality differentials have been studied extensively showing that the low socio-economic group

suffer the highest mortality [16,17]. Such a trend was not observed for CVD in India until the 1990s, and CVD was regarded as a disease of the affluent classes [18]. The epidemic of CVD struck the more affluent sections of India first, but as the epidemic is maturing, we are observing a graded reversal of social gradient, with socio-economically disadvantaged groups becoming increasingly vulnerable to CVD. For example, the social class gradient in cardiovascular event rates among Indians has reversed with evidence for excess CVD events among the lower socio-economic groups [19,20].In 45 rural villages in India, 32 per cent of all deaths were due to CVD, outranking infectious diseases, which were responsible for 13 per cent giving clear evidence that the epidemic has reached its advanced stage even in rural India [21]. Neglect of this epidemic, particularly ignoring the socio-economic context as they are driven by social and economic changes with lack of an adequate public health response will further fuel the inequities associated with CVD in Indians [22]. Socio-economic mortality differentials have been demonstrated using several indicators of social position representing occupational, educational, and financial aspects [23].

Cardiovascular disease (CVD) is a general term that describes a disease of the heart or blood vessels, and includes coronary heart disease (heart attacks), cerebrovascular disease (stroke), raised blood pressure (hypertension), peripheral artery disease, rheumatic heart disease, congenital heart disease and heart failure [24]. The major causes of cardiovascular disease (CVD) are tobacco use, physical inactivity, an unhealthy diet and harmful use of alcohol [25]. These diseases are epidemic in urban locations of these countries and are rapidly increasing in rural areas as well [26]. Socioeconomic circumstances seriously affect health and wellbeing, making health inequalities a major public health concern around the world. This can be seen in the simple statistic that richer countries tend to have better average health than poorer ones [27]. Although no consistent association has been found between Gross Domestic Product (GDP) and life expectancy amongst richer countries, several studies have found that within richer countries lower socioeconomic status is associated with poorer health [28,29,30,31]. The same tends to be true for individuals in poorer countries and regions of the world, although the evidence-base is not as broad [32] and is often derived from ecological studies that compare average levels of wealth and health in countries [33]. An exciting field of current research studies whether environmental or psychosocial factors such as stress, affect the onset of disease and investigates the complex interactions linking the body'smajor control and sensory systems in health and disease. NIM also investigates how psychosocial factors influence the endocrine system [34]. Accumulating evidence underlines the major rolen of chronic stress in accumulating visceral fat, secondary to altered eating behaviors [35,36] Increased abdominal obesity predisposes to the metabolic syndrome, diabetes and cardiovascular diseases (CVD) [37]. The socio-economic scenario of the study area has large degree disparities affecting health of the people accordingly.

2 Study Area

Jammu division is situated in the north-western part of India and lies between 32^{o} 17' to 34^{o} 12' north latitudes and 73^{o} 58' to 76^{o} 47' East longitudes. It covers an area of 26,293 square kilometers which is more than one half times to that of Kashmir division and around 1/8th of the total area of the state of Jammu and Kashmir (Census 2011). The division is bounded by the Kashmir Division in the north, by Kargil district of Ladakh division in the north-east. In the south-east it adjoins the Chamba district of Himachal Pradesh. In the south it is bordered by the Gurdaspur district of Punjab, while on the west it is the bounded by Pakistan and territory of Pakistan occupied Kashmir. The Jammu division comprised of 10 districts namely, Rajouri, Poonch, Jammu, Samba, Kathua, Udhampur, Ramban, Reasi, Doda and Kishtwar (image 1).

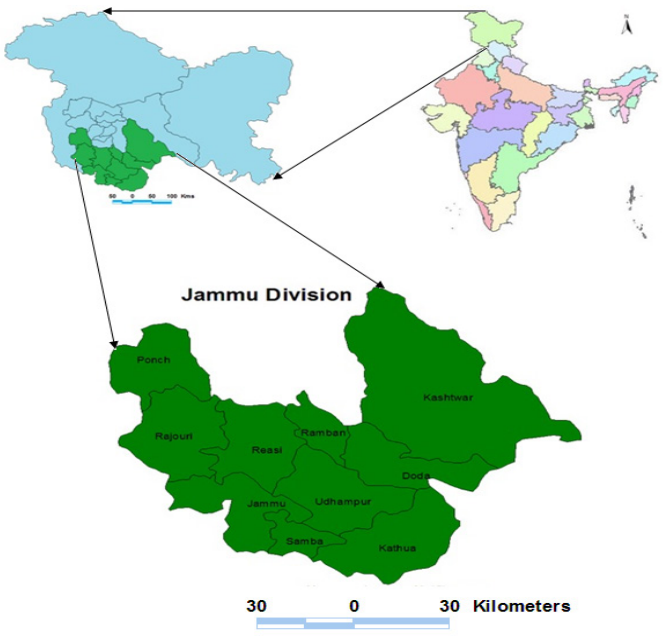

Image 1. Location of the Study Area

3 Materials and methods

In order to work out the spatial variation in the distribution of disease Patten area across diffrent districts in the study, data was collected from hospitals/district surviellence offices falling in each district and also from chief medical officers office and block medical officers office. In order to gauge out the incidence of diseases in the study area, data was collected from hospitals, dispensaries and other relevant institutions. Apart from this primary survey was also carried out in all the sample villages.

3.1 Calculation of Incidence Rate

In the present study the incidence rate of selected communicable and non-communicable of diseases sex wise has been calculated for five years by using the following formula:

$$\text{IR} = \frac{Number\ of\ new\ case\ of\ a\ diseas\ during\ a\ given\ time\ period}{Total\ population\ at\ Risk\ during\ the\ same\ period\ of\ time} \times 1000$$

3.2 Correlation of socio-economic Parameters and diseases

In simple linear regression, the model used to describe the relationship between a single dependent variable y and a single independent variable x is

$$\mathbf{y = a_0 + a_1 x + k}$$

a_0 and a_1 are referred to as the model parameters, and is a probabilistic error term that accounts for the variability in y that cannot be explained by the linear relationship with x. The formulas used in correlation and regression analysis are;

$$r = \frac{\sum d_x d_y}{\sqrt{\left(\sum d_x^2 \sum d_y^2\right)}}$$

(i) Coefficient of Correlation,

(ii) The Linear Regression equation for *y* on *x* is; Y= a+b*x*, where 'b' is the slope and 'a' is the intercept (the point where the line crosses the Y-axis); **a= y- b** $\bar{x}$ and

$$b = \frac{\sum d_x d_y}{\sum d_x^2}$$

4 Results and Discussion

The distribution and incidence of cardiovascular diseases is uneven across the districts of the Jammu division. From table 1, it is clear that the incidence of cardiovascular diseases has increased in all the districts of Jammu division with few exceptions (image 2). In the Jammu province, the incidence rate of cardiovascular diseases has increased from 28.93 persons/1000 to 31.26 persons/1000 of

population (Table 1). Jammu has the maximum rate of incidence (42.78 persons/1000), followed by Samba (36.72 persons/1000), and Kathua (36.59 persons/1000). The minimum incidence rate is observed in Ramban district (17.68 persons/1000); followed by Kishtwar (17.68 persons/1000) and Doda (22.38 persons/1000). The incidence rate is depicted in image 3 and image 4.

Table 1. Incidence rate of Cardiovascular Diseases in Jammu Division (2008-2012)

District	Incidence rate of Cardiovascular Diseases per 1000 Persons															Change (%)
	2008			2010			2012			2014			2016			
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	
Rajouri	20.97	24.23	**22.48**	21.98	23.93	**22.88**	20.94	23.26	**22.01**	23.95	25.9	**24.85**	22.98	24.82	**23.83**	**6.01**
Poonch	20.6	23.18	**21.76**	23.67	21.7	**22.74**	25.78	25.21	**25.51**	24.83	22.47	**23.72**	26.37	24.4	**25.44**	**16.91**
Jammu	45.15	40.15	**42.82**	43.38	43.97	**43.66**	45.55	40.78	**43.32**	44.07	41.71	**42.97**	44.96	40.28	**42.78**	**-0.09**
Samba	24.81	30.65	**27.56**	25.73	31.78	**28.58**	24.67	34.66	**29.36**	28.3	37.34	**32.55**	38.36	34.89	**36.72**	**33.24**
Kathua	27.88	28.5	**28.18**	29.87	29.96	**29.91**	3.71	64.83	**32.84**	36.01	33.81	**34.98**	37.15	35.95	**36.59**	**29.84**
Reasi	17.67	21.4	**19.42**	22.8	18.52	**20.79**	25.77	15.52	**20.95**	21.88	22.43	**22.14**	25.08	25.42	**25.24**	**29.97**
Udhampur	25.95	28.37	**27.07**	26.48	28.98	**27.64**	26.27	28.67	**27.39**	26.59	26.98	**26.77**	26.81	26.14	**26.49**	**-2.14**
Doda	22.26	24.35	**23.86**	23.64	25.76	**24.65**	22.87	24.09	**23.45**	23.75	23.81	**23.78**	22.33	22.44	**22.38**	**-6.20**
Ramban	16.84	18.84	**17.78**	16.19	17.77	**16.94**	14.51	13.92	**14.23**	16.62	13.96	**15.36**	19.42	15.73	**17.68**	**-0.56**
Kishtwar	13.52	17.28	**15.32**	16.59	15.53	**16.08**	17.13	14.93	**16.07**	21.97	12.41	**17.39**	21.66	16.47	**19.17**	**25.13**
Total	28.93	29.34	**29.13**	29.57	24.29	**29.91**	27.21	33.24	**30.04**	31.08	30.18	**30.66**	32.27	30.12	**31.26**	**7.31**

Source: Directorate of Health, J&K.

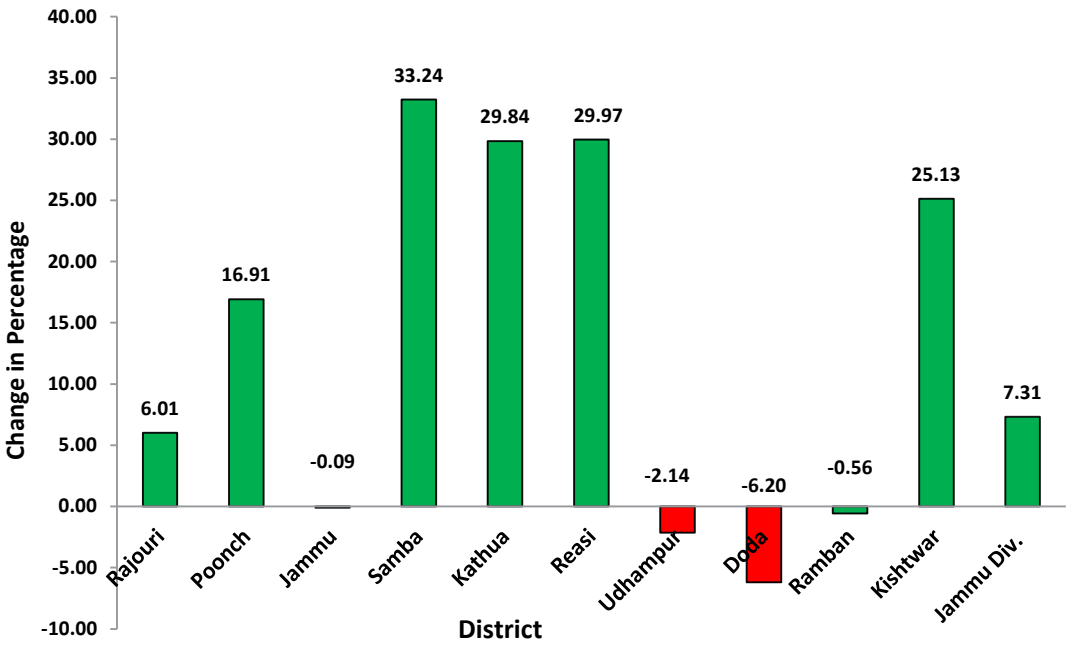

Image 2. change of the incidence rate of Cardiovascular Diseases

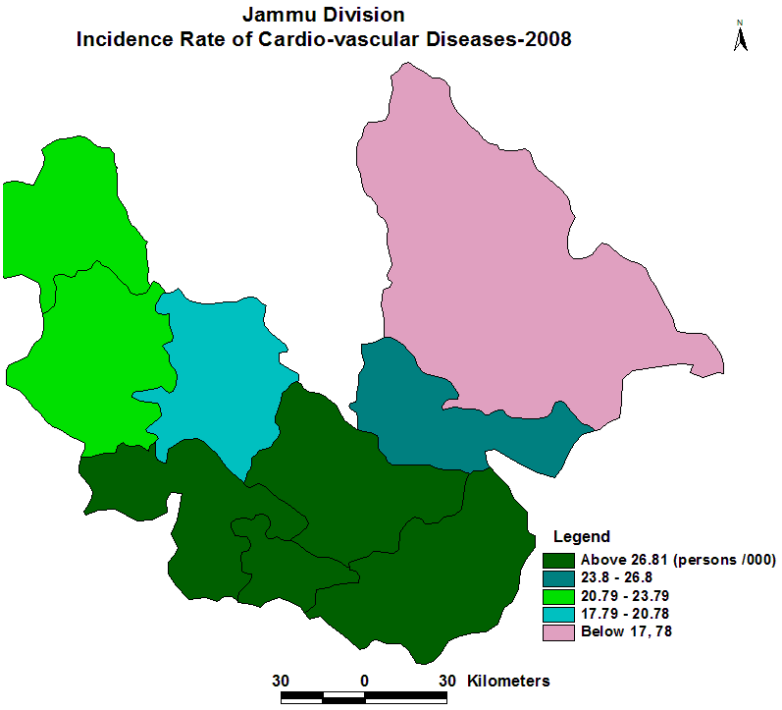

Image 3. incidence rate of Cardiovascular Diseases-2008

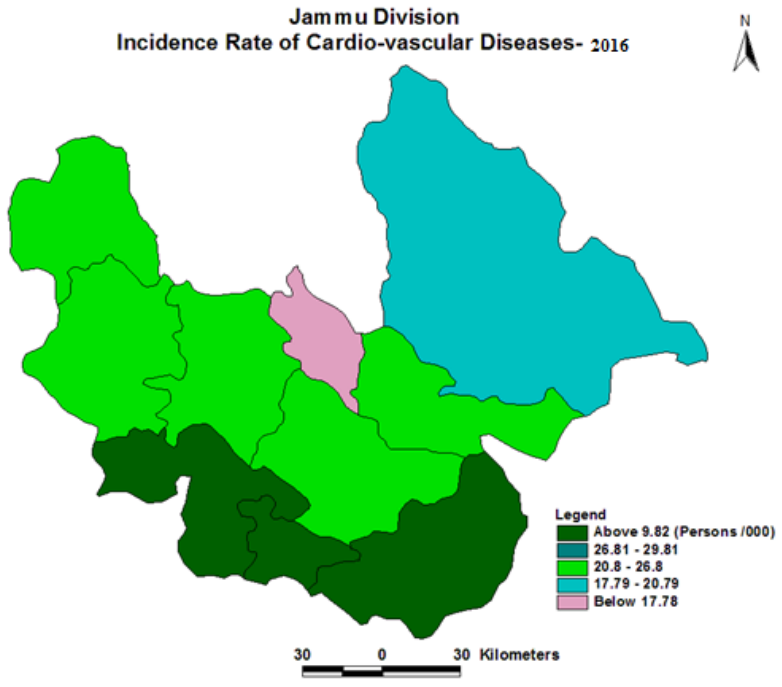

Image 4. incidence rate of Cardiovascular Diseases-2016

Table 2. Relationship between Socio-economic Factors and Cardiovascular Diseases (CVD) in Jammu division

Socio-economic Variables	Total Respondent	Prevalence of Cardiovascular	Odds ratio	Standard Error	Z Value	Level of Significance (P Value)
Residence						
Rural	546	85 (15.6)	0.204897	0.088662	3.66	00.00
Urban	204	65 (31.9)				
Total	750	120 (20.0)				
Religion						
Hindu	313	59 (18.8)	1.144864	0.254359	0.61	0.543
Muslim	309	65 (21)				
Sikh	128	26 (20.3)				
Total	750	120 (20.0)				
Caste						
Upper	436	54 (12.4)	0.546678	0.160136	-2.06	0.05
Lower	314	96 (30.6)				
Total	750	120 (20.0)				
Sex						
Male	460	90 (19.6)	1.505817	0.428429	1.44	0.15
Female	290	60 (20.7)				
Total	750	150 (20.0)				
Age						
0-6	130	0 (0)	0.42117	0.364533	4.38	0.001
7_14	168	15 (8.9)				
15-59	311	91 (29.3)				
>60	141	44 (31.2)				
Total	750	150 (20.0)				
Education						
Illiterate	218	22 (10.1)	.20749	0.167723	1.36	0.017
Primary	182	26 (14.3)				
Middle	73	16 (21.9)				
Secondary	145	41 (28.3)				
Graduation	92	26 (28.3)				
P.G & Above	40	19 (47.5)				
Total	750	150 (20.0)				
Occupation						
Primary	312	32 (10.26)	0.44567	0.174833	-2.06	00.03
Secondary	245	50 (20.41)				
Tertiary	193	68 (35.23)				
Total	750	150 (20.0)				
Income						
<7000	271	27 (10)	.290048	0.416032	4.26	00.00
7000-14000	206	32 (15.5)				
15000-22000	100	24 (24)				
23000-29000	70	22 (31.4)				
>30000	103	45 (43.7)				
Total	750	150 (20.0)				
House Type						
Kachha	423	56 (13.2)	.15959	2.061227	2.94	0.003
Pucca	327	94 (28.7)				
Total	750	150 (20.0)				
Toilet						
Yes	295	90 (30.5)	1.21311	0.51759	0.46	0.645
No	455	60 (13.2)				
Total	750	150 (20.0)				
Separate Kitchen						
Yes	227	40 (17.6)	0.346076	0.17036	-2.16	0.031
No	523	110 (21)				
Total	750	150 (20.0)				
Tobacco						
Yes	286	65 (22.7)	1.324387	0.492827	1.6	0.011
No	464	85 (18.3)				
Total	750	150 (20.0)				
Alcohol						
Yes	264	62 (23.5)	1.461434	0.40569	1.37	0.017
No	486	88 (18.1)				
Total	750	150 (20.0)				
		_cons	**0.02733**	**0.030559**	**-3.22**	**0.001**
log likelihood= --228.35639	**N=750**	**LR chi2(13) 85.65**	**Psedudo R2 0.1579**		**Prob>chi2 .0043**	

Source: Based on field study, 2015

4.1 Relationship between Socio-economic Status and Cardiovascular Diseases (CVD)

Prevalence of cardiovascular diseases in the rural population (15.6 percent) is lower than the urban population (31.9 percent) (table 2). Residence has a Positive impact on CVD. As there is change in residence from rural area to urban by one percentage points, the percentage of people having CVD increase (odd ratio 0.204897). Same is the case with occupation (odd ratio 0.44567), education (odd ratio 0.20749) and income (odd ratio 0.290048) of the respondents. As there is structural transformation from primary to secondary and tertiary sector, the percentage of people having chances of CVD increase. Likewise as educational standard and level of income of the respondent's increases, the chances of CVD increase. The variable age is significant and positive which means that as the age of respondent increases there are 42 percent chances of increase in CVD. Consumption of tobacco and alcohol are significant related to cardiovascular diseases. Table 2, further indicates that a urban population (P = 0.00), old age (p = 0.00), high income (p = 0.00) better education level (P = 0.017), lives in pacca houses (P = 0.003), and consumption of more tobacco (p = 0.011) and alcohol (p = 0.017) were significant independent predictive risk factors for the prevalence of cardiovascular diseases.

5 Conclusion

The study highlights that the distribution and incidence of cardiovascular diseases is uneven across the districts of the Jammu division. The incidence rate of cardiovascular diseases has increased from 29.13 persons/1000 to 31.26 persons/1000 of population from 2008 to 2016. The study further reveals the relationship between different Socio-economic Status and Cardiovascular Diseases in the study area. Health promotion strategies such as community-based awareness activities on how to reduce behavioral risk factors of CVDs and appropriate counseling regarding cardiovascular risk reduction ought to be routinely performed. Furthermore, interventional studies should be considered to reduce risky associated with CVDs.

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