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Original article

Cardiovascular diseases and health care expenditure (HCE) of inpatient and outpatient: A study from India Human Development Survey

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ABSTRACT

Objective: India contributes disproportionally in global burden of diseases due to cardiovascular diseases (CVDs) that accounted alone 28.1% in all deaths. These diseases are a major driver of economic burden, where the disparities persisted across social gradient. Therefore, the research aims to study CVDs and the HCE and to examine their association with socioeconomic-demographic covariates and the preventive effect of lifestyle behaviors on CVDs.

Methods: The longitudinal data of India Human Development Survey (IHDS) of 2004-05 and 2011-12 of population aged 15 + years was used. Descriptive statistics and analytical methods (random effects, Tobit model, and PAF) were performed.

Result: The prevalence of CVDs was increased during 2004-05 to 2011-12 (26–50 per 1000 population). The mean HCE on CVDs also increased (INR 8,483 and INR 14,380) over the same period. The HCE increased with an increase in income, age, and education. Females were significantly less expending on health care than males. The HCE was more in private health facility than public ones. As many as 18.3% of CVD cases attributed due to diabetes, ~17% each having no-education and 6–12 years of education, and almost 8.4% cases attributed to overweight.

Conclusion: CVDs increased in 7 years period. At the same time HCE has also increased nearly by 80% (percent change); relatively more among outpatient treatment. There is need to develop multipronged strategies to reduce pace of increasing CVD and also the cost of treatment to avoid people falling into the trap of poverty due to HCE.

1. Introduction

Globally in 2018, non-communicable diseases (NCDs) alone accounted 41 million (71%) of all deaths.[1] Of these, 17.9 million deaths are caused due to cardiovascular diseases (CVDs), which are projected to rise to 22.2 million by 2030.[2] Among the population aged 30–69 years, CVDs are one of the leading causes of death. Over three-quarters of global deaths from CVDs occur in low and middle-income countries.[1] Morbidity and mortality due to CVDs have been causing a high economic burden. In India, CVDs accounted for 28.1% of total deaths and 14.1% of total Disability Adjusted Life Years (DALYs) in 2016.[3] While India has made considerable improvements in health indicators like infant mortality, maternal mortality, and incidence of communicable diseases, while, chronic non-communicable diseases have considerably increased in the country.[4] These diseases are major drivers of health care burden and deteriorate the quality of life. Large health disparities between rural and urban populations and economic and social gradients persist across different strata in India.

Developed and developing countries alike are facing a huge economic burden due to CVDs. For example, in the United Kingdom, CVDs accounted for £30.7 billion per year of health care cost in 2006.[5] In 2010, the American Heart Association estimated the direct health care cost to be $50.8 billion due to coronary heart diseases (CHD), $18.1 billion due to stroke, and $15.6 billion due to hypertension.[6] The direct and indirect medical care cost of CVDs for the United States was estimated to be $273 billion and $172 billion in 2010.[7] In India, study depicts that the aggregate medical care cost of CVDs was approximately $7.5 billion in 2010.[8] The per patient tertiary care cost for heart diseases was $46.35 in 2007 in India.[9] The UNDP in 2015 estimates revealed that India's expenditure on health is 3.9% of total national

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GDP.[10] Estimates on CVD shown that, there were 1.4 million deaths and 6.7 million hospitalizations occurred in 2004 in India. These numbers would increase to 2.1 million and 10.9 million respectively in 2021.[11] A majority of the population hospitalized would be from the adult ages (25–59 age group).[11] Therefore, the study of CVDs and the HCE incurred on them needs more attention in developing countries, particularly in India.

The mean cost of hospitalization for CVDs in private health facilities is nearly five times higher than in the public ones, and the gap becomes wider over time.[12] Poor households face an immense financial strain on the treatment of CVDs. A large proportion of the Indian population becomes impoverished because of the high out-of-pocket health care expenditure and suffers due to the poor quality of health care. Poor quality of health care is also a significant driver of mortality. Chronic diseases need long and constant care, which translates into a huge HCE that hampering the development of countries.[13]

Literature reviews suggest that, CVDs is leading cause of deaths in India and caused burden of health care expenditure. Several studies have estimated the out-of-pocket expenditure, catastrophic-expenditure, and health coverage for communicable and non-communicable diseases as a whole.[12,14,15] Likewise, there is very few studies that focus on financial strategies based on specific diseases.[12,16–18] Moreover, none of them has focused on HCE of CVDs. Therefore, purpose is to study CVDs and the HCE and to examine their association with socioeconomic-demographic covariates and the preventive effect of lifestyle behaviors on CVDs. It presents the CVDs scenario in India over a seven-year period. The estimates of health care expenditure for CVDs will help to identify the health care costs for inpatients and outpatients, which will in turn help further the policy perspective for treating CVDs. The variability in health care expenditure by socioeconomic-demographic subgroups may help to present the differences as well as the scenario of incurring treatment costs on CVDs in different subgroups. According to the WHO, for preventing the extra burden of cost on health care and for attaining the sustainable development goal, there should be a global and national level target for reducing the NCDs 25% by 2025 and premature deaths 33% by 2030.[1]

2. Methods

The study utilized the secondary data of India Human Development Survey (IHDS) round 1 (2004-05) surveyed 41,554 households that included 215,754 individuals, and round 2 (2011-12) surveyed 42,152 households that included 204,568 individuals of both rural and urban areas. Both the rounds comprised respondents spread across 33 states and union territories (except Andaman and Nicobar; and Lakshadweep), covering 384 districts, 1503 villages, and 971 urban blocks. The IHDS provides both cross-sectional as well as longitudinal information.

For the longitudnal analysis, out of the entire respondents 215,754 in round 1, 141,272 adults aged 15 years and above age (excluding death cases) were considered for the round 1 study. Of these, 18,432 respondents could not be re-contacted for an interview in IHDS round 2 and only 122,840 respondents were re-contacted. Out of these, proxy cases and those who had migrated or died or lost were also excluded from the analysis. Therefore, 99,974 individuals from IHDS round 2 respondents were considered for the analysis. The IHDS data are publicly available through the Inter-university Consortium for Political and Social Research (ICPSR) at the following link: https://www.icpsr.umich.edu/icpsrweb/DSDR/studies/22626.

2.1. Outcome variable

The present study includes CVDs as an outcome variable. Both the rounds contain information on major morbidities, including heart diseases and high blood pressure (HBP). The survey asked the question to the household members: “Has a doctor ever diagnosed any member of your household as having high blood pressure, heart diseases etc.?” We followed the guideline provided by the International Classification of Diseases (ICD-10) and used the information of high blood pressure (ICD-10: I10–I15) and heart diseases (ICD-10: I30–I52) made a dummy variable of cardiovascular diseases. The information was used and coded as “1” for having CVDs and “0” for having Non-CVDs in the present study.

2.2. Variables used in the analysis

The HCE for inpatients and outpatients is calculated on the basis of the type of treatment, hospitalization, cost of doctors, hospital, surgery cost, medical test cost, medicine, and transportation cost. Lifestyle behaviors took into account factors like fat intake, body mass index (BMI), alcohol consumption, tobacco use, and occupation. Fat intake is measured based on the household consumption, during a reference period of 30 days preceding the survey. The National Sample Survey (NSS) conversion factor table was used to measure the fat intake. Alcohol, tobacco use, and occupation were considered for the analysis. BMI is defined as a person's weight in kilograms divided by the person's height in meter square (kg/m2). BMI was divided into four categories as: underweight (BMI; < 18.5), normal weight (BMI; 18.5–24.9), overweight (BMI; 25.0–29.9), and obese (BMI; ≥ 30.0). Diabetes was also considered as a risk factor of CVDs.

The socioeconomic-demographic covariates included sex, place of residence, age group, social group and religion. Education was considered in terms of completed years of schooling. The principal component analysis (PCA) was used to construct the monthly per capita expenditure (MPCE) based on the household monthly consumption and expenditure. The MPCE was categorized into five categories as: poorest, poor, middle, rich, and richest.

2.3. Statistical analysis

The prevalence of CVDs was obtained by the number of diseases person divided by the total number of the surveyed population. The study included both panel and pooled analysis. The pooled analysis included both rounds of the respondents. Pooling the sample for a study minimizes the recall and selection bias, resulting in a more accurate prediction.[19] The study also included panel analysis because it provides a higher capacity to capture the complexity of human behaviors.[20] The study carried out a random effects model using panel data to access the adjusted effect of health care expenditure on CVDs by socioeconomic-demographic subgroups. The random effects model is more comprehensive because it allows estimating the effects of both time-constant and time-varying variables. The study also uses the Tobit model. Tobit model commonly used to describe and measure the relationship between a censured (zero value) and non-negative dependent variable with explanatory variables.[21] Tobit model was used because of asymmetrical distribution of health care cost and large number of zero value.

The HCE is estimated based on the cost incurred during treatment, diagnostic tests, drug prescription, hospitalization cost, transportation cost for treatment, etc. for inpatient and outpatient visit. The HCE of CVDs was calculated as:

$$\text{Total health care expenditure (in Rs.) of inpatient and outpatient} = \frac{\textit{Total health expenditure cost of inpatient \& outpatient visit due to CVDs}}{\textit{Total number of inpatient and outpatient visit due to CVDs}}$$

For the analysis, the mean HCE of CVDs was calculated for various socioeconomic-demographic subgroups. The mean HCE of round 2 was adjusted for inflation rate with 2004-05 as the base year using a deflator. In IHDS data, the information on deflator is provided based on the Consumer Price Index (CPI) that was used for convert the 2012 prices into the base year prices.

The study also used the Population Attributable Fraction (PAF) for estimating the preventive effect of the risk factors on diseases. The contribution of a risk factor to the disease, expressed as a fraction of CVDs attributable to the risk factor in a population, is referred to as the

PAF. The formula is as follows:

$$PAF = Pd * AP = \frac{Pe\ (RRe - 1)}{Pe\ (RRe - 1) + 1}$$

Here.

Pe is the proportion of the total surveyed population exposed to the risk factors
Pd is the proportion of the population affected by a disease
AP is an attributable fraction (percentage of the diseased in the exposed group that is attributable to exposure).
RRe is the relative risk ratio expressed as the ratio of the exposed group to the unexposed group of the population.

We also estimated the confidence interval (95% CI) for PAF. The statistical analysis was performed in Stata-13 package.

3. Results

Table 1 presents the prevalence of CVDs for round 1, round 2, and pooled analysis. Result indicate that prevalence of CVDs was increased from (26 and 50 per 1000 population) 2004-05 to 2011-12. It was higher in females and those having less than 5 years of education and lower among males and those having 6–12 years of education. As household income and member's age increased, the prevalence of CVDs increased too. CVDs were more prevalent among diabetic patients, and markedly higher in the 33 years and above age population in both

Table 1
Prevalence rate of cardiovascular disease (per 1000 population) by socioeconomic-demographic characteristics in population aged 15 years and above age in India: round 1, round 2, and pooled data.

Socioeconomic-demographic characteristics	Cardiovascular diseases prevalence (per 1000 population)		
	Round 1 (2004-05)	Round 2 (2011-12)	Pooled data (2004-05 & 2011-12)
Overall	26.1	50.0	37.6
Place of residence			
Rural	20.6	40.3	29.9
Urban	39.8	71.1	55.6
Household's social group			
Non-SC/ST/OBC	36.6	70.5	52.2
Other Backward Class (OBC)	25.3	48.8	36.8
Scheduled Caste (SC)/Scheduled Tribes (ST)	16.0	31.8	23.7
Household's religion			
Hindu	25.1	46.9	35.6
Muslim	26.1	61.8	43.2
Others [a]	39.2	70.0	53.4
Household's Monthly Per Capita Expenditure (MPCE)			
Poorest	8.1	20.3	13.4
Poor	12.7	29.2	20.3
Middle	21.8	40.1	30.4
Rich	30.3	56.4	43.1
Richest	50.8	81.8	66.8
Age-group			
15–29	2.7	2.9	2.8
30–44	20.0	29.0	24.3
45–59	50.8	86.4	69.5
60 and above age	79.1	132.1	108.1
Member's sex			
Male	21.3	39.6	30.3
Female	31.0	61.5	45.3
Member's education: Completed Years of Schooling			
Not educated	26.7	56.2	39.9
1–5 years	31.9	65.9	48.0
6–12 years	22.5	41.0	31.6
> 12 years	31.6	44.4	38.7
Member's occupation			
Non-workers	30.1	61.1	44.4
Legislator senior officials/professional	39.1	55.3	47.0
Skilled agricultural/elementary workers	12.1	25.2	18.8
Craft and machine trade workers	17.7	30.9	24.6
Other workers	28.1	44.3	36.4
Body Mass Index (BMI)			
Underweight	8.8	21.6	18.0
Normal weight	25.9	44.5	33.8
Overweight	56.2	109.3	96.3
Obese	74.2	161.4	141.8
Fat intake (per capita g/day)			
< 60 gm.	25.2	47.6	35.7
60-75 gm.	34.5	55.4	46.1
≥75 gm.	32.9	73.2	55.2
Diabetes			
No	21.6	39.0	29.9
Yes	333.0	443.5	406.3
Number of diseases	**3,772**	**5,381**	**9,153**
Total surveyed population	**141,272**	**99,974**	**241,246**

[a] Others religion includes Christian, Sikh, Buddhist, Jain, and Others religion.

Table 2
Mean cost of total health care expenditure (medical and non-medical) of cardiovascular diseases of inpatient and out-patient in population aged 15 years and above age in India, 2004-05 and 2011-12.

Health care expenditure of inpatient and out-patient	Health care expenditure (in rs.)		Percent Change from 2004-05 to 2011-12
	2004–05 (95% CI)	2011–12 (95% CI)	
Total health care expenditure	8483 (6447–10520)	14380 (11718–17043)	69.5
Inpatient cost	15725 (10199–21251)	24360 (19062–29657)	54.9
Medical & treatment[a]	14699 (9361–20037)	23509 (18245–28772)	59.9
Transportation[b]	1026 (679–1374)	851 (664–1038)	−17.1
Out-patient cost	4183 (3553–4813)	7500 (5060–9940)	79.3
Medical & treatment[a]	3879 (3283–4476)	7245 (4823–9668)	86.8
Transportation[b]	304 (235–373)	254 (192–317)	−16.2

Health expenditure for round 2 (2011-12) presented at a constant price of 2004-05.
Note: The expenditure cost calculated only for those individuals having only CVDs (no any other major morbidities).
[a] Medical & treatment cost includes the doctors fee, hospital cost, surgery cost, medicine, and other test expenses, etc.
[b] Includes bus train taxi fare or lodging while getting treatment.

Table 3
Mean cost of health care expenditure of CVDs for both inpatient and outpatient by socioeconomic and demographic characteristics in population aged 15 years and above age in India, 2004-05 and 2011-12.

Socioeconomic-demographic characteristics	Total health care expenditure (in Rs)		Percent Change from 2004-05 to 2011-12
	Round 1 (2004-05)	Round 2 (2011-12)	
Overall	**8483 (6447–10520)**	**14380 (11718–17043)**	**69.5**
Type of health facility			
Public	6434 (4374–8493)	12319 (7087–17551)	91.5
Private	9395 (6642–12148)	15098 (11948–18248)	60.7
Others[b]	2598 (1224–3972)	7037 (756–13319)	170.9
Place of residence			
Rural	7449 (5474–9424)	14178 (11210–17147)	90.3
Urban	10055 (6166–13944)	14674 (9793–19556)	45.9
Household's social group			
Non-SC/ST/OBC	10053 (7051–13055)	16730 (12606–20854)	66.4
Other Backward Class (OBC)	8207 (4266–12147)	14279 (9471–19087)	74.0
Scheduled Caste (SC)/Scheduled Tribes (ST)	5650 (3232–8068)	10311 (6290–14331)	82.5
Household's religion			
Hindu	8243 (10102 - 6383)	14697 (11778–17616)	78.3
Muslim	10686 (1502–19870)	13024 (4701–21346)	21.9
Others[a]	6590 (3679–9500)	13594 (5586–21602)	106.3
Household's Monthly Per Capita Expenditure (MPCE)			
Poorest	3047 (1120–4975)	6148 (2854–9443)	101.8
Poor	3000 (2063–3938)	4565 (2899–6231)	52.2
Middle	3899 (2820–4977)	6731 (3463–9998)	72.6
Rich	6071 (4611–7532)	8690 (5777–11604)	43.1
Richest	13741 (9202–18280)	24489 (18850–30129)	78.2
Member's sex			
Male	12171 (7874–16468)	18561 (14428–22694)	52.5
Female	5741 (4512–6969)	9907 (6697–13117)	72.6
Age-group			
15–29	4657 (2807–6508)	6800 (4076–9524)	46.0
30–44	6498 (4624–8373)	10086 (6117–14056)	55.2
45–59	7783 (5121–10445)	14518 (9654–19381)	86.5
60 and above age	14107 (7379–20835)	17737 (12848–22627)	25.7
Member's education: Completed Years of Schooling			
Not educated	6263 (4810–7717)	11222 (7282–15162)	79.2
1–5 years	6691 (4249–9132)	14524 (9487–19562)	117.1
6–12 years	9106 (4549–13664)	15353 (10416–20290)	68.6
> 12 years	20624 (8112–33136)	27776 (13794–41759)	34.7
Duration of hospitalization (in days)			
No days	4183 (3553–4813)	7547 (5124–9971)	80.4
1–5 days	6310 (4826–7794)	12856 (7990–17722)	103.7
6–10 days	12700 (5962–19437)	20484 (14262–26706)	61.3
≥11 days	33528 (17455–49601)	40254 (27540–52968)	20.1

Health expenditure for round 2 (2011-12) presented at a constant price of base year (2004-05).
Note: Health care expenditure includes medical and non-medical cost (doctors fee, hospital cost, surgery cost, medicine, and test expenses, and bus train taxi fare or lodging while getting treatment) of inpatient and outpatient of CVDs.
The expenditure cost calculated only those populations were suffering from cardiovascular diseases.
The cured cases were excluded from the analysis due to recall biasness.
[a] Others religion includes Christian, Sikh, Buddhist, Jain, and Others religion.
[b] Other included traditional healer, pharmacy, and others.

Table 4
Random effect logistic regression and Tobit model of effect of health care expenditure on CVDs by socioeconomic-demographic characteristics in population aged 15 years and above age in India, panel data analysis.

Socioeconomic-demographic characteristics	Random effect logistic regression model		Tobit model	
	Adjusted odds ratio (95% CI)	p value	HCE (95% CI)[#]	p value
Type of health facility				
Public[a]				
Private	0.97(0.82,1.15)	0.730	3541.29** (559.93,6522.64)	0.020
Others	0.52***(0.35,0.79)	0.002	−2340.93 (−6468.34,1786.49)	0.266
Duration of hospitalization (in days)				
No days[a]				
1–5 days	1.59***(1.27,1.99)	0.000	2256.39 (−1173.62,5686.4)	0.197
6–10 days	1.90***(1.49,2.44)	0.000	6975.36*** (2491.62,11459.09)	0.002
≥11 days	2.16***(1.71,2.72)	0.000	23799.35*** (15117.22,32481.48)	0.000
Place of residence				
Rural[a]				
Urban	1.38***(1.18,1.62)	0.000	−1649.00 (−5074.08,1776.08)	0.345
Household's social group				
Non-SC/ST/OBC[a]				
Other Backward Class (OBC)	0.88(0.75,1.04)	0.145	471.85 (−3538.75,4482.45)	0.817
Scheduled Caste (SC)/Scheduled Tribes (ST)	0.80**(0.65,1.00)	0.045	−329.84 (−4269.1,3609.41)	0.870
Household's religion				
Hindu[a]				
Muslim	1.48***(1.20,1.83)	0.000	2343.27 (−3219.12,7905.65)	0.409
Others	1.14(0.87,1.49)	0.353	−1742.03 (−6013.77,2529.71)	0.424
Households Monthly Per Capita Expenditure (MPCE)				
Poorest[a]				
Poor	1.34(0.92,1.94)	0.125	−1443.85 (−4509.19,1621.49)	0.356
Middle	1.49**(1.05,2.11)	0.024	−1590.91 (−5257.34,2075.53)	0.395
Rich	1.59***(1.13,2.24)	0.007	211.67 (−3213.83,3637.16)	0.904
Richest	1.61***(1.15,2.25)	0.006	6605.35*** (2244.46,10966.24)	0.003
Member's sex				
Male[a]				
Female	0.79***(0.68,0.93)	0.005	−3409.99** (−6300.35, −519.63)	0.021
Age-group				
15–29[a]				
30–44	1.19(0.84,1.70)	0.323	−834.05 (−5756.35,4088.26)	0.740
45–59	1.20(0.85,1.71)	0.303	782.10 (−4499.2,6063.4)	0.771
60 and above age	0.96(0.67,1.38)	0.823	2816.92 (−2389.09,8022.92)	0.289
Member's education: Completed Years of Schooling				
Not educated[a]				
1–5 years	1.02(0.83,1.26)	0.819	370.75 (−3640.42,4381.92)	0.856
6–12 years	0.97(0.80,1.18)	0.75	1792.96 (−2408.22,5994.13)	0.403
> 12 years	0.97(0.70,1.35)	0.852	5699.64 (−3997.53,15396.82)	0.249
Marital status				
Single[a]				
Married	1.16(0.77,1.74)	0.473	3129.24 (−3254.95,9513.42)	0.336
Widow/divorced/separated	1.09(0.69,1.73)	0.704	5619.92 (−2439.76,13679.61)	0.172

****significant at p < 0.01, **significant at p < 0.05, * significant at p < 0.10.
Note: The HCE (95% CIs) is presented in Indian Rupees (INR).
+Others religion includes Christian, Sikh, Buddhist, Jain, and Others religion.
++ Other included traditional healer, Pharmacy, and others.
[a] Reference category.

round and pooled data.

The mean HCE on CVDs (for both inpatients and outpatients) is presented in Table 2. The HCE for 2011-12 is presented at the constant price for base year 2004-05. The HCE is expressed in Indian rupees (INR). The overall HCE was INR 8,483 in 2004-5, which became INR 14,380 in 2011-12. The health care cost was higher for inpatients than for outpatients. On the other hand, transportation cost for health care for inpatients as well as for outpatients was decrease (−17.1% versus −16.2%) during the same period.

Table 3 presents the mean HCE on CVDs by socioeconomic-demographic characteristics for 2004-05 and 2011-12. The average HCE increases over time in all socioeconomic-demographic subgroups. Health care expenditure increased more in population residing in rural areas (INR 7,449 and 14,178) compared to the urban areas (INR 10,055 and 14,674) over time. It also increased with increasing income, age, and education of members. It was observed to be lower among females (INR 5,741 and 9,907) than males (INR 12,171 and 18,561) during the study period. The HCE increased with an increasing number of days hospitalized due to CVDs. The percent change was more in case of those who were hospitalized for 1–5 days (103.7%) than those who were hospitalized for 11 and above days (20.1%) from 2004-05 to 2011-12.

Table 4, comprising results of the random effects model of HCE on CVDs was found that compared with the rural areas, the urban areas was significantly associated with HCE on CVDs (1.38, 95% CI: 1.18–1.62). Similarly, richest population was significantly associated with spending more of HCE than the poorest population. The Tobit model of marginal effect of HCE on CVDs presented in Table 4. The adjusted HCE of CVDs (in INR) is dependent variable. The health care expenditure significantly more in private health facility (INR 3541.29, CI: 559.9–6522.64) than public ones. It was higher for those hospitalized 6–10 days (INR 6975.36, CI: 2491.62–11459.09) and ≥11 days (INR 23799.35, CI: 15117.22–32481.48) than non-hospitalized population. Similarly, expending on health care of CVDs was lower in females (INR -3409.99, CI: −6300.35–519.63) as compared to male population.

The analysis of the PAF was done using the adjusted odds of risk factors that are presented in Table 5. Almost 3.0% of the CVD cases

Table 5
Population attributable fraction (PAF) of cardiovascular diseases in population aged 15 years and above age in India, pooled data (2004-05 and 2011-12).

Risk factors	Adjusted PAF (95% CI)
Body Mass Index (BMI)	
Non-obese	
Overweight risk	8.43 (7.65–9.20)
Obese	4.77 (4.23–5.31)
Fat intake (per person g/day)	
< 60 g/day	
60–75 g/day	2.08 (1.39–2.76)
≥75 g/day	2.96 (2.23–3.68)
Diabetes	
No	
Yes	18.34 (17.64–19.03)
Member's education: Completed Years of Schooling	
> 12 years	
6–12 years	17.61 (13.12–21.86)
1–5 years	−10.74 (−17.34–4.51)
Not educated	16.51 (11.38–21.33)

were attributable to ≥75 g/person/day fat intake. The result also reveals that 18.3% of the CVD cases were attributable due to diabetes. About ~17% cases each were attributable to having no education and having 6–12 years of education. The PAF analysis revealed that 8.4% and 4.8% cases were attributable to overweight and obesity.

4. Discussion

CVDs are a significant cause of morbidity in India and pose a grave economic burden. The present study attempts to study the scenario of CVDs and the HCE incurred on them by socioeconomic-demographic subgroups. Our study findings revealed that CVDs increases at an almost double rate from 2004-05 to 2011-12. The prevalence of the diseases increased with increase in age, income, overweight, and obesity. The findings are consistent with other study show that overweight and obesity are associated with coronary heart diseases[22] and it is one of the risk factors of hypertension.[23] Unhealthy diet and low physical activity are prevalent among overweight and obese population. Many epidemiological studies have found that heart diseases, diabetes, stroke, obesity, etc. are mainly caused by a high calorie and unbalanced diet.[23,24] A healthy diet is an important modifiable risk factor in the prevention and development of chronic disease.[24,25] The PAF analysis showed that an ample number of CVD cases could be attributed to overweight and obesity. A previous study shows that physical activity is one of best practices to improve the health status.[26] Therefore, study suggests increasing physical activity with consumption of low-fat diet.

The health care expenditure on CVDs has increased over time. It is lower in females than in males even though the prevalence of CVDs is more in females compared to males. A study has shown that there is a considerable gender gap in HCE in India.[27] A study found that 73% of the difference in HCE can be attributed to gender discrimination. The difference is more in treatment seeking and medical expenses.[27] Gender discrimination in health care expenditure occurs because women are more engaged in household chores and non-economic activities. Only about 27% of women are involved in paid employment in India.[28] Women involved in household chores and caregiving do not receive direct economic benefits the way men do; consequently, female health receives less importance than male health. The discrimination is also caused due to health shocks faced by households due to financial constraints. Budget constraints result in more importance being accorded to male health than to female health.[29]

Our study found that urban populations expend more on health care of CVDs than rural population. The health care expenditure goes on increasing from the poorest to the richest, the youngest to the oldest, and the least educated to the most educated population. A previous study showed that more CVDs occurred in settings where the health expenditure was growing at a higher rate and was led by the private sector. The HCE is higher among the rural population, those who stay longer in hospitals, those who utilize private health facilities, and those who suffer from NCDs.[30] The study found that, the HCE in private health facilities was higher than in public health facilities. The HCE increases with the number of hospitalization days. The medical and treatment cost of inpatient visits is significantly higher than that of outpatient visits. This finding is supported by another study, which highlighted that the inpatient care cost of the decedent population was higher compared to that of the survivors.[30]

The present study has contained some limitations. The first and the most crucial limitation is that the health care expenditure information was collected during a 12-month reference period. Therefore, there is a possibility of recall bias that may have affected the overall health care expenditure data. Secondly, the IHDS data provides the health care expenditure information for any major morbidities (not for specific diseases). For our analysis of health care expenditure, we considered those respondents that reported only CVDs. Therefore, the actual health care cost may be slight differing. However, despite these limitations, this study provides comprehensive panel estimates of the prevalence of CVDs, the health care expenditure on them, and their association with socio-economic-demographic covariates. This study suggests that minimizing the risk factors can prevent and delay the burden of CVDs and reduces health care expenditure.

In conclusion, the study reveals that the prevalence of CVDs increases for all socioeconomic and demographic subgroups over time. Similarly, the health care expenditure on CVDs also increases over time and it increases more for inpatients than for outpatients. The health care expenditure on CVDs increases with increase in income, age, and education. The health care expenditure on CVDs is lower among females. It increases with the increase in the number of hospitalization days. The study findings also suggest that diabetes, overweight, and obesity are preventive risk factors of CVDs. Therefore, the high-risk population needs to take necessary steps for the prevention of CVDs and from the superfluous burden of health care expenditure.

Ethical clearance

The study utilized the secondary data of India Human Development Survey (IHDS) which is publicly available through Inter-University Consortium for Political and Social Research (ICPSR). The ethical approval to use the data granted by the University of Maryland and the National Council of Applied Economic Research (NCAER), New Delhi.

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Declaration of competing interest

We declare that no competing interests exist.

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Not applicable.

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