

Differential in the disease pattern and its effect over household out-of-pocket healthcare expenditure: An analysis of fifteen agro-climatic zones in India

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Background

Increasing burden of non-communicable diseases (Kshatriya & Acharya, 2016; Deo, 2016; Prabhakaran, Jeemon & Roy, 2016), persistence of communicable diseases (Dikid et al.,2013; John et al., 2011) growing elderly population (Yadav & Arokiasamy, 2014; Maharana & Ladusingh, 2014) high out-of-pocket health care expenditure (Mohanty et al., 2016; Das & Ladusingh, 2018) dominance of private health care sector (Balarajan, Selvaraj & Subramanian, 2011) are recently the most discussed concerns in Indian healthcare system. The rapid epidemiological transition along with demographic transition over the last two decades has drastically impacted on morbidity patterns and associated healthcare expenditure in India. India is a very heterogeneous country in terms of climatic conditions, soil, land use pattern besides uneven distribution, concentration, and characteristics of the population across the region. Recent evidences suggest that, although India currently is experiencing a rapid epidemiological transition but the disease pattern is not similar across the country due to various land pattern and climatic conditions (Den, 2003; Majra & Gur, 2009; Dash & Hunt,2007).

Further the distribution of diseases is largely effected by environmental factors, availability and accessibility of health care services of a particular area(Dhara, Schramm & Luber, 2013; Joon & Jaiswal, 2012). Latest report published in 2014 by Intergovernmental Panel on Climate Change (IPCC), an organisation jointly established by United Nations Environmental Programme and World Meteorological Organisation in 1988 to look at the impact of climate change globally in different sector, raised major concern over rise in temperature, change in rainfall and sea level rise in the current century globally.

In India, under the Ministry of Environment & Forest, Government of India (GOI) a network based programme, namely, Indian Network of Climate Change Assessment (INCCA) which undertake scientific assessment of different aspect of climate change projected regional analysis for 2030s in four climate sensitive region of India, i.e. himalayan region, western ghat, coastal area, north-east region. According to the report, a rise by 1.7°C and 2.0°C in 2030s is projected in the annual mean surface air temperature. Moreover, the frequency of rainy days is likely to decrease all over country but the climate change will vary across regions (Ministry of environment, India, 2010).

Health is affected by the consequences of climate changes namely, increasing temperature, extreme weather, air pollution, increment in the water, food, vector and rodent borne diseases, food and water shortage and population displacement (McMichael, Woodruff & Hales, 2006). Globally a loss of 5.5 million disability adjusted life years (DALYs) was estimated due to climate change in 2000 (compared to the baseline climate of 1960-91) (McMichael et al., 2003). And in South-Asian regional countries the estimated loss was about 2.2 million which was nearly half (46.6%) of the total loss. Around 20 per cent of DALYs due to global burden of diseases attributed to India, whereas, percentage share of DALYs due to global burden of chronic diseases and communicable diseases were 44 per cent and 42 per cent respectively (McMichael et al., 2003). There was a 36.2% fall of age-standardised in India from 1990 to 2016. And the magnitude, causes of diseases burden and the risk factors vary greatly across states (Dandona et al., 2017).

However, this statistics, overlook the variation in diseases prevalence within India but this indicates a strong requirements of the awareness about potential impact of climate change in human health across agro-climatic regions. The resulting concerns are not just epidemiological but also economic. Irrespective of household wealth status, the healthcare expenditure is largely dependent on the burden of communicable and non-communicable diseases over the population. The healthcare system of India is one of the most highly dependent on out-of-pocket (OOP) payment in the world 67.74 per cent in 2013-14 (MOSPI, 2016). It is largely dominated by the private sector which is unregulated and exorbitantly expensive trapping people in catastrophic out-of-pocket expenditure (Xu et al., 2003), pushing households into impoverishment.

In 2013-14, out-of-pocket health expenditure in India has been estimated and 94.79 per cent of the total household health expenditure and it equates to 2.58 per cent of GDP (MOSPI, 2016). The insurance in rural areas and urban areas were 14.1 per cent and 18 per cent respectively (Kumar et al., 2015). Higher expenditure on health has been leading households into the trap of poverty. Health expenditure has been one of the most important areas of research in the context of India in the last two decades. Most of the study done in India on health expenditure focused on catastrophic expenditure (Mohanty et al., 2017; Pandey et al., 2018) and inter-state heterogeneity in the catastrophic expenditure (Pradhan & Dwivedi, 2017; Pandey et al., 2018; Choudhury et al., 2018).

Using household and individual level data studies largely focusing on out-of-pocket (OOP) healthcare payment in Indian context and concluded that place of residence, wealth status, insurance, demographic characteristics of household and household head, illness, number of individuals in a household are the main determinants of household health care expenditure (Das & Ladusingh, 2018; Balarajan & Selvaraj, 2011; ladusingh & Pandey, 2013; Dhak, 2015).

Although the level of OOP household healthcare expenditure over household income bears a significant contribution to lead a household into the catastrophic payment and impoverishment, no studies have examined the extent of OOP household payment on health at agro-climatic regional level in India.

Monitoring the differentials in disease pattern and associated level of out-of-pocket expenditure is important to focus the requirement for health policies to distribute the resources and services to the populations of different agro-climatic regions in India.

The purpose of the study was to analyse the differentials of epidemiological transition across different agro-climatic regions in India in between 1995-2015. In addition to this, we aimed to explore the level of out-of-pocket healthcare payment and its significant determinants across different agro-climatic regions in India during 2014-15.

Methods:

Data

Unit level data of consumption expenditure on health were used from three decadal rounds of national representative surveys on morbidity and healthcare conducted by the national sample survey organisation (NSSO); 52nd (1995-96), 60th (2004-05) & 71st (2014-15) for this study. The NSSO, under the ministry of statistics programme implementation (MOSPI), government of India (GOI) collect detailed information on various socioeconomic and health aspects of the population. The detailed sampling design, survey instruments, funding and initial findings is available in national reports (www.icsrdataservice.in). Although sample size were different, in all the three surveys similar sampling design were adopted. This permits the comparability in variables which can be used to make statistical inference about the change across three points. The individual-level data were collected from households sampled were 120942 in NSS 1995-96, 73868 in NSS 2004-05 and 65932 in NSS 2014-15, respectively. The total number of individual sampled were 633405 in NSS 1995-96, 385055 in NSS 2004-05 and 335499 in NSS 2014-15. Information collected on episodes of hospitalisations for one year recall period and non-institutional information on the occurrence of diseases for 15 days recall period from every household. Items on institutional health care expenditure includes doctor's/surgeon's fee, medicines, diagnostic tests, bed charges, other medical expenses, and transport and non-medical expenses in the reference period of 1 year.

Non-institutional health spending includes doctor's/surgeon's fee, medicines, diagnostic tests, other medical expenses, transportation and other non-medical expenditure in the reference period of 15 days. We used age-wise population distribution of India data from census 1991, 2001, 2011 at regional level from freely available census of India website (censusindia.gov.in).

Measures

Based on physiography, soil, cropping patterns, geological formation, agricultural production and climatic behaviour, India was divided into 15 agro-climatic zones (**Appendix 1**) as defined by the Planning Commission of India (www.planningcommission.nic.in). These regions are: western himalaya region, eastern gangetic plain region, lower gangetic plain region, middle gangetic plain, upper gangetic plain, trans gangetic plain, eastern plateau and hill region, central plateau and hill region, western plateau and hill region, southern plateau and hill region, east coast plain and hill region, west coast plain and hill region, Gujarat plain and hill region, western plain and hill region, and island region. These agro-climatic division were used in this study.

The classification adopted by world health organisation (WHO) in global burden of diseases (GBD) 2013 was followed to classify the communicable and non-communicable diseases in this study (**Appendix 2**). Using the concept of direct standardization method (Pathak & Ram, 1992), age-adjusted prevalence rate (AAPR) of any morbidity or ailment has been defined as the number of persons ailing within reference period per 100000 persons exposed to the risk of the ailment of the same population adjusted by age-group. For each age group, age-specific prevalence rate (ASPR) is defined as the number of cases in each age-group estimated population of that age group with a multiplier of 10000. AADR of Each ASPR is multiplied by the proportion of standard population (i.e., corresponding census of India) of the same population. The formula is $AAADR = \text{Summation of } (ASDR \times \text{Standard population})$ (Naing, 2000).

The outcome variable in this study, out-of-pocket household health care expenditure, was given in the dataset in two format i.e. inpatient and outpatient. This survey has collected information on medical and

non-medical expenditure for inpatient care for every hospitalisation cases in a household for one year recall period. For out-patient, expenditure information on each spell of ailment in a household has been collected for 15 days recall period. Out-of-pocket expenditure were obtained after deducting the reimbursement amount or paid directly by the employer, insurance companies or other agencies. Both inpatient and outpatient expenditure were estimated for one month. It is to be stated that although household health expenditure is close to out-of-pocket expenditure, there may be a slight difference (Mohanty et al., 2016).

The main dependent variable for this study is the household out-of-pocket healthcare expenditure was used in two format. First, the estimated monthly out-of-pocket household healthcare expenditure was used to assess average out-of-pocket household healthcare expenditure in fifteen agro-climatic regions in India and to find whether the difference in the average household healthcare expenditure across agro-climatic zones is statistically significant or not. Second, to find out the extent and significant factors of more household out-of-pocket healthcare expenditure on overall household income, the ratio between monthly household healthcare expenditure and month household income was taken for the analysis.

Based on the literature review a number of covariates which are found to be significant contributors on out-of-pocket household healthcare expenditure were considered in the analysis. The household characteristics namely place of residence (Ladusingh and Pandey, 2013; Ladusingh, Mohanty & Thangjam, 2018; Das, 2018), wealth status (Pandey et al., 2018) , insurance (Ladusingh and Pandey, 2013), household size (Ladusingh and Pandey, 2013), religion (Dwivedi &Pradhan, 2017) and social group (Dwivedi &Pradhan, 2017); household head characteristics like age (Ladusingh and Pandey, 2013; Pal, 2012), sex (Modajhvaj and Saikia, 2019; Pal, 2012), educational level (Ladusingh and Pandey, 2013) were used in the analysis. Occurrence of diseases is the most important factor variable for the incident of out-of-pocket household healthcare expenditure.

Statistical Methods

Descriptive analysis were used to examine change in the prevalence rate of communicable, non-communicable diseases between zones over three time points i.e., 1995-96, 2004-05 and 2014-15. To test the statistical significance of the difference in the prevalence rate, generalised linear model were applied separately across zones and across three time points.

Average monthly household out-of-pocket payment were calculated for all over India, each zone for social, demographic and household head characteristics and the statistical significant difference were assessed.

Fractional response model overcome the linear and non-linear econometric solution in the study of bounded data. Papke and Wooldrige (1996) proposed an alternative for linear models which doesn't require adjustment for extreme values (i.e. 0 or 1). Moreover, the quasi-likelihood approach for estimating the parameters what they proposed was fully robust and relatively efficient under the GLM assumption. Fractional logit model was used in this study to find significant correlates of out-of-pocket household healthcare expenditure at regional level.

Graphs were drawn using QGIS and for statistical data analysis, STATA 14 was used.

Results

Table 1a: Variables description and sampled households for agro-climatic regions in India, 2014-15

Variables		India	Eastern Himalaya	Western Himalaya	Lower Gangetic Plain	Middle Gangetic Plain	Upper Gangetic Plain	Trans Gangetic Plain	Eastern Plateau & Hills
		N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)
Sector	Rural	36479(67.4)	5562(81.7)	1439(81.7)	2032(65.4)	3837(89.2)	2679(68.4)	1759(51.7)	3160(80.8)
	Urban	29446(32.6)	3319(18.4)	736(18.3)	2155(34.6)	1710(10.9)	2045(31.6)	2738(48.3)	1909(19.2)
MPCE	Poor	22136(44.2)	3113(49.1)	690(36.3)	1776(53.6)	2416(53.9)	1624(43.3)	668(24.1)	2812(68.3)
	Middle	22522(32.8)	3492(36.1)	769(35.5)	1334(30.3)	1968(33.6)	1626(34.1)	1211(29.5)	1351(22.8)
	Rich	21267(23.0)	2276(14.8)	716(28.3)	1077(16.1)	1163(12.5)	1474(22.6)	2618(46.4)	906(8.8)
Insurance	No	55264(86.2)	6912(82.3)	1650(73.0)	3118(76.5)	4910(87.7)	3854(83.0)	3288(73.7)	4272(85.1)
	Yes	10661(13.8)	1969(17.7)	525(27.0)	1069(23.5)	637(12.3)	870(17.0)	1209(26.3)	797(14.9)
Household Size	1-5	43081(73.9)	6264(76.8)	1373(71.6)	3117(83.1)	2825(58.0)	2349(57.9)	2862(71.3)	3346(73.7)
	More than 5	22844(26.1)	2617(23.2)	802(28.4)	1070(16.9)	2722(42.0)	2375(42.1)	1635(28.7)	1723(26.3)
Age	12-29	24515(33.8)	3358(31.2)	803(35.4)	1482(32.1)	2175(37.2)	1923(36.5)	1735(36.8)	1958(35.3)
	30-50	19067(31.1)	2797(36.9)	632(34.6)	1253(34.1)	1409(25.3)	1188(27.1)	1359(31.6)	1456(29.9)
	More than 50	22343(35.1)	2726(32.0)	740(30.0)	1452(33.7)	1963(37.5)	1613(36.4)	1403(31.6)	1655(34.8)
Sex	Male	33609(52.0)	4549(52.8)	1102(48.1)	2148(52.1)	2887(51.0)	2455(53.4)	2348(54.3)	2632(53.3)
	Female	32316(48.1)	4332(47.2)	1073(51.9)	2039(48.0)	2660(49.0)	2269(46.6)	2149(45.7)	2437(46.7)
Education	Illiterate	20056(31.3)	1881(19.9)	630(25.0)	1196(25.7)	2239(40.4)	1785(37.6)	1163(24.1)	1698(33.1)
	Upto 10 th	33969(52.9)	5592(66.9)	1128(56.5)	2265(59.6)	2561(50.0)	2059(46.3)	2125(52.3)	2578(54.7)
	12 th and above	11900(15.8)	1408(13.2)	417(18.5)	726(14.7)	747(9.6)	880(16.1)	1209(23.6)	793(12.2)
Religion	Hinduism	50655(82.4)	4630(61.5)	1198(62.1)	3098(71.8)	4697(85.2)	3567(80.5)	3156(67.0)	4431(87.7)
	Muslim	8987(12.6)	974(22.6)	886(36.1)	1057(27.3)	834(14.6)	1122(18.4)	302(6.6)	384(6.5)
	Others	6283(5.1)	3277(16.0)	91(1.9)	32(0.9)	16(0.2)	35(1.1)	1039(26.4)	254(5.8)
Social Group	SC	11057(18.7)	819(14.0)	314(16.4)	964(25.0)	1131(21.0)	985(24.1)	1188(27.9)	793(16.0)
	ST	8382(9.1)	3817(26.3)	215(9.3)	179(4.0)	96(1.5)	61(1.4)	60(1.6)	1244(29.3)
	OBC	25842(43.3)	1979(18.9)	213(12.4)	538(11.6)	3236(60.7)	2272(47.6)	987(22.5)	1811(37.0)
	Others	20644(28.9)	2266(40.8)	1433(62.0)	2506(59.5)	1084(17.2)	1406(27.0)	2262(48.0)	1221(17.7)
Disease	No diseases	42846(68.1)	7679(83.9)	1568(76.0)	1987(50.3)	4049(74.6)	3052(67.8)	2875(67.7)	3673(75.0)
	Both com & non-com	2834(3.3)	64(0.6)	56(2.6)	378(7.2)	145(2.2)	167(2.5)	213(3.6)	128(1.7)
	Only Com	7587(12.3)	612(8.9)	175(6.7)	584(15.5)	629(12.9)	697(16.8)	594(14.2)	725(13.6)
	Only Non-Com	12659(16.4)	526(6.7)	376(14.7)	1238(27.0)	724(10.4)	808(13.0)	815(14.5)	543(9.7)
Total		65,926	8,881	2,175	4,187	5,547	4,724	4,497	5,069

Table 1b: Variables description and sampled households for agro-climatic regions in India, 2014-15

Variables		Central Plateau & Hills	Western Plateau & Hills	Southern Plateau & Hills	East Coast Plains & Hills	West Coast Plains & Hills	Gujarat Plains & Hills	Western Dry Region	Islands
		N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)
Sector	Rural	2735(74.4)	2999(59.5)	3688(56.4)	2624(64.4)	1551(47.5)	1456(56.4)	671(74.1)	287(36.2)
	Urban	2195(25.6)	2693(40.5)	3691(43.6)	2254(35.7)	1933(52.5)	1432(43.6)	413(25.9)	223(63.8)
MPCE	Poor	1987(52.1)	1740(38.4)	2243(40.8)	1656(43.4)	545(24.5)	532(26.1)	203(26.7)	131(36.4)
	Middle	1461(28.2)	1860(31.8)	2951(36.9)	1756(36.2)	1138(32.8)	1097(40.3)	343(33.1)	165(23.4)
	Rich	1482(19.8)	2092(29.8)	2185(22.3)	1466(20.4)	1801(42.7)	1259(33.6)	538(40.3)	214(40.2)
Insurance	No	4630(96.2)	5306(93.2)	6571(90.3)	4339(91.3)	2275(67.6)	2596(89.6)	1056(97.9)	487(90.4)
	Yes	300(3.8)	386(6.8)	808(9.7)	539(8.7)	1209(32.4)	292(10.4)	28(2.1)	23(9.6)
Household Size	1-5	2871(68.1)	3608(74.3)	5515(84.9)	3842(89.0)	2499(80.8)	1729(72.7)	545(61.7)	336(82.0)
	More than 5	2059(31.9)	2084(25.7)	1864(15.1)	1036(11.0)	985(19.2)	1159(27.3)	539(38.3)	174(18.0)
Age	12-29	1951(35.5)	2081(33.5)	2611(30.7)	1670(30.1)	1084(32.2)	1048(31.5)	447(417)	189(37.1)
	30-50	1318(29.0)	1652(32.0)	2255(35.3)	1412(31.6)	1044(29.1)	868(34.2)	262(25.8)	162(35.4)
	More than 50	1661(35.5)	1959(34.4)	2513(34.0)	1796(38.4)	1356(38.7)	972(34.2)	375(32.5)	159(27.6)
Sex	Male	2618(53.1)	2944(53.2)	3625(50.4)	2337(50.9)	1669(49.1)	1498(53.3)	538(49.0)	259(53.2)
	Female	2312(47.0)	2748(46.8)	3754(49.6)	2541(49.2)	1815(50.9)	1390(46.7)	546(51.0)	251(46.9)
Education	Illiterate	1738(37.3)	1612(25.1)	2493(33.4)	1549(32.7)	671(15.5)	822(28.1)	440(45.1)	139(20.4)
	Up to 10th	2349(50.1)	2978(56.2)	3471(47.9)	2458(50.8)	2047(63.0)	1573(56.6)	503(43.1)	282(54.5)
	12 th and above	843(12.6)	1102(18.7)	1415(18.6)	871(16.5)	766(21.5)	493(15.3)	141(11.8)	89(25.1)
Religion	Hinduism	4452(92.5)	4775(84.9)	6309(87.2)	4376(91.3)	2264(67.4)	2543(90.1)	892(85.6)	267(74.7)
	Muslim	423(6.6)	570(9.5)	830(10.1)	286(5.0)	744(19.9)	280(7.9)	146(10.8)	149(8.8)
	Others	55(0.8)	347(5.6)	240(2.7)	216(3.7)	476(12.7)	65(2.0)	46(3.6)	94(16.5)
Social Group	SC	960(20.8)	883(15.2)	1286(17.4)	945(19.3)	293(9.3)	269(9.1)	212(20.7)	15(3.0)
	ST	688(17.6)	620(11.2)	365(5.3)	147(3.5)	207(5.1)	479(17.2)	38(5.6)	166(11.2)
	OBC	2161(43.5)	2140(38.3)	4151(57.9)	2759(55.8)	1755(49.5)	1168(38.1)	563(54.9)	109(24.3)
	Others	1121(18.1)	2049(35.3)	1577(19.4)	1027(21.3)	1229(36.2)	972(35.6)	271(18.8)	220(61.6)
Disease	No diseases	3599(77.4)	3915(76.3)	4096(64.3)	2309(57.3)	1313(45.2)	1722(70.7)	779(79.0)	229(54.9)
	Both com & non-com	117(1.4)	152(1.7)	404(3.3)	296(3.4)	454(11.8)	172(4.1)	31(2.7)	57(5.1)
	Only Com	519(11.1)	625(10.9)	884(11.4)	599(10.2)	445(14.1)	328(10.0)	103(7.2)	68(13.7)
	Only Non-Com	695(10.0)	1000(11.2)	1995(21.0)	1674(29.2)	1272(29.0)	666(15.3)	171(11.2)	156(26.3)
Total		4,930	5,692	7,379	4,878	3,484	2,888	1084	510

Table 2a: Average total household healthcare expenditure by agro-climatic zones and background characteristics in India, 2014-15.

		India (in INR)	Western Himalaya (in INR)	Eastern Himalaya (in INR)	Lower Gangetic Plain (in INR)	Middle Gangetic Plain (in INR)	Upper Gangetic Plain (in INR)	Trans Gangetic Plain (in INR)	Eastern Plateau & Hills (in INR)
		Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)
Sector	Rural	3396(3195, 3597)	3477(2656,4298)	1252(1022,1482)	3058(2168,3948)	2366(1969,2762)	3918(3242,4593)	4775(3161,6389)	1709(1416,2002)
	Urban	5385(5036, 5735)	2646(1162,4131)	4816(3563,6068)	5159(3960,6358)	3765(2812,4719)	7365(5235,9495)	5310(4248,6371)	3808(2648,4967)
MPCE	Poor	1685(1538, 1832)	1789(1174,2404)	960(707,1213)	2190(1266,3115)	1469(1115,1824)	2018(1454,2583)	1534(715,2353)	1393(1078,1709)
	Middle	3333(3110,3557)	4050(2616,5484)	1446(1124,1768)	3017(2259,3774)	2804(2135,3473)	3352(2704,4000)	3421(2431,4412)	2470(1909,3030)
	Rich	9586(9023,10149)	4386(2931,5842)	6170(4480,7860)	10523(8065,12981)	6259(4975,7542)	13208(10091,16325)	7875(6209,9541)	6727(4446,9008)
Insurance	No	3858(3668, 4047)	3307(2443,4172)	1851(1442,2260)	3361(2578,4144)	2339(1991,2687)	4573(3897,5250)	4610(3515,5704)	1989(1580,2398)
	Yes	5206(4645, 5767)	3373(2220,4527)	2163(1313,3014)	5163(3540,6787)	3788(2255,5322)	7123(3168,11078)	6222(4490,7954)	2807(1863,3751)
Household Size	1-5	3339(3125, 3553)	2787(1901,3673)	1787(1311,2263)	3270(2577,3962)	1934(1487,2380)	3414(2056,4773)	4151(2991,5311)	1748(1295,2201)
	More than 5	6038(5694, 6382)	4684(3508,5860)	2300(1872,2728)	6321(4112,8530)	3325(2749,3901)	7193(6074,8313)	7223(5687,8759)	3131(2455,3806)
Age	12-29	4312(4001, 4623)	3487(2467,4506)	2442(1685,3199)	4549(3058,6039)	2773(2168,3377)	6062(4110,8015)	5183(3846,6519)	1979(1532,2427)
	30-50	3507(3216, 3798)	3393(1763,5023)	1380(904,1856)	3071(1879,4263)	2655(2001,3308)	4550(3198,5902)	4321(3138,5503)	2094(1334,2853)
	More than 50	4259(3927, 4591)	3057(2076,4038)	1991(1340,2641)	3779(2808,4749)	2173(1579,2768)	4285(3353,5217)	5573(3386,7761)	2260(1509,3011)
Sex	Male	3978(3730, 4225)	3457(2553,4361)	2023(1400,2645)	4365(3114,5616)	2709(2179,3240)	5069(4142,5996)	4785(3336,6234)	1846(1464,2228)
	Female	4115(3849, 4381)	3203(2118,4288)	1776(1411,2141)	3155(2534,3776)	2319(1844,2793)	4933(3350,6515)	5328(4230,6426)	2414(1745,3083)
Education	Illiterate	3228(2962, 3493)	2842(1581,4104)	1683(1015,2351)	2698(1924,3472)	2168(1722,2615)	3342(2683,4001)	5159(2690,7628)	2016(1541,2491)
	Upto 10 th	3765(3544, 3987)	3522(2531,4514)	1399(1186,1612)	3548(2556,4539)	2300(1798,2802)	4692(3760,5624)	4427(3425,5430)	1947(1485,2409)
	More than 10th	6590(5921, 7258)	3375(1715,5035)	4812(2660,6963)	6648(4253,9043)	5126(3443,6809)	9799(5482,14117)	6247(4343,8151)	3107(1387,4828)
Religion	Hinduism	3933(3730, 4136)	3941(2898,4985)	2014(1540,2489)	3853(2968,4738)	2579(2180,2978)	5029(3947,6110)	4696(3792,5601)	2137(1734,2541)
	Muslim	4000(3567, 4433)	2053(1430,2675)	1994(446,3542)	3646(2502,4790)	2143(1397,2889)	3850(2918,4782)	2497(892,4103)	2571(1189,3953)
	Others	5946(5078, 6813)	7459(0,16974)	1366(1107,1625)	2569(0,7937)	3586(0,11948)	22768(0,47304)	6521(3771,9270)	1199.2(0,2703)
Social Group	SC	2946(2652, 3239)	3123(1616,4630)	1512(838,2187)	3273(1546,5000)	2296(1663,2929)	3062(2249,3875)	3652(2707,4597)	1599(1036,2162)
	ST	1877(1620, 2133)	2817(1082,4552)	1221(1002,1441)	880(11,1749)	1307(0,3065)	23145(7470,38821)	4216(0,8928)	1176(812,1539)
	OBC	4169(3887, 4452)	2621(488,4753)	2312(1651,2973)	2283(1364,3201)	2326(1895,2757)	4160(3353,4968)	3811(2478,5144)	2631(1961,3300)
	Others	5250(4832, 5669)	3595(2650,4540)	2296(1288,3303)	4500(3545,5455)	3561(2417,4705)	7290(4632,9947)	6435(4735,8136)	3036(1813,4259)
Disease	No diseases	2545(2388,2702)	2595(1782,3408)	1428(1143,1713)	2842(1868,3816)	1779(1422,2137)	3547(2849,4245)	3222(2443,4000)	1697(1312,2082)
	Only Com	4054(3519, 4588)	3705(2441,4969)	1558(1134,1983)	4357(1299,7414)	2658(1775,3541)	3388(2314,4462)	5204(3822,6586)	2244(1484,3004)
	Only Non-Com	8884(8208, 9560)	6425(4325,8524)	6150(2807,9494)	4739(3658,5820)	6390(4840,7939)	12651(8299,17004)	10933(7011,14855)	4262(2405,6118)
	Com & non-com	8651(7630, 9672)	5321(2086,8555)	17104(0,36389)	5092(3521,6662)	5432(2618,8246)	8361(4113,12609)	12740(5188,20292)	5705(3320,8091)
Total		4043(3862,4225)	3325(2618,4033)	1906(1538,2274)	3785(3072,4498)	2518(2160,2875)	5006(4112,5900)	5033(4107,5960)	2111(1736,2486)

Table 2b: Average total household healthcare expenditure by agro-climatic zones and background characteristics in India, 2014-15.

		Central Plateau & Hills (in INR)	Western Plateau & Hills (in INR)	Southern Plateau & Hills (in INR)	East Coast Plains & Hills (in INR)	West Coast Plains & Hills (in INR)	Gujarat Plains & Hills (in INR)	Western Dry Region (in INR)	Islands (in INR)
Variables		Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)	Average(95% CI)
Sector	Rural	2328(1732,2923)	4987(4116,5858)	4102(3397,4807)	3442(2902,3982)	10036(7809,12262)	3260(2496,4024)	3486(2249,4722)	1463(166,2759)
	Urban	4505(3360,5651)	5041(4037, 6045)	5433(4606,6259)	6186(4633,7739)	7267(5835, 8699)	4148(3011,5284)	3374(1446,5303)	3025(999,4985)
MPCE	Poor	1145(821,1470)	2133(1526,2740)	2158(1701,2616)	1717(1151,2283)	1679(994,2365)	1374(625,2122)	1134(514,1755)	232(0,617)
	Middle	2765(1831,3698)	4257(3406,5108)	4318(3442,5193)	3499(2743,4254)	4767(3714,5820)	2183(1564,2802)	2305(1318,3291)	2671(1230,411)
	Rich	7650(5827,9473)	9513(7841,11185)	9916(8429,11403)	11810(9363,14257)	15482(12900,18064)	7168(5619,8717)	5944(3783,8104)	4355(1661,7048)
Insurance	No	2808(2254,3363)	4986(4304,5668)	4578(4016,5141)	4419(3654,5183)	9097(7263,10931)	3416(2789,4043)	3468(2429,4506)	2304(1117,3492)
	Yes	4864(2025,7703)	5321(2918,7724)	5655(3841,7469)	4436(2824,6048)	7510(6308,8711)	5631(2136,9125)	2954(0,11668)	3920(0,10784)
Household Size	1-5	2273(1631,2916)	3706(3016,4396)	4086(3479,4693)	3868(3085,4652)	6788(5455,8121)	2994(2200,3787)	2290(1266,3314)	2351(987,3714)
	More than 5	4195(3198,5192)	8780(7308,10252)	8029(6834,9223)	8904(7207,10600)	6120(12788,19451)	5389(4144,6634)	5335(3370,,7299)	2960(365,5555)
Age	12-29	2748(2008,3488)	5163(4180,6146)	5445(4574,6316)	4027(3292,4763)	8825(6261,11389)	3662(2642,4683)	4109(2230,5987)	2335(894,3777)
	30-50	2215(1616,2813)	4112(3109,5115)	3706(2931,4482)	4826(3058,6594)	6382(4883,7881)	3011(1916,4107)	2965(761,5170)	2514(548,4480)
	More than 50	3573(2306,4839)	5693(4334,7052)	5008(3902,6115)	4395(3336,5453)	10040(7746,12333)	4267(2941,5593)	3010(1823,4197)	2558(0,5414)
Sex	Male	3048(2295,3801)	4753(3843,5663)	4413(3765,5061)	4063(3250,4876)	8950(6873,11027)	3114(2311,3917)	3327(2234,4419)	2469(701,4236)
	Female	2703(1914,3491)	5300(4352,6248)	4957(4100,5814)	4790(3640,5940)	8230(6684,9776)	4255(3165,5344)	3582(1841,5322)	2450(871,4029)
Education	Illiterate	2384(1620,3147)	4599(3557,5642)	4066(3036,5095)	3780(2904,4656)	6857(5218,8495)	2598(1871,3324)	2419(1241,3596)	2068(89,4046)
	Upto 10 th	2834(2001,3667)	4755(3813,5698)	4537(3892,5182.)	3617(2891,4343)	7752(6220,9285)	3802(2832,4772)	4372(2618,6127)	2122(632,3613)
	Above 10 th	4575(2993,6158)	6316(4719,7913)	6165(4710,7620)	8153(5056,11250)	1225(8421,16086)	4994(2922,7067)	4083(497,7668)	3509(23,6996)
Religion	Hinduism	2783(2232,3335)	5009(4291,5728)	4462(3902,5022)	4363(3603,5124)	8048(6411,9685)	3508(2823,4193)	3472(2363,4580)	2363(920,3806)
	Muslim	3790(1283,6298)	4626(2785,6468)	6055(4082,8029)	3909(2233,5586)	9115(6883,11347)	3964(1801,6127)	3565(25,7105)	5519(1563,9476)
	Others	7078.(0,15550)	5652(2639,8665)	6651(3056,10246)	6524(3200,9847)	10590(6704,14477)	8696(0,17866)	2781(0,6516)	1265(0,3794)
Social Group	SC	1992(965,3019)	3869(2716,5022)	3653(2776,4531)	2592(192,3260)	5364(2931,7796)	3176(1563,4789)	3227(1970,4485)	10894(0,24938)
	ST	1215(681,1748)	2049(1007,3091)	3503(1813,5194)	1414(126,2702)	1310(602,2018)	1742(991,2492)	646(0,2014)	4316(484,8148)
	OBC	2943(2200,3686)	4998(3916,6081)	5081(4264,5898)	4936(3830,6043)	9808(7865,11752)	3099(2350,3848)	3422(2105,4740)	2159(283,4035)
	Others	5396(3549,7243)	6451(5145,7756)	4736(3743,5729)	5218(3775,6662)	8751(6486,11016)	5273(3642,6904)	4648(1371,7926)	1833(434,3231)
Disease	No diseases	2178(1625,2731)	3607(2932,4281)	2784(2300,3269)	2282(1679,2885)	3459(2401,4517)	2134(1594,2674)	2360(1555,3164)	1246(169,2324)
	Only Com	2330(1485,3175)	5550(3921,7178)	4036(3138,4934)	8907(4362,13451)	3770(2783,4758)	3468(1930,5006)	6430(0,14051)	3443(0,7898)
	Only Non-Com	7447(5011,9882)	12289(9850,1478)	9720(7987,11454)	6278(5118,7439)	17636(14284,20988)	9162(6625,11699)	8229(4309,12148)	3632(1273,5991)
	com & non-com	7817(3092,12543)	13143(5373,2093)	10211(7933,1249)	10755(7945,13566)	9310(7382,11237)	7553(4597,10509)	5763(1937,9590)	5375(0,12834)
Total		2886(2341,3430)	5009(4352,5665)	4683(4145,5221)	4420(3713,5127)	8583(7300,9867)	3647(2979,4314)	3457(2424,4490)	2460(1270,3650)

Table 1a and 1b shows the frequency and per cent distributions of number of households for each agro-climatic zones and potential covariates for out-of-pocket household healthcare payment. Table 2a and 2b further presents the average out-of-pocket healthcare expenditure for each agro-climatic zones and separately background characteristics.

Variation in prevalence of communicable and non-communicable diseases by agro-climatic zone and change over time is better visualize from pictorial presentation as map.

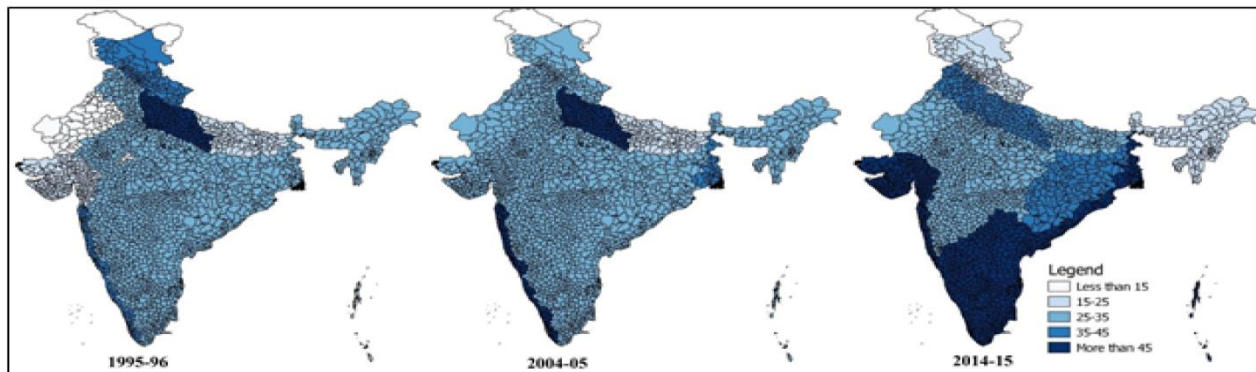


Figure 1: Age-adjusted prevalence rate of communicable diseases in regions of India, 1995-2015.

Figure 1, presents the trends in age-adjusted prevalence rate for communicable diseases across fifteen agro-climatic zones in India, 1995-2015. The prevalence for communicable diseases decreased in western Himalaya, eastern Himalaya and upper Gangetic plain in between 1995-96 to 2014-15. Whereas, the prevalence rate increased in rest of zones in India. Slight increment in the age-adjusted prevalence rate of communicable diseases were observed in middle Gangetic plain, central plateau & hills, western plateau & hills and western dry region. The age-adjusted prevalence rate of communicable diseases increased to 35-45 per 100000 population in trans Gangetic plain, eastern plateau & hills region during 1995-2015. Substantial rise in the age-adjusted prevalence of communicable diseases was witnessed in Gujarat plain & hills, West coast and plain hills, Southern plateau & hills, East coast & plains & hills, Lower gangetic plain regions of India during 1995-2015.

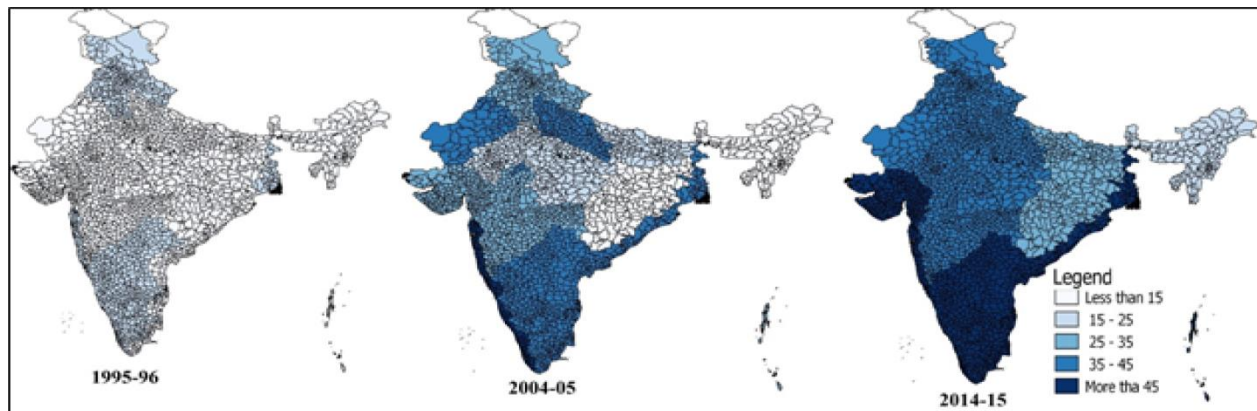


Figure 2: Age-adjusted prevalence rate of non-communicable diseases in regions of India, 1995-15.

Between 1995 and 2015, the age-adjusted prevalence rate of non-communicable diseases increased across every zones in India (Figure 2). Age-adjusted prevalence rate of non-communicable diseases slightly increased to 15-25 per 100000 population during 1995-2015 in eastern Himalaya region. In Eastern plateau & hills and Middle Gangetic plain the age-adjusted prevalence of non-communicable diseases increased to 25-35 per 100000 population in between 1995 to 2015. In regions namely western Himalaya, trans Gangetic plain, upper Gangetic plain, western dry region, central plateau & hills, western plateau & hills there were a moderate increase in age-adjusted prevalence rate of non-communicable during 1995-2015. Looking at the concentration in prevalence rate of non-communicable diseases, a substantial increment were observed to the regions falling in the coastal and southern areas of India namely Gujarat plain & hills, west coast & plain hills, southern plateau & hills, east coast & plain & hills, lower Gangetic plain. All the difference between zones and time points were statistically significantly different at $P < 0.05$.

Table 3: Percentage of households incurring expenditure on health by level of spending on health over household income across fifteen agro-climatic regions of India, 2014-15.

Proportion of expenditure	India	Western himalaya	Eastern himalaya	Lower gangetic plain	Middle gangetic Plain	Upper gangetic plain	Trans gangetic plain	Eastern plateau & hills	Central plateau & hills	Western plateau & hills	Southern plateau & hills	East coast plains & hills	West coast plains & hills	Gujarat plains & hills	Western dry region	Islands
0-5	69.4	70.4	80.5	56.1	73.9	67.2	70.3	74.0	77.7	72.4	66.0	64.2	53.4	76.1	78.0	88.0
5-10	6.8	7.3	5.1	8.6	6.8	6.4	7.9	5.8	4.8	6.6	6.7	8.0	9.1	6.7	4.2	3.2
10-50	17.0	15.4	10.4	25.7	12.1	19.5	16.7	14.0	11.8	15.6	19.0	19.7	27.3	14.1	13.9	5.5
50-90	3.9	4.2	2.7	5.1	4.3	3.7	3.4	3.3	3.1	2.7	4.6	4.9	6.5	1.5	2.1	2.1
>90	3.0	2.8	1.3	4.5	3.0	3.3	1.8	2.9	2.6	2.7	3.7	3.2	3.7	1.7	1.8	1.2

Table3 presents extent of out-of-pocket (OOP) expenditure on over household income across fifteen agro-climatic regions of India, 2014-15. The level of out-of-pocket health expenditure on overall household income were categorised into five classes i.e. 0-5 per cent, 5-10 per cent, 10-50 per cent, 50-90 per cent and more than 90. In India, average 69.4 per cent households spent at least 5 per cent of their income on health during 2014-15. Around 17 per cent households spent 10-50 per cent of their household income on health whereas 3 per cent of the average Indian households spent more than 90 per cent of their household income on health during 2014-15. 80.5 per cent households spent at least 5 per cent and 10.4 per cent households spent 10-50 per cent of their household income on health in eastern Himalaya region during 2014-15. However, in west coast plain & hills, the percentage of households spent at least 5 per cent of their usual household expenditure were lesser than other zones 53.4 per cent. In Gujarat plains & hills, central plateau & hills, western dry region and island higher percentage of households were reported spending at least 5 per cent of household income on health. On an average 4.5 per cent of the households in lower Gangetic plain spent more than 90 per cent of the household income. More than one-fourth of the average households in the west coast hills & plain region spent 10-50 per cent of their household income on health.

Table 4a. Average marginal effect of determinants of out-of-pocket household healthcare expenditure across fifteen agro-climatic zones in India, 2014-

15

	Categories	Eastern Himalaya	Western Himalaya	Lower Gangetic Plain	Middle Gangetic Plain	Upper Gangetic Plain	Trans Gangetic Plain	Eastern Plateau & Hills
	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)
Sector	Rural® Urban	1.08(0.98-1.18)	0.83(0.69-0.98)	0.83(0.75,0.93)	0.86(0.77,0.96)	0.81(0.72,0.90)	0.87(0.78,0.98)	0.96(0.85,1.08)
MPCE	Poor® Middle	0.76 (0.69-0.84)	.81(0.67,0.98)	.73(.65,.83)	.85(.75,.95)	.76(.67,.85)	.72(.60,.85)	.73(.64,.83)
	Rich	0.74 (0.65-0.84)	.53(.42,.66)	.67(.58,.78)	.72(.62,.83)	.73(.63,.84)	.54(.46,.65)	.65(.55,.78)
Insurance	No® Yes	0.87(0.79-0.97)	1.06(0.88,1.28)	.91(.81,1.01)	1.24(1.07,1.44)	.88(.77,1.01)	.98(.87,1.10)	1.03(.90,1.19)
Household Size	1-5® More than 5	0.97(0.89-1.07)	.86(0.73,1.03)	.87(.78,.98)	.82(.74,.92)	.97(.87,1.08)	1.01(.90,1.13)	.91(.81,1.02)
Age	12-29®							
	30-50	0.99 (0.89-1.09)	1.01(.84,1.23)	1.12(.99,1.26)	1.11(.99,1.26)	1.01(.89,1.14)	1.05(.93,1.19)	1.18(1.04,1.33)
	More than 50	1.19 (1.07-1.32)	1.24(1.04,1.49)	1.30(1.16,1.46)	1.13(1.01,1.27)	1.08(.96,1.21)	1.03(.91,1.17)	1.18(1.05,1.34)
Sex	Male® Female	1.03 (0.95-1.12)	1.05(.89,1.22)	.95(.86,1.05)	1.03(.93,1.13)	1.00(.91,1.11)	1.06(.96,1.18)	1.09(.98,1.21)
Education	Illiterate® Up to 10 th	1.04(0.93-1.16)	1.03(.87,1.23)	1.06(.94,1.18)	1.21(1.09,1.34)	1.16(1.04,1.29)	1.03(.91,1.16)	1.09(.97,1.23)
	12 th and more	1.48 (1.27-1.71)	1.20(.94,1.53)	1.41(1.19,1.66)	1.51(1.28,1.78)	1.27(1.08,1.49)	1.02(.87,1.19)	1.22(1.03,1.45)
Religion	Hinduism®							
	Muslim	0.95 (0.81-1.10)	.98(.82,1.16)	.95(.84,1.08)	1.10(.95,1.26)	.95(.84,1.07)	.75(.60,.93)	.99(.83,1.19)
	Others	0.94 (0.83-1.08)	.97(.61,1.55)	.69(.40,1.20)	1.82(.98,3.39)	.63(.32,1.25)	1.12(.99,1.27)	.69(.53,.90)
Social Group	SC®							
	ST	0.85 (0.71-1.01)	.91(.65,1.27)	.83(.61,1.13)	1.05(.70,1.57)	.73(.46,1.14)	.88(.53,1.44)	.71(.60,.84)
	OBC	1.22 (1.04-1.42)	.66(.48,.89)	1.07(.89,1.27)	1.190(1.04,1.35)	1.03(.90,1.18)	1.00(.86,1.16)	1.21(1.04,1.41)
	Others	1.13 (0.96-1.33)	.82(.64,1.03)	1.27(1.11,1.44)	1.32(1.12,1.55)	1.17(1.01,1.36)	1.04(.91,1.18)	1.11(.94,1.32)
Disease	No diseases® Both com & non-com	10.45 (7.57-14.43)	8.60(6.14,12.05)	6.21(5.29,7.29)	6.33(5.03,7.97)	6.28(5.05,7.82)	6.03(4.99,7.28)	7.25(5.61,9.37)
	Only Com	4.76 (4.21-5.37)	4.63(3.69,5.82)	2.30(2.00,2.64)	3.22(2.83,3.67)	2.49(2.20,2.82)	2.74(2.39,3.15)	3.27(2.89,3.70)
	Only Non-Com	6.76 (5.96-7.68)	7.25(6.06,8.69)	3.97(3.52,4.48)	6.63(5.85,7.52)	4.64(4.12,5.23)	4.65(4.10,5.28)	5.92(5.12,6.86)

Table 4b. Average marginal effect of determinants of out-of-pocket household healthcare expenditure across fifteen agro-climatic zones in India, 2014-15

Variables	Categories	Central Plateau & Hills	Western Plateau & Hills	Southern Plateau & Hills	East Coast Plains & Hills	West Coast Plains & Hills	Gujarat Plains & Hills	Western Dry Region	Islands
	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)	OR(95% CI)
Sector	Rural [®] Urban	.72(.64,.81)	.84(.76,.93)	.87(.80,.94)	.90(.82,.99)	1.01(.91,1.12)	.78(.68,.91)	.77(.60,.98)	1.49(.96,2.32)
MPCE	Poor [®] Middle Rich	.91(.79,1.04) .80(.68,.93)	.78(.70,.88) .66(.58,.75)	.79(.72,.87) .73(.65,.82)	.78(.69,.87) .71(.63,.81)	.92(.77,1.09) .80(.68,.95)	.79(.65,.95) .74(.60,.93)	.65(.47,.89) .56(.40,.77)	1.00(.59,1.69) .82(.46,1.46)
Insurance	No [®] Yes	.79(.62,1.00)	.68(.57,.82)	.77(.68,.87)	.99(.86,1.14)	.80(.72,.89)	.75(.60,.94)	1.29(.59,2.83)	.44(.17,1.15)
Household Size	1-5 [®] More than 5	.87(.77,.98)	.95(.86,1.04)	.93(.85,1.02)	.96(.86,1.07)	1.02(.91,1.14)	.73(.63,.85)	.77(.61,.98)	.89(.57,1.37)
Age	12-29 [®] 30-50 More than 50	1.17(1.02,1.33) 1.48(1.30,1.68)	1.00(.89,1.11) 1.17(1.05,1.30)	.98(.89,1.07) 1.11(1.01,1.22)	1.00(.89,1.12) 1.16(1.03,1.30)	1.02(.90,1.16) 1.18(1.04,1.34)	.99(.85,1.16) 1.11(.95,1.30)	1.13(.84,1.5) 1.08(.84,1.38)	.85(.53,1.38) .84(.48,1.47)
Sex	Male [®] Female	1.07(.96,1.19)	1.01(.93,1.11)	1.03(.96,1.11)	1.00(.92,1.10)	1.06(.96,1.18)	1.26(1.11,1.43)	1.17(.93,1.46)	1.23(.82,1.87)
Education	Illiterate [®] Up to 10 th 12 th and more	1.12(.99,1.27) 1.32(1.11,1.58)	1.03(.92,1.14) 1.20(1.04,1.39)	1.02(.93,1.11) 1.14(1.01,1.29)	1.09(.98,1.21) 1.22(1.06,1.42)	1.00(.88,1.13) 1.02(.87,1.21)	1.12(.96,1.30) 1.48(1.18,1.85)	1.21(.96,1.52) 1.44(.98,2.12)	.93(.57,1.52) 1.28(.63,2.62)
Religion	Hinduism [®] Muslim Others	1.02(.85,1.23) 1.11(.66,1.86)	.79(.67,.92) 1.01(.82,1.24)	.93(.83,1.0) .82(.66,1.02)	.89(.74,1.06) 1.07(.87,1.31)	.97(.85,1.10) 1.21(1.04,1.41)	1.15(.92,1.42) .98(.62,1.54)	1.00(.71,1.39) .81(.47,1.39)	.69(.38,1.24) .40(.18,.86)
Social Group	SC [®] ST OBC Others	.72(.59,.88) 1.03(.89,1.20) 1.25(1.06,1.48)	.74(.61,.91) 1.16(1.00,1.34) 1.24(1.07,1.44)	.98(.81,1.20) 1.16(1.04,1.29) 1.22(1.07,1.38)	1.10(.82,1.48) 1.08(.96,1.22) 1.35(1.17,1.56)	.63(.47,.85) 1.03(.85,1.26) 1.03(.85,1.26)	.57(.43,.75) .94(.74,1.18) 1.12(.88,1.44)	.98(.52,1.85) 1.15(.84,1.56) 1.23(.88,1.73)	2.11(.72,6.11) 1.41(.51,3.89) .71(.26,1.94)
Disease	No diseases [®] Both com & non-com Only Com Only Non-Com	6.32(4.87,8.19) 3.56(3.08,4.12) 5.78(5.07,6.59)	5.80(4.667,2.1) 2.89(2.56,3.26) 4.73(4.256,5.26)	5.66(4.89,6.54) 2.59(2.33,2.88) 4.36(4.00,4.76)	6.62(5.56,7.88) 2.66(2.32,3.04) 3.93(3.52,4.37)	5.04(4.29,5.93) 2.00(1.71,2.34) 3.86(3.39,4.40)	4.37(3.45,5.54) 2.69(2.23,3.24) 4.21(3.62,4.89)	6.57(4.12,10.48) 3.27(2.37,4.51) 5.98(4.55,7.84)	4.59(2.63,7.99) 1.48(.79,2.77) 2.89(1.80,4.66)

Table 4a and 4b presents the odds ratio and 95% confidence level of odds ratio for covariates of out-of-pocket household healthcare expenditure for all fifteen agro-climatic zones. Controlling the occurrence of diseases in a household, proportion of out-of-pocket healthcare payment were positively associated with lower income household, absence of insurance, and presence of any sort of diseases in eastern Himalaya region. Controlling the presence of diseases, household belonging to highest wealth tertile were 0.53 times more likely to spend more of their household income on health as compared to lowest wealth tertile.

Place of residence has no significant effect on higher level of out-of-pocket healthcare expenditure over household income in eastern Himalaya, eastern plateau & hills, west coast plains and hills and Islands. Except western Himalaya, Gangetic plain, eastern and central plateau and hills, east coast plains and hills, western dry region and island has no significant effect on proportion on out-of-pocket expenditure on health. However, the presence of insurance inversely effected on level of out-of-pocket expenditure in eastern himalaya, middle gangetic plain, central plateau & hills, western plateau & hills, southern plateau & hills, west coast plains & hills, gujarat plains & hills at significant level $P < 0.05$. Household with more than 5 family members spent less of their household income on health as compared to household with 5 or less family members. And this relationship is statistically significant in lower Gangetic plain, middle Gangetic plain, central plateau and hills, Gujarat plains and hills, western dry region at $P < 0.05$. The proportion of out-of-pocket household healthcare expenditure on overall healthcare expenditure was significantly higher in household headed by 30 or more years age-group than the household headed aged less than 30 years age-group in eastern plateau and hills and, central plateau and hills. Household headed by females were more likely to spend household income on health in Gujarat plains and hills and this association was significant at $P < 0.05$. Household headed class by educational level of class 10th or more are likely to spend more on healthcare rather than household headed by illiterate individuals.

Discussion:

Focus of research in the last two decades has been on the increasing burden of non-communicable diseases (Gulati & Pandey, 2015; Lee et al., 2012; Beaglehole et al., 2011), burden of infectious diseases (Joon & Jaiswal, 2012; Gupta et al., 2012) but the differential in the increasing pattern of both communicable and non-communicable diseases and associated household out-of-pocket healthcare expenditure have not been explored.

This paper reiterates the fact that increasing burden of diseases is the main cause of out-of-pocket household health care expenditure. In this study, we assessed the regional variation in the diseases pattern due to agro-climatic differentials and associated out-of-pocket health expenditure. This study also determined significant factors for out-of-pocket household healthcare expenditure in fifteen agro-climatic zones.

The main findings of this study are: first, along with non-communicable diseases, communicable diseases are also increasing at the same pace but the dispersion was highly heterogeneous across agro-climatic zones. Second, the significant increment in the concentration of both communicable and non-communicable diseases increased in Gujarat plain & hills, west coast & plain hills, southern plateau & hills, east coast & plain & hills and lower Gangetic plain regions of India. Third, out-of-pocket household healthcare expenditure was substantially higher in lower Gangetic plain, southern plateau & hills, east coast & plain & hills, west coast & plain & hills region in India, 2014-15. Fourth, controlling occurrence of diseases and other household level variables significance difference in the mean out-of-pocket household healthcare expenditure were observed across agro-climatic regions. Fifth, monthly out-of-pocket household healthcare expenditure was substantially higher in west coast plains and hills (₹8583), trans gangetic plain (₹5033), upper Gangetic plain (₹5006) and lower in eastern Himalaya (₹1906), eastern plateau and hills (₹2111) and island (₹2460). Sixth, difference in the influencing factors for out-of-pocket healthcare expenses across agro-climatic regions were observed.

Now we shall discuss for each agro-climatic regions in India.

In Eastern himalaya region the age-adjusted prevalence of communicable (17/1000) and non-communicable diseases (16/1000) was comparatively lower than other agro-climatic region in 2014-15. Around 14.4 per cent households spent more than 10 per cent household income on health, which was comparatively lower than most of the agro-climatic regions of India. Average out-of-pocket household healthcare spending was lower (₹8105) in this region as compared to other regions. Controlling occurrence of diseases in a household; wealth status, presence of insurance was significant determinants of more household healthcare expenditure. Similar to the Eastern himalaya, in Eestern himalaya there was decrement in the age-adjusted prevalence rate of communicable diseases reduced (38/1000 to 24/1000) and non-communicable diseases (18/1000 to 40/1000) moderately increased. Household's place of residence was a significant determinant of household out-of-pocket inpatient healthcare expenditure.

In case of gangetic plain, except Upper gangetic plain, everywhere the prevalence of communicable diseases increased. The increment in the communicable diseases (35/1000 to 65/1000) was substantially higher in lower Gangetic plain during 1995-2015. The age-adjusted prevalence rate of non-communicable diseases increased in every part of Gangetic plain, however, the increment was substantially higher in lower Gangetic plain (17/1000 to 103/1000). Consequently, the amount of out-of-pocket household healthcare expenditure was higher than any other parts of Gangetic plain. More than one-fourth of the households spent 10-50 per cent of household income health. However, mean estimated out-of-pocket household healthcare expenditure in the trans gangetic plain (₹23109) was higher than average amount of household out-of-pocket healthcare expenditure by the in the lower Gangetic plain (₹18458). Controlling occurrence of diseases in a household; the place of residence, household wealth status was significant across all the gangetic plains.

Moderate increment in the prevalence of communicable diseases were observed in all the plateau and hills areas. However, the prevalence of non-communicable diseases substantially increased in Southern plateau & hills (17/1000 to 83/1000) regions. The mean out-of-pocket household healthcare expenditure was

significantly higher in the Western and southern plateau and hills (₹20092 and ₹19304) than other areas of plateau and hills regions. Household place of residence, wealth status, presence of insurance, social group were the significant contributor in the out-of-pocket household healthcare expenditure.

Highest increment in the prevalence of non-communicable diseases were observed in coastal areas i.e. in east coast plain and hills, it increased from 15/1000 to 117/1000 and in the west coast plain and hills it increased from 17/1000 to 142/1000 respectively. Households in the coast areas are the most vulnerable to incur more amount of household spending on health.

Conclusion:

This study suggest requirement of proper programme implementation considering differentials in the disease prevalence and pattern of health expenditure. Along with initiation and strengthening of programmes for non-communicable diseases, existing programmes for communicable diseases need to be monitored and supervised strictly. The insurance coverage needs to be widened, regional disparity in health expenditure needs to be reduced and vulnerable zones need to be focussed upon and subsidised health care facilities need to be increased.

Declarations:

Ethical approval and consent to participate: Not Applicable

Consent to publication: Not Applicable

Availability of data and material: The datasets analysed during the current study are available in the openICPSR repository, <http://doi.org/10.3886/E106802V1>

Competing interests: The authors declare that they have no competing interests.

Funding: This research did not receive any specific funding agencies in the public, commercial, or not-for-profit sectors.

Authors' contributions: SKD and LLS conceptualized and designed the study. SKD reviewed the literature for relevant data and documentation. SKD compiled the data, performed the analysis and prepared the primary draft of the manuscript. LLS edited and critically revised the manuscript. The manuscript is part of SKD's M.Phil work. All authors read and approved the final manuscript.

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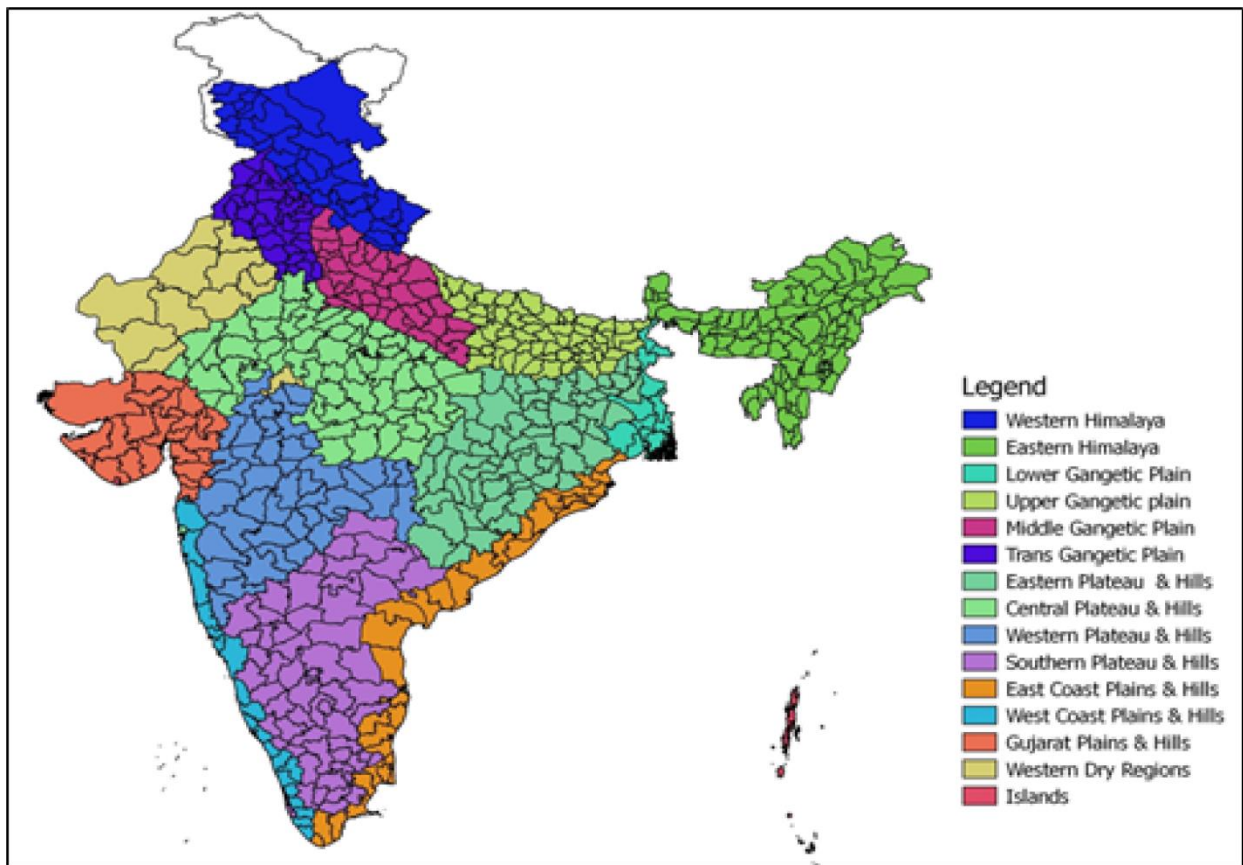
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Appendix 1: Figure 3: Agro-climatic zones of India classified by planning commission of India

Appendix 1: Table 1: Classification of communicable and non-communicable diseases

Communicable Diseases

Diarrhoea/dysentery, Gastritis/gastric or peptic ulcer, Worm infestation, Amoebiasis, Hepatitis/Jaundice, Tuberculosis, Diseases of Kidney/urinary system, Conjunctivitis, Sexually transmitted diseases, Malaria, Eruptive Mumps, Diphtheria, Whooping cough, Fever of unknown origin, Tetanus and Filariasis/Elephantiasis

Non-communicable diseases

Heart diseases, Hypertension, Respiratory including ear/nose/throat ailments, Bronchial asthma, Disorder of joints and bones, Prostatic disorder, Gynaecological disorders, Neurological disorder, Psychiatric disorders, Glaucoma, Cataract, Diseases of skin, Goitre, Diabetes mellitus, Anaemia, Locomotor, Visual including blindness (excluding cataract), Speech, hearing, and Diseases of Mouth/Teeth/Gum, Cancer and other tumors.