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Rural-Urban Differentials in NCD Multimorbidity in Adult Population in India: Prevalence and Cost of Care

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Introduction

Non-Communicable Diseases (NCDs) have collectively become the leading cause of global disease burden and also major contributors to mortality and morbidity in Low and Middle-Income Countries (LMICs). The Global Status Report released by WHO in 2010 show NCDs as one of the most significant causes of mortality worldwide contributing to 80% of mortality occurring in LMICs [1]. In India, chronic diseases are estimated to account for 53% of all deaths and 44% of disability-adjusted-life-years (DALYs) in 2005 alone [2]. Improvements in survival and an aging population are two key factors attributed for the prevalence of chronic disease and the likelihood of living with more than one condition (multimorbidity). These are expected to continue rising in the foreseeable future [3].

The prevalence of multimorbidity is associated with an increased risk of premature mortality, reduced quality of life, substantial societal costs due to increased healthcare utilization, and higher out of pocket expenditure [4]. As the population of a country ages, multimorbidity steadily increases. Clinical management of multimorbidity is complex and hindered essentially by the lack of specific guidelines. Healthcare delivery systems and medical education even in the present context continues to be addressed only as a single-disease framework. The study of the burden of multimorbidity has largely been confined to developed countries. However, there is a steady increase in the recognition of the importance of multimorbidity to populations in lower and middle-income countries [5]. There is a lack of literature in India on rural and urban differentials of NCDs and multimorbidity prevalence. This lack has hampered evidence-based interventions to reduce the prevalence of multimorbidity.

Urban areas are generally associated with lifestyle factors that lead to an increase in NCDs. Interestingly, however, studies have also shown that the prevalence of NCD is similarly high among the rural population [6]. Understandably, the access to services, health and other services, is severely limited in the rural areas compared to the urban areas [7-10]. Studies on the prevalence of NCD multimorbidity in India have been conducted to a large extent. However, studies that significantly explain its rural-urban differentials are to be carried out in the country. Hence, the need for the present study, which aims to look at the rural-urban differential in the prevalence of NCDs and at the NCD multimorbidity in the age group between 19-59 years. Previous studies show that in India NCDs starts at an early age, mostly affecting working-age population. This leads to a huge loss in work hours thus impacting the economy adversely. NCD multimorbidity is associated with a higher cost of care. The high cost of treatment becomes an immense burden for most households in India, especially those who are below the poverty line.

This becomes even more poignant and alarming when considering the plight of people who are currently employed in the private sectors in the country. Most of the workers here are employed without any health insurance cover or healthcare facilities, high out of pocket expenditure due to multimorbidity leaves many of such workers in precarious conditions. Making both ends meet while desperately attempting to foot the cost of medical treatments at the same time becomes almost always a battle for survival.

The present study also aims to compare the out-of-pocket expenditure in the rural and in the urban adult after adjusting for the insurance. In brief, this study focuses on a population between 19-59 years of age considering the pivotal role played by people in between this age group in sustaining their families and in the care and nurture of their children and the impact that NCDs have upon the former [11,12]. The study also seeks to make comparisons of the impact of NCD multimorbidity on the cost of care and out-of-pocket expenditures between the rural and the urban adult population.

Materials and Methods

Data Source

This study is based on the findings of the second round of India Human Development Survey (IHDS) which was conducted during 2011-13 under the supervision of the National Council of Applied Economic Research, New Delhi. The IHDS-II, to a large extent, provides a panoramic view of the people's status and reach in terms of education, health, employment, income, marriage, fertility, gender relations and social capital. It is described to be "a nationally representative, multi-topic panel survey of 42,152 households in 384 districts, 1420 villages and 1042 urban neighbourhoods across India." These same households have been participants also in the first IHDS. The data for the second round was collected from January 2011 to March 2013. The IHDS survey involves an interview conducted by the representative(s) of the IHDS and usually a knowledgeable informant in the household, which in most cases is the male head.

The interview covers a wide range of topics such as the socio-economic condition of the household, its level of social capital as measured by social networks and association memberships, the employment and education of all household members and short term and major morbidity. Questions on members of the household suffering with major NCDs morbidity, its related cost of care and the household's utilization of available services were also raised. The data were collected from the sample of households by face-to-face interviews with members of the household using an interview schedule. Morbidities diagnosed by doctors as major are characterized as such and inquiry on major morbidity, during the interviews, was conducted with reference to a period of 365 days. The respondents were asked whether a doctor has ever diagnosed a member of the household as having cataract, tuberculosis, heart disease, high blood pressure, diabetes, leprosy, cancer, asthma, polio, paralysis, epilepsy, mental illness, STDs/AIDS, or any other long-term illness. In the above mention list, cataract, hypertension, heart diseases, diabetes, cancer, asthma, epilepsy and mental illness represent NCDs morbidity. Further, IHDS also collected information on the choice of service provider (public/private/pharmacy/traditional) and cost incurred due to a visit to the doctor, hospitalisation, having a surgery performed on a member of the household, having tests conducted, administering medicines, and transportation to the hospital.

Analysis conducted by this study made use of data derived from studies on 1, 10,434 adults between age group 19 to 59 years with complete information on study variables. The data were derived from the data set using basic statistic, selecting only those age group belonging to 19-59 years. The data sets are publicly available through the Inter-University Consortium for Political and Social Research (ICPSR). Additional IHDS information is available at www.ihds.umd.edu.

Statistical Analysis

Statistical analyses were carried out using the Statistical Package for Social Sciences, version 22.0 (SPSS, Chicago, USA). The IHDS-II made use of a multistage sampling design in its survey. It is, therefore, important, in this regard, to use appropriate weights to make the representative estimates and also to adjust for oversampling and non-response. Hence, the study has accordingly used appropriate weights as IHDS-II while generating all the estimates presented in the paper. The details of the sampling weights, methods and organization of the IHDS-II are given in the IHDS-II report [13].

To examine the rural-urban difference in prevalence of NCD multimorbidity and its cost of care, the analysis on the whole was conducted in two parts - rural and urban. This was done in order to make a comparative study of the situation in these areas. We calculated the prevalence of NCD major morbidity by dividing the number of persons suffering with NCD major morbidity by the total number of persons in the sample. To identify the factors associated with NCDs multimorbidity, bivariate and multivariate analyses were performed.

Bivariate analyses were performed to examine the nature of the association between NCDs multimorbidity with reference to selected socioeconomic characteristics. But the binary logistic regression was applied to investigate which factors best explain the incidence of NCDs multi-morbidity. We applied two multivariate logistic regression models in this case. In the first model, the dependent variable was coded as '0' for not suffering with any NCD, as '1' for suffering with at least on NCD. In the second model dependent variable was coded as '0' for not suffering with any NCD, as '1' for suffering with NCD multimorbidity. The adjusted odds ratio (AOR) and its 95% confidence interval (CI) were calculated. A P value of <0.05 was considered significant.

The binary response (y, suffering from at least one NCD (2+ NCDs) or not) for each individual was related to a set of categorical predictors, X, and a fixed effect by a logit link function as following.

$$\text{Logit}(\pi\_i) = \log[\pi\_i/(1-\pi\_i)] = \beta\_0 + \beta(x) + \varepsilon$$

The probability of an individual who could suffer from one NCD (2+ NCDs) is π_i. The parameter $\beta 0$ estimates the log odds of suffering with one NCD (2+ NCDs) for the reference group, and the parameter β estimates with maximum likelihood the differential log odds of suffering with one NCD (2+ NCDs). These parameters are associated with the predictor X as compared to the reference group and ε represents the error term in the model.

For a cost of care and OOPE calculation, the dependent variable was coded as '0' for not suffering with any NCD, as '1' for suffering with at least one NCD and '2' as suffering with two or more NCDs. Median was calculated at 95% confidence interval

for the direct, indirect and total cost of care as well as for the OOPE. The median was also calculated after taking the source of care into consideration.

Results

Sociodemographic Characteristics and Distribution of NCD Multimorbidity

The sociodemographic characteristics of the respondents are shown in (Table 1).

Socio-demographic characteristics and lifestyle factors (tobacco and alcohol use)	Zero NCD		One NCD		More than two NCDs		AOR for having any NCD		AOR for having multi-morbidity		Unweighted N (Weighted %)	
	In (%)											
	R	U	R	U	R	U	Rural	Urban	Rural	Urban	Rural	Urban
Age												
19-26 Years	0.99	0.99	0.01	0.01	0	0	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	20352 (29)	11238 (27.5)
27-34 Years	0.98	0.98	0.02	0.02	0	0	2.568 (2.561, 2.574)	2.588 (2.578, 2.597)	5.223 (5.172,5.275)	5.204 (5.141, 5.268)	14422 -20.1	8439 -20.9
35-42 Years	0.95	0.93	0.05	0.06	0.01	0.01	6.694 (6.678, 6.710)	7.53 (7.504, 7.555)	17.878 (17.714, 18.044)	18.367 (18.155, 18.582)	14814 -21.2	8440 -21
43-50 Years	0.9	0.85	0.08	0.12	0.02	0.03	13.766 (13.734, 13.799)	18.703 (18.642, 18.765)	61.196 (60.643, 61.754)	56.612 (55.966, 57.266)	11693 -16.9	7081 -17.6
51-59 Years	0.86	0.76	0.11	0.18	0.03	0.06	20.719 (20.670, 20.769)	33.872 (33.760, 33.984)	118.907	136.634 (135.078, 138.209)	8707 -12.9	5248 -13
Gender												
Male	0.96	0.93	0.04	0.06	0.01	0.01	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	34016 -48.2	20179 -50
Female	0.94	0.91	0.05	0.07	0.01	0.02	1.327 (1.326, 1.329)	1.162 (1.161, 1.164)	1.36 (1.356, 1.364)	1.292 (1.288, 1.296)	35972 -51.8	20267 -50
Education												
Illiterate	0.94	0.88	0.05	0.1	0.01	0.02	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	23094 -35.3	6161 -15.1
Primary	0.94	0.89	0.05	0.08	0.01	0.02	1.257 (1.255, 1.258)	1.039 (1.037, 1.041)	1.485 (1.481, 1.489)	1.229 (1.224, 1.233)	11646 -16.6	4922 -12.4
Secondary	0.95	0.92	0.04	0.06	0.01	0.02	1.199 (1.198, 1.201)	0.997 (0.995,0 .998)	1.687 (1.683, 1.692)	1.184 (1.180, 1.187)	25047 -34.1	16098 -39.9

Higher Secondary	0.97	0.96	0.03	0.04	0	0.01	1.113 (1.110, 1.115)	0.803 (0.801, 0.804)	1.223 (1.216, 1.231)	0.826 (0.822, 0.831)	6507 -8.7	6220 -15.3
Graduate and above	0.97	0.94	0.02	0.05	0	0.01	0.707 (.705, .709)	0.802 (0.801, 0.804)	0.761 (0.755,0 .766)	1.051 (1.047, 1.056)	3694 -5.3	7045 -17.3
Table 6.1 Continued												
Marital Status												
Others	0.92	0.85	0.06	0.11	0.02	0.03	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	5878 -9.4	2743 -6.6
Married	0.94	0.91	0.05	0.08	0.01	0.02	0.893 (0.892, 0.894)	0.921 (0.919, 0.922)	0.848 (0.846,0 .851)	0.88 (0.877, 0.883)	5261 9(74.9)	28296 -70.6
Single	0.99	0.99	0.01	0.01	0	0	0.891 (0.889, 0.894)	0.808 (0.805, 0.810)	0.932 (0.925,0 .940)	0.764 (0.758, 0.770)	1149 1(15.7)	9407 -22.7
Wealth Index												
Poorest	0.96	0.93	0.04	0.06	0.01	0.02	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1867 6(30.2)	3406 -8.5
Poor	0.96	0.93	0.04	0.06	0.01	0.01	0.986 (0.985, 0.988)	1.086 (1.083, 1.088)	0.774 (0.772, 0.776)	1.013 (1.008, 1.018)	1607 8(24.6)	6013 -14.9
Middle	0.95	0.93	0.04	0.06	0.01	0.01	1.068 (1.067, 1.070)	0.999 (.997, 1.002)	1.01 (1.007,1.014,)	0.829 (.825, .833)	1381 1(18.6)	8270 -20.7
Rich	0.94	0.93	0.05	0.06	0.01	0.02	1.007 (1.005, 1.008)	1.002 (1.000, 1.004)	0.749 (0.747, 0.752)	0.95 (0.946, 0.954)	1213 7(15.9)	9953 -25
Richest	0.91	0.9	0.07	0.08	0.02	0.02	1.44 (1.438, 1.442)	1.168 (1.165, 1.170)	1.05 (1.046, 1.053)	1.136 (1.131, 1.140)	9279 -10.7	12804 -30.9
Occupation												
Student and not working	0.94	0.92	0.05	0.07	0.01	0.02	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1917 6(28.7)	19055 -47.3

Agriculture .animal and farm work labourer	0.95	0.91	0.05	0.07	0.01	0.02	0.636 (0.635, 0.637)	0.685 (0.683, 0.687)	0.421 (0.420, 0.422)	0.603 (0.600, 0.606)	2783 0(38.7)	1926 -4.6
Non-Agricultural labourer	0.96	0.94	0.03	0.05	0.01	0.01	0.604 (0.603, 0.605)	0.672 (0.671, 0.674)	0.47 (0.468, 0.472)	0.551 (0.549, 0.554)	122 40(18)	4812 -12.2
Salaried employees	0.95	0.92	0.04	0.06	0.01	0.01	0.743 (0.742, .744)	0.847 (0.846, 0.848)	0.667 (0.664, 0.670)	0.724 (0.721,0.726)	6109 -8.1	9559 -23.9
Family business work	0.94	0.92	0.05	0.06	0.01	0.02	0.822 (0.821, .824)	0.831 (0.830, 0.833)	0.886 (0.882, 0.889)	0.928 (0.924, 0.931)	4633 -6.4	5094 -12
Caste												
Others	0.93	0.91	0.06	0.07	0.01	0.02	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1866 2(24.8)	15117 -36
SC/ST	0.96	0.93	0.03	0.06	0	0.01	0.634 (0.633, 0.635)	0.86 (0.859, 0.862)	0.44 (0.439, 0.442)	0.776 (0.774, 0.779)	233 55(34)	8920 -21.4
OBC	0.95	0.92	0.05	0.06	0.01	0.02	0.818 (0.817, .819)	0.833 (0.832, .834)	0.73 (0.728, .732)	0.683 (0.681,0.685)	2797 1(41.3)	16409 -42.6
Religion												
Others	0.94	0.91	0.05	0.07	0.02	0.02	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	4787 -5.7	2591(6)
Hindu	0.95	0.92	0.04	0.06	0.01	0.02	0.883 (0.881,0 .885)	0.867 (0.865, 0.869)	0.578 (0.575, 0.580)	0.695 (0.692, 0.697)	580 18(83.8)	31016 -77.9
Muslim	0.93	0.92	0.05	0.06	0.02	0.02	1.215 (1.212, 1.218)	1.117 (1.114, 1.120)	1.313 (1.307, 1.319)	1.268 (1.262, 1.274)	718 3(10.5)	6839 -16.1
Location												
North zone	0.95	0.92	0.05	0.07	0.01	0.02	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	189 72(23.5)	10896(21.9)
East zone	0.95	0.92	0.04	0.07	0.01	0.01	0.836 (0.835, 0.837)	0.885 (0.883, 0.886)	0.911 (0.908, 0.914)	0.823 (0.820, 0.826)	1085 5(25.1)	6962 -14.4
West zone	0.96	0.94	0.04	0.05	0.01	0.01	0.844 (0.842, 0.845)	0.552 (0.551, 0.553)	0.773 (0.770, 0.777)	0.493 (0.491, 0.494)	139 60(17.9)	8113 -25.9
South zone	0.93	0.9	0.05	0.07	0.02	0.03	1.272 (1.270, 1.274)	1.129 (1.128, 1.131)	2.726 (2.717, 2.734)	1.729 (1.723, 1.734)	14212 (19.8)	10133 -28.7

Central zone	0.96	0.91	0.04	0.07	0	0.02	0.93 (.929, .932)	1.102 (1.100, 1.104)	0.986 (.980, .991)	1.09 (1.085, 1.096)	8429 -8.5	2545 -6.6
North Eastern zone	0.94	0.95	0.05	0.04	0.01	0.01	1.023 (1.021, 1.026)	0.512 (0.509, .514)	1.498 (1.491, 1.505)	0.561 (0.556, 0.565)	3560 -5.1	1797 -2.5
Smoke tobacco												
No	0.95	0.92	0.04	0.06	0.01	0.02	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	8804 -12.5	3260 -7.7
Yes	0.94	0.9	0.05	0.08	0.01	0.02	0.959 (0.958, 0.960)	0.818 (0.817, .820)	0.651 (0.648, 0.654)	0.815 (0.811, 0.818)	611 84 (87.5)	37186(92.3)
Chew tobacco/ gutkha												
No	0.95	0.92	0.04	0.06	0.01	0.02	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	124 77 (19.7)	4636 -11.7
Yes	0.95	0.91	0.05	0.07	0.01	0.02	1.001 (1.000, 1.003)	1.027 (1.025, 1.028)	0.833 (0.830, 0.836)	1.048 (1.044, 1.052)	575 11(80.3)	35810 -88.3
Drink alcohol												
No	0.95	0.91	0.04	0.07	0.005	0.02	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	1.00 (Ref)	7090 -10.5	2913 -7
Yes	0.94	0.92	0.04	0.63	0.009	0.01	0.917 (.915, .919)	1.052 (1.050, 1.055)	0.875 (0.871, 0.879)	1.259 (1.254, 1.265)	62 898 (89.5)	37533 -93

Table 1: Distribution of NCDs among adults across socio-demographic characteristics.

The sample comprised 65.5 % rural and 34.5 % urban individuals. In the rural area, 29% were between the ages of 19-26 years, 35% of the sample were illiterates, and 74.9 % were married. The poorest of the sample constitutes 30.2%, 41.3% belonged to the OBC category and 83.8% to the Hindu community. About 38.7% of the samples were farm labourers. The sample constitutes 25.1% from East Zone, 87.5% did not smoke tobacco, 80.3% who did not chew tobacco/gutkha and 89.5% of the adult did not drink alcohol. In the urban area, 27.5% of the sample were between the ages of 19-26 years, 39.9% responded saying that they have completed secondary schooling, and 70.6% of the sample were married. The richest of the sample constitutes 30.9%, 42.6% belonged to the OBC category and 77.9% belonged to the Hindu community. Student and those who were without any employment made up 47.3% of the sample. South Zone constitutes 28.7%, who did not smoke tobacco, 92.3%, who did not chew tobacco/gutkha, 88.3% and adult who did not drink alcohol, 93%.

Prevalence of NCD Multi-Morbidity in Both Rural and Urban Adults

(Figure 1) shows that 4.4% of the rural sample population suffered with at least one NCD while in the sample urban population 6.4% of the sample suffered with at least one NCD. In the rural areas, 0.9% suffered with multi-morbidity NCD whereas in the urban areas 1.6% suffered with two or more than two NCDs.

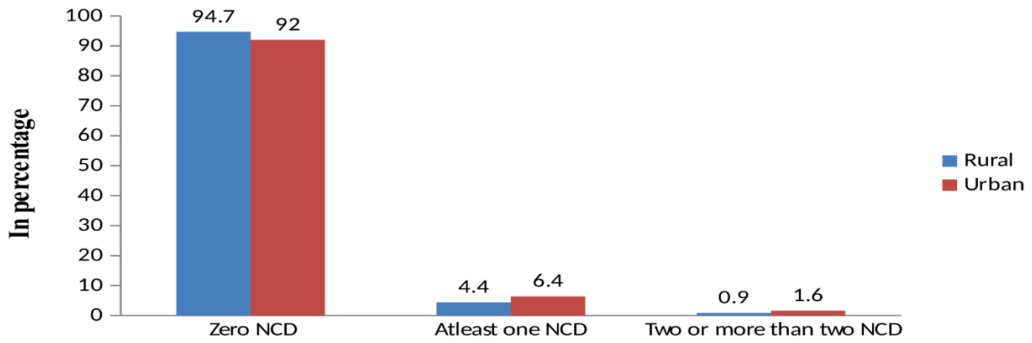

Fig 1: TIFF

Figure 1: A graph depicting the percentage of adults who suffered with zero NCD, at least one NCD and two or more than two NCD in rural and urban areas.

A breakdown of the prevalence estimates by demographic variables in rural and urban is also included in (Table 1). The table also shows that the prevalence of at least one NCD and more than two NCD is higher amongst the urban adults aged between 51-59 years; amongst females; amongst those who have completed their primary schooling, and; amongst adult who are neither married nor single, which means those who are divorced, living separately, or are widows. The prevalence is higher amongst adults who are richest, both in the case of the rural as well as of the urban areas. The prevalence of at least one NCD is higher among adults who belong to neither SC/ST nor OBC category and amongst adults who belong to other categories of religion as compared to the Hindus and the Muslims. While the prevalence of at least one NCD is higher in all four zones, NCD Multimorbidity is higher amongst the population in the South zone, both in the rural as well as in the urban areas. The prevalence of at least one NCD is higher amongst adults residing in the urban areas who smoke tobacco, chew tobacco or gutkha and consume alcohol.

Adjusted Odds Ratio for Having at Least One NCD and Multimorbidity

As expected, older adults (between 51-59 years) are more likely to suffer with one NCD (Odds Ratio=20.719, Confidence Interval=20.670, 20.769 for adult living in rural areas and OR=33.87, CI=33.760, 33.984 for adult living in urban areas) and NCD multimorbidity (OR=118.907, CI=117.835, 119.989 for adult living in rural areas and OR=136.634, CI =135.078, 138.209 for adult living in urban areas) compared to young adults in both the rural and the urban areas. Gender wise, the odds of suffering with one NCD and NCD multimorbidity is higher amongst the females residing in both the rural (OR=1.327, CI=1.326, 1.329 for one NCD and OR=1.360, CI= 1.356, 1.364 for NCD multimorbidity) and the urban areas (OR=1.162, CI=1.161, 1.164 for one NCD and OR=1.292, CI=1.288, 1.296 for NCD multimorbidity). In the rural area, adults having completed their Bachelor's degree and above were significantly less likely to suffer with one NCD (OR=0.707, CI=0.705, 0.709) as well as NCD multimorbidity (OR=0.802CI=0.801, 0.804)) compared to illiterates (reference category). However, urban adults who have completed their higher secondary education were less likely to suffer with NCD multimorbidity (OR=0.826, CI=0.822, 0.831) as compared to adults who are illiterate.

Adults belonging to the highest wealth quintile have a higher odd of suffering with one NCD (OR=1.440, CI=1.438, 1.442 for rural and OR=1.168, CI=1.165, 1.170 for urban) and NCD multimorbidity (OR=1.050, CI=1.046, 1.053 for rural and OR=1.136, CI=1.131, 1.140). Further, adults who belong to the Muslim religion have a higher odd of suffering with at least one NCD (OR=1.215, CI=1.212, 1.218 for rural and OR=1.117, CI=1.114,1.120 for urban) as well as with NCD multimorbidity (OR=1.313, CI=1.307, 1.319 for rural and OR=1.268, CI=1.262, 1.274 for urban). Again, adults belonging to the south zone have a higher odd of suffering with both or at least with one NCD (OR=1.272, CI=1.270, 1.274 for rural and OR=1.129, CI=1.128, 1.131 for urban) as well as with NCD multimorbidity (OR=2.726, CI=2.717,2.734 for rural and OR=1.729, CI=1.723, 1.734 for urban).

(Table 2) presents the direct and indirect cost of care for NCDs. The direct cost includes the cost incurred in paying for the doctors' check-up, medicines and diagnostic tests whereas the indirect cost includes travel expenses only. The table also shows the OOPE, which was calculated as total cost of care minus reimbursements. According to IHDS-II survey, only 11.3 % rural and 12.4 % urban adults had some form of health insurance.

No. of NCDs	Direct Cost				Indirect Cost				Total cost of care				Total OOPE			
	Rural		Urban		Rural		Urban		Rural		Urban		Rural		Urban	
	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI
0	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0
1	1500	1300, 2000	1100	1000, 1200	100	100, 100	10	0, 21.3	2000	1800, 2100	1300	1200, 1500	2000	1700, 2100	1205	1145.2, 1444.8
2+	4800	3055, 6000	3600	3000, 5000	300	200, 400	100	100, 100	5050	4000, 6200	4050	3327, 5029	5000	3693, 6000	3900	3105.4, 5000

Table 2: Median cost of care and Out of Pocket Expenditure for NCDs.

Cost of care associated with NCD multi-morbidity

The overall total cost of care for one NCD was higher amongst adults who resided in the rural areas compared to those who stay in the urban areas. Same is the case with NCD multimorbidity. The median total cost of care for NCD multimorbidity was found to be almost three times higher than the median total cost of care for one NCD in both the rural and the urban areas. In the urban areas, the total cost of care of NCD multimorbidity was INR 4050 which falls to INR 3900 after adjusting the insurance. However, in the rural areas the cost of care of NCD multimorbidity was INR 5050 and after adjusting insurance it was still on the higher side at INR 5000. For the total out-of-pocket expenditure, even after having adjusted for insurance, the median OOPE of one NCD and NCD multimorbidity is still higher in the rural area compared to the urban area. The median direct and indirect cost was also higher amongst the rural adults suffering with NCD multimorbidity (direct cost=INR 4800, CI= 3054.97,6000 indirect cost=INR 300, CI=200,400) compared to the urban adults who suffered with one NCD (direct cost=INR 1100, CI=1000, 1200, indirect cost=INR 10, CI=0, 21.92). (Table 3) highlights the total cost of care of NCD multi-morbidity according to source of treatment.

Number of NCDs	No treatment				Public				Private			
	Rural		Urban		Rural		Urban		Rural		Urban	
	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI
Zero NCD	0	0,0	0	0,0	2300	20,003,000	1850	1043.26,2445	5000	48,005,200	5000	42,005,500
One NCD	0	0,0	0	0,0	1200	10,001,607.56	600	500,831.77	3200	30,003,549.80	2000	20,002,200
Two or more than two NCD	0	0,0	0	0,624 .67	2200	15,004,000	1900	1000-2812.47	7000	60,008,917.50	5490	50,006,300

Table 3 Continued.

Number of NCDs	Pharmacy				Others			
	Rural		Urban		Rural		Urban	
	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI	Median	Median 95% CI
Zero NCD	470	202.07,1200	1500	46.62,2821.82	1400	530.52,2389.53	445	133.45,3667.15
One NCD	500	2,001,472.86	500	200-1268.11	2500	517.27,4883.53	1525	432.41,5482.74
Two or more than two NCD	100	0,6000	100	0,7147.55	30,000	200,062,300	1900	2,003,600

Table 3: NCDs multi-morbidity total cost of care by Source of treatment.

The cost of care, regardless of whether it was at a medical centre, a public hospital or a private one, was found to be higher in the rural areas than in the urban areas. While people from both rural and urban areas spend the same amount of INR 100 at a pharmacy, however, when it came to payment to other sources of treatment, which includes traditional healers besides the regular doctors, the cost of care was found to be higher (INR=2500, CI= 517.27, 4883.53 for one NCD and INR=30,000, CI= 2000, 62300 for NCD multimorbidity) amongst adults who live in the rural areas than those who live in the urban areas. (Table 4) shows that almost 90% of the adults in both the rural and the urban areas did not have health insurance.

Health insurance

Health insurance	IHDS- II			
	Percentage		Frequency	
	Rural	Urban	Rural	Urban
Yes	11.3	12.3	7146	5044
No	88.7	87.7	62842	35402

Table 4: Health insurance status of the adults in rural and urban in IHDS-II.

Discussion

This is the first study in India to provide a rural-urban estimate of prevalence, cost of care and OOPE of NCD multimorbidity amongst the working age group pertaining to an adult population. The findings of this study are based wholly on a nationally representative sample provided by the IHDS-II. The present study, conducted using the IHDS-II data, shows that 4.4 % of the rural adults and 6.4 % of the urban adults between the ages of 19-59 years in India have at least one NCD. About 1% of adults in the rural areas and 1.6% in the urban areas have two or more than two NCDs. The percentage of at least one NCD and NCD multimorbidity was found to be higher in the urban areas compared to the rural areas, which is consistent with the study conducted by Lee et al. (2015) in Middle-Income Countries. The reason for such a phenomenon could be because of increased prevalence of risk factors such as a sedentary urban lifestyle, physical inactivity, increase in energy and fat intake and so on. Urbanization also appears to contribute to the increase in the prevalence of the NCD risk factors [14-16]. In this regard, adults living in the urban areas have easy access to health care facility which could enhance health seeking behaviour. This could lead to prompt diagnosis of the prevalence of NCD as well as multimorbidity at higher rates than for those who are based in the rural areas with limited access to any health facilities.

The odds of suffering with one NCD and NCD multimorbidity increases with age and it was higher amongst adults who live in the urban areas than amongst those who live in the rural areas, which is consistent with the previous studies [17-19]. A study conducted by Mini and [20] also found out that prevalence of NCD increases with age and higher among those living in the developed state of India. The reason could be because of an increased access to health care services in the urban or developed state.

According to the present study, it was found that the odds of suffering with one NCD as well as NCD multimorbidity was higher amongst the females than amongst the males, which is similar to the findings of previous studies that confirm the consistent associations between gender and multimorbidity [5,19,21,22]. A higher prevalence of multimorbidity in women, in this case, may be due to the longer average life span of women, which is marked by an occurrence of multimorbidity with an increase in age [21].

The results of the association between education and an occurrence of multimorbidity, vary according to the level of education. Adults with basic education (primary school level)

have a higher odd of suffering with one NCD than people who are illiterate. Interestingly, in a study conducted by Nagel et al, (2008) [18] it was observed that low educational level was significantly associated with a higher prevalence of multimorbidity.

The odds of suffering with one NCD was higher amongst adults with the highest per capita income in rural areas as compared to the urban counterpart. However, the odds of suffering with NCD multimorbidity was higher amongst the urban adults with the highest per capita income compared to the rural adults within the same economic strata. Such findings have been noticed in earlier studies too [4,17,20]. Access to health care services is also hampered by poverty, therefore it could be that adult in the lower strata of the community could not get themselves diagnosed for NCD multimorbidity.

The prevalence of NCD multimorbidity increased substantially with increasing household wealth both in urban and rural areas. The reason for such an occurrence could be that affluent people have increased knowledge of NCDs and could afford to undergo regular check-up. In India, the correlation between socioeconomic status and multimorbidity is in contrast to that of the Western countries, where people from lower socioeconomic status are more likely to suffer from NCDs [22,20]. This difference in correlation, in India as well as in other developing countries when compared with developed countries, could be attributed to contrasting socioeconomic patterns of risk factors for non-communicable diseases. Low health care–seeking behaviour and probability of under-diagnosis amongst low-income populations could be possible explanations for lesser prevalence [22,20].

Students and not-working-adults have higher odds of suffering with one NCDs as well as NCD multi-morbidity. In the present study only those adults who were above 19 years of age were being considered for the purpose of analysis. Therefore, only a small proportion of the population comprise students while the majority of the sample is unemployed or not working. These findings have been noticed in earlier studies conducted by Picco et al, (2016) and Björklund et al. (2015) [23,24] which identified a positive association between unemployment and chronic condition.

Adults from the Southern zone of India have higher odds of suffering with one NCD and NCD multi-morbidity compared to adults from the Northern zone. A study conducted by [6] Kinra et al. (2010) appeared to confirm this finding. According to Kinra et al. the risk factors related to NCDs and NCD multimorbidity were more prevalent among South Indians when compared with the North Indians. Further, data from this study also suggest that the differences in prevalence of risk factors may be responsible, at least in part, for the higher prevalence of non-communicable diseases in South India. The evidence, however, in this regard, is limited.

Contradictory to common believe, adults who reported to be smoking and chewing tobacco as well as drinking alcohol were found to be less likely to suffer with an NCD as well as NCD multi-morbidity according to this study. Measures such as frequency of smoking, chewing tobacco and drinking alcohol were not considered in the analysis since information on the quantity of the substance and number of years consumed was not available in the IHDS data set. This contradictory finding may have cropped in due to the less reliable nature of the questions asked on tobacco and alcohol use.

The study reveals that lifestyle factors like smoking, chewing tobacco and drinking alcohol are inversely associated with the occurrence of any NCD contradictory to the previous studies. Since the IHDS-II did not collect information related to the frequency and duration of tobacco and alcohol used, there is a possibility that posing any questions in this regard would have resulted in the questions being considered unreliable. Such a scenario could arise if people having experimented at least once with tobacco or alcohol were to be inadvertently considered as regular users. Hence, the decision to avoid such questions in the first place. Furthermore, information on family history of illness was also not available in the IHDS data, hence analysis on the effect of genetic factors also could not be made.

The likelihood of having multiple chronic conditions increase with a positive family history of any chronic disease. This includes genetic, behavioural or environmental factors common to members of the same family [25].

Cost Burden Associated with One NCD and NCD Multi-Morbidity

The median total cost of care and OOPE for NCD multi-morbidity was found to be almost three times higher compared to that of one NCD. In almost all types of services, multimorbid respondents incurred higher costs than those with one or no chronic conditions. The costs of hospitalization, the fee for visiting doctors, and medication were the biggest drivers of healthcare costs [23,26]. Multimorbid persons are at high risk for polypharmacy leading to soaring healthcare costs with the increase in the number of drugs intake. Furthermore, with more adverse drug reactions due to polypharmacy, people tend to seek more specialty services leading to even higher healthcare costs [27, 28]. The median cost of care at source was higher in private facility when compared with public services as per the finding of the present study, and it was higher in people with multimorbidity. Further, the median cost of care and OOPE was higher in rural areas than in urban areas. Even after adjusting for insurance, the out-of–pocket expenditure for rural adults remains almost the same whereas for urban adults the out-of-pocket expenditure reduces marginally. This indicates that the urban population is far more covered and benefits much from insurance schemes than the rural one [29,30,31]. Moreover, study

also found out the overall health insurance cover in the country is 25% [32]. The reason of low percentage could be because of lack of awareness about the insurance scheme especially those living in the rural areas and having low educational status.

The study is consistent with the previous findings on the factors leading to NCD multimorbidity. As per the study age, sex and socio-economic status were the major determinant of NCD multimorbidity. The study mentions the types of NCD taken into consideration but not the disease wise prevalence of NCD multimorbidity which is one of the limitations of the study. Demographic and epidemiological transition is occurring globally, but remarkable transitions are experienced by the developing countries with increasing life expectancy at birth, economic development and decreasing fertility. These transitions lead to the difference in multimorbidity distribution among the various social groups thus increasing social inequality which is observed in the present study as well. Therefore, research on NCD multimorbidity in low and middle-income country is the need of the hour in order to provide evidence for policy formulation [33]. The policy planned by the government of these countries should be such that it protects the health of the working age population which are the major contributor to the economy.

Conclusion and Policy Implications

The present study highlights the prevalence of NCD multimorbidity amongst the working adult population in India. It reveals that the prevalence of NCD multimorbidity was quite high even amongst adults who are below 60 years of age. Though the prevalence is less in comparison to the studies conducted amongst the elderly population, the findings cannot be ignored since such a disease burden amongst the working age group could prove to be detrimental and costly to the society.

The study also discovered a significant relationship between the demographic variables and one NCD as well as NCD multimorbidity. Those who were found to be associated with higher odds of suffering from one and two or more than two NCDs were - adults in the older age category, females, adults with lower educational status, population with higher income, those who are unemployed and population of the Southern zone of India. Further, the study also found that the impact of insurance on the out-of-pocket-expenditure was almost negligible amongst adults from the rural areas and that the mean cost of care, out-of-pocket-expenditure was also quite high compared to the urban areas.

The current Indian National Health Policy 2017 emphasises the importance of screening for major NCDs and its secondary prevention. According to the Policy, the measures to be adopted include services in comprehensive primary health care network with linkages to specialist consultations and follows up at the primary level. However, the Policy appears to have overlooked the matter of multimorbidity. Hence, efforts need to be put in into conducting more studies in this area; creating standard treatment guidelines, and; increasing the coverage of health protection plans to reduce expenditures. The risk factors of the diseases should be addressed appropriately through lifestyle modifications, not only in the urban areas but also in the rural areas as well. Some of the immediate preventive steps that could be highlighted are balanced and healthy diets, regular exercises, addressing tobacco, alcohol and substance abuse, reducing stress and improving safety in the workplace.

Impact evaluation of health insurance especially among the rural population should be done since the population incurs a high out-of-pocket-expenditure in most situations. Further, since the rural population has limited access to proper healthcare facilities, the study recommends that appropriate policy measures be adopted by the concerned authorities to provide affordable medical services and health insurances to people in the rural areas.

Ethics Statement

The IHDS data for both the rounds were made freely available in the public domain at www.ihds.info. It is noteworthy to state here the IHDS did not implicitly or explicitly restrict the use of its data by anyone. Hence, as far as copyright infringements are concerned, the study can be safely said to be in the clear.

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