Prevalence of Multimorbidity (Chronic NCDS) and Associated Determinants Among Elderly in India

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Abstract

The primary aim of the study is to investigate the self-reported prevalence of multimorbidity (major chronic Non-Communicable Diseases) and their predictors among elderly in India. As the number of elderly in India is growing, there are around 103 million older persons in India (Census, 2011). By using the Building Knowledge Base on Population Ageing in India (BKPAI) data (2011), the study investigates the prevalence and the associated factors related to self-reported chronic non-communicable disease basically (Arthritis, Stroke, Angina, Diabetes, Chronic Lung Disease, asthma, depression, High Blood Pressure, cataract). The exposure variables were socio-demographic characteristics such as Place of residence, age, gender, education, caste, marital status, and wealth status. Multinomial logistic regression was used to determine socio-demographic determinants predictive of the presence of chronic NCDs.

The imperial finding suggests that the prevalence of chronic Non-communicable disease among elderly was 58.02%. Of all the given NCD, Arthritis evolved as the most pronounced chronic diseases among elderlyin India followed by High Blood Pressure and cataract. The prevalence of multimorbidity (1+ Chronic disease) was 23.6%. Multivariate logistic regression analysis showed that being female, being in age groups 60_69 70_79 and 80 & above, being OBC caste, having no schooling and primary level of schooling, having greater wealth, being currently not married and residing in a rural area were associated with the presence of Multimorbidity (1+ NCDs). The rising burden of multimorbidity is significantly affecting at an older age and incurs a heavy burden on the healthcare. However, due to the economicproblem, it needs more demand of healthcare service.

Introduction

A major emerging demographic concern of the 21st century is the population aging as an inevitable consequence of the demographic transition experienced by India. Declining fertility and increasing longevity have resulted in higher number of older people in the country. Even the 100-year longevity is not a rare event now. Against the backdrop of persistent economic development, India is also the residence of an increasingly older population with 103.2 million elders (Chandramouli, C., 2011). Elderly or older refers to ages close to or over the average lifespan of human beings. However, the phenomena cannot be exactly defined because it varies in all over the world communities. In India, a person aged more or equal to 60 years is referred as 'elderly.' According to census 1961, there were 5.6% of theelderly population lived in India which increased both in their size and shares with 7.4% in 2001 and 8.3 in 2011 census. It is also projected to increase to 12.4% of thepopulation by 2026 (RGI, 2011).

India's life expectancy has increased from 32 years in 1947 to 68 years in 2011 and the decline in Total Fertility Rate from 5.2 in 1971 to 2.3 in 2014 (RGI, 2013; RGI 2014). With the access to better education, health facilities and increase in life expectancy, the percentage of the elderly population (60+) has increased from 5.3 to 5.7 percent during 1971 to 1981 and 6.0 to 8.0 percent correspondingly, during the periods of 1991-2011 (RGI, 2013).

Increasing life expectancy gives not only more life years but also some health problems as well. As the health condition (morbidity) is more likely to occur in older age, the emergence of multiple chronic diseases can be attributed to theincreased lifespan of the population. The lifelong exposure can easily describe these phenomena to the risk factors such as smoking, drinking, overweight, unhealthy lifestyle.With theincrease in the life expectancy, the risk of chronic disease conditions also increases, such as diabetes, heart disease, cancer, and arthritis. Chronic diseases (non-communicable) comprise the most recurrent and costly health problems,in particular among the older population. It is prominent among the people belonging to a lower socio-economic group of the society (Arokiasamy, P.,*et al.* 2015).

Extensive literature review reveals that there is insufficient information on the distribution of chronic conditions and multimorbidity by socioeconomic and demographic factors in India. One of the studies in Chandigarh found out that female elderly were more prone to morbidity (Swami *et al.,* 2002). A Karnataka-based study on the prevalence of multimorbidity concluded that it was equally distributed amongst elderly men and women (Shraddha *et al.*, 2012). The prevalence of multimorbidity has often

been investigated in the developed nation or high-income country for example in Sweden (Marengoni, A., Angleman, S., &Fratiglioni, L. 2011), USA (Verbrugge, L. M., Lepkowski, J. M., & Imanaka, Y. 1989), and Europe (Van den Akker., *et al.,*1998). However, there are lacking available literature on multimorbidity in the low and middle-income country. As in India, a study found 83% of elderly have more than three morbidities (Joshi, K., Kumar, R., &Avasthi, A. 2003) also there are on an average 2.77 morbidity presence in rural india (Purty, A. J., *et al.,* 2006), A study of Bargarh District of Odisha found that the multimorbidity is more prominent in older age with the prevalence of 54%. Age, state of economic independence and lifestyle indicators are more important predictors of multimorbidity among study population (Banjare& Pradhan, 2014).In a study of rural Bangladesh, the overall prevalence of multimorbidity among the study population was 54% (Khanam, M. A., *et al.,* 2011).

Although the association between socio-economic status and prevalence of specific chronic diseases is well established (Marmot, 2005), very few studies have examined the association between multimorbidity and socio-economic status (Walker, 2007; Salisbury *et al.,* 2011). Limited studies have investigated how diseases distribute or co-occur in the same individual. A study on multimorbidity in Australia found that 85% of 70+ year elderly have multi-morbidity and the prevalence is higher among elderly, with obese, female, in low socio-economic status, living alone and less educate, leading to negative impact on quality of life (Walker, 2007).

Need for the Study

The impact of thenon-communicable disease is extensive, so it put theburden on the economy especially the low and middle-income country as there is high demand of health service system. Being more number of older person multimorbidity is more pronounced in the older age, so there is more concentrate on the geriatric care. Sometimesthis also shifts the share of thebudget from developmental work to more on health care services. That put adverse impact on the overall development of the economy regarding workforce (Alwan, A. 2011; Hosseinpoor, A. R., *et al.,* 2012; Kowal, P., *et al.,*2010). In most of the study multi-morbidity or co-morbidity is defined as the presence of several chronic diseases in one person (van den Akker, *et al.,* 1996). Although the study of multimorbidityis associated with aging, the prevalence of multimorbidity among population below the age of 65 yearsis often seen. The concern of multimorbidityis high due to the increasing size of theolder population is rapidlyincreasing (Chandramouli, C., 2011). India is the second largest country after Chinaregardingan absolute number of older population aged 60 years or above in the world. There is a little known about the prevalence of chronic NCDs in among 60+ populations in India. It is also important to produce evidence of chronicNCDs to make a health care system but also make strategies for prevention of NCDs(Bloom, D. E., *et al.,* 2012). This study aims to investigate the prevalence and predictors of chronic NCDs (multimorbidity) among elder Indian who participated in the BKPAI 2011.

Methods

The BKPAI (Building Knowledge Base on Population Ageing in India) is carried out in India with United Nations Population Fund (UNFPA) India, in collaboration with the Population Research Centre (PRC), Institute for Social and Economic Change (ISEC), Bangalore, the Institute of Economic Growth (IEG), New Delhi and the Tata Institute of Social Sciences (TISS), Mumbai. A primary survey was carried out in seven states of India(Himachal Pradesh, Punjab, West Bengal, Odisha, Maharashtra, Kerala and Tamil Nadu), that covered a total of 9852 elders from 8329 elderly households in rural and urban areas.As these states have a higher percentage of the 60+ population compared to the national average and these states also represent all regions of the country.The BKPAI sample design entails a two-stage probability sampling. Where first villages were classified into different strata on the basis of population size, and the number of PSUs to be selected was determined in proportion to thepopulation size of each stratum. Using probability proportional to population size (PPS) technique, the PSUs have been chosen,and within each selected PSU, elderly households were selected through systematic sampling. A similar procedure was applied in drawing samples from urban areas (UNFP. 2013).

The BKPAI survey questionnaire consisted of two main parts (i) a household questionnaire (ii) An individual questionnaire. The individual's questionnairewith focus on thesocio-demographic profile, work history, and benefit, income, and assets, living arrangement, social activities, thehealth status of elderly & social security related question.

Measures

The outcome variable for the current study was aself-reported diagnosis of chronic NCDs which was previously made by a health professional. What these NCDs include the analysis is arthritis, stroke, angina, diabetes, COPD, asthma, depression, high blood pressure, and cataract. These chronic diseases were assessed by self-reported through the question 'Has a doctor or nurse ever told you that 'you have any of the following ailments?' The exposure variable in the analysis were sociodemographic characteristics as age, gender, place of residence, educational level, marital status, religion, caste and wealth quintile.

The data from the survey were analyzed using STATA version 13. Data is weighted at household and individual levels separately for rural and urban areas. The design weight were calculated by adjusting for nonresponse at both the household and individual levels. The sample weight was further normalized at the state level to obtain standardizedstate weights for each seven states so that the total number of weighted cases equaled to the total number of unweighted cases (UNFP. 2013). Multinomial logistic regression was used to determine socio-demographic factors predictive of the outcome variable- the presence of chronic NCDs (0= No morbidity, 1= 1 morbidity, 2= 2 & 2+ morbidity).

Results

(Table 1About Here)

The investigationinto the elderly self-reported prevalence of chronic non-communicable diseases by socio-demographic factors shows the prevalence of nine chronic NCDs. Imperial investigation reveals that the most prevalent chronic NCDs reported by elderly across the study sample were arthritis (29.3%), High blood pressure (21%) followed by Cataract(12.9%), Diabetes (10.1%), Asthma(7.8%) and Angina (5.8%). Elderly residing in Urban Indian areas are most prevalent to Arthritis were about one-fourth (24.23%) of the elderly population live with the disease followed by High BP(23.9%), diabetes(13.8, and Cataract (12.32%). Among all of the above NCDs diabetes has emerged as the diseases which have predominance in Urban India. While Elderly in rural areashas prevalence in arthritis(31.1%), followed by High BP (19.98%) and cataract (13.1%). Arthritis has progressed, as diseases among elderly residing in rural areas as wide rural-urban differential exist. The prevalence of arthritis was higher among the illiterate elderly person (36%), female (33.77%), andresidents in rural areas (31.1%),currently not married (31.8%), Sikh religion (47.4%), and individuals in 2nd (Poor) wealth quintile (31.4%).The distribution of High blood pressure is higher for urban residents (23.9%), with higher age(24%), female (23.9%), having higher level of education (28.1%), currently not married (23.2%), Sikh and other religion (35.1%) and those in highest wealth quintile (38.7%). Apart from this, the prevalence of diabetes is greater in anurban area (13.8%), male (1.9%), currently married (10.4%), others religion (12.9%) and among higher wealth quintile (22.4%). The spatial spread of diseases demonstrates that Arthritis, High BP, and Angina is prevalent mostly among elderly in the state of Punjab. Whereas Stroke is experienced mostly in West Bengal.Asthma, COPD, and Cataractis especially high for the elderly in states of Maharashtra and Kerala.

(Table 2 About here)

The association between chronic NCDs pertaining to elderly in different socio-demographic characteristics describes that 42% of the individuals stated that they did not have any morbidity. Simultaneously around one-third (34%) reported they have atleast one morbidity and around one-fourth (23.6%) reported they have multi-morbidity (more than two morbidities). In the study, the number of chronic NCDs differed significantly by state, age-group, sex, education level, marital status, religion, caste and wealth quintile ($p<0.001$). The number of chronic NCDs did not differ significantly by place of residence ($p=0.001$). Elderly in the state of Kerala self-reported to have the highest number of cases (42.02%) in multi-morbidity, followed by the states of Punjab (35.78%), Maharashtra(23.42%), and West Bengal (23.15%). The elderly residing in states of Maharashtra(40.68%), Himachal (38.39%), West Bengal (33.81), and Kerala (33.65%) reported highest to experience one morbidity. Elderly residing in the states of Tamil Nadu (63.03%), Odisha (55.05%) Himachal (38.39%) and West Bengal (38.81%) reported highest to experience no morbidity condition at older ages. The proportion of elderly experiencing no morbidity was highest in states of Tamil Nadu, Odisha, and Himachal Pradesh.

Elderly individuals residing in urban areas (43.49%) have confirmed to experience no morbidity condition less in contrast to elderly in rural areas (41.43%). The incidence of multi-morbidity is

positively associated with age, with anincrease in age from young-old (19.82%) through old-old (28.17%) to oldest of old (33.97%) the multi-morbidity has increased significantly. Female elderly (25.42%) responded stated considerably to experience one morbidity and multimorbidity more than the male (21.66%) counterpart did.Unmarried elderly individual(25.27%) are observed to experience multi-morbidity higher than the ever-married (25.27%) individuals. An investigation by wealth quintile describes elderly falling in poorer wealth quintile state to experience good health than the individuals in thericher category. Moving from 1st wealth quintile (14.84) to 5th wealth quintile (38.72) the self-reported health status for reporting multi-morbidity has increased double.

(Table 3About Here)

The socio-demographic predictors of chronic NCDsamong elderlyareassessedusingmultinomial logistic regression analysis to establish the association of NCDs to various exposure variable considering 'No Morbidity' as thereference category. With theincrease in age,result reveals that the relative risk of having atleast one morbidity is increasing. Considering 60-69 age-group as the reference category, the relative risk of having atleast1 morbidity in 70-79 age group is 1.36 times more likely,while it is more in the 80+ age group where the relative risk is 1.73 times more compared to the reference category (p <0.001).Examination of education shows that elderly having at-lest middle level of schooling (i.e., 6-8) and upto theintermediate level of schooling (i.e., 9-12) have around 33% (p <0.001) less relative risk of having 1 morbidity in comparison to the reference category that is illiterate. By religion, it is observed that Muslim, Sikh, and other religion have amore relative risk of multi-morbidity compare to Hindu. Being a Muslim is more pronounced of having 1 morbidity in compared to Hindu. With theincrease, the wealth the relative risk of having multi-morbidity is increasing as it is 3.91 times have more relative risk of multi-morbidity compared to 1st quintile (Poorer). The relative risk of having atleast1disease increased with the increase in wealth quintile and all the value is significant at thelevel of 95%.An investigation by gender shows thatfemalehave multimorbidity 1.48 time more relative risk compared to male(p <0.001).

Discussion

The present Investigation holds substance as life expectancy has increased considerably with technological and medical expertise; increasing number of elderly is like never before. The self-reported health and the prevalence of chronic NCDs (Multimorbidity) among elderly is investigated, where it is found that a sizable proportion of elderly in the category illiterate were not aware of their health situation. Elderly in the category of higher education attainment and residing in urban areas self-reported more to be in abad state of health condition experiencing multimorbidity. A resemblance in proviso akin literacy status is wealth quintile, elderly Indian laying in poorer wealth quintile assess their health to be good experiencing no morbidity condition. Contrary to the elderly individuals in richest wealth quintile describe to be in bad health condition experiencing greatermultimorbidity. Such results suggest that elderly individuals in category illiterate and falling in poor wealth quintile are not aware their health, whereas the richer take all possible interventions and seek medical care (Ha, N. T., Le, N. H., Khanal, V., &Moorin, R. 2015). The most chronic NCDs experienced by elderly are Arthritis, High blood pressure, and Cataract.Arthritis was relatively higher among the illiterate elderly person, female, and elderly residing in rural areas, and those who were currently not married. The distribution of High blood pressure and diabetes is moderately higher among elderly male and for urban residents. Elderly residing in the states of Kerala, Punjab, and Maharastra reported highest to experience two or more NCDs,i.e.,multimorbidity, whereas thestate of Tamil Nadu, Odisha, Himachal and West Bengal were among those who experienced no morbidity condition at older ages significantly higher than rest of the states. The results of the study are also consistent with earlier studies where theincidence of Multimorbidityis positively associated with age, with anincrease in age the proportion of no morbidity to one morbidity and multimorbidity increased many folds (Chirinda, W., *et al.*2015, Arokiasamy, P., *et al.,* 2015). Findings also substantiate that females are at the darker edge of health condition and elderly female reported considerably higher to experience one morbidity and multimorbidity than the males.

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Table 1. Self-reported prevalence of NCDs among elderly in India: BKPAI-2011

	Arthritis	Stroke	Angina	Diabetes	COPD	Asthma	Depression	High BP	Cataract
State									
Total	**29.31**	**0.99**	**5.84**	**10.13**	**1.57**	**7.75**	**1.54**	**21.03**	**12.89**
Himachal Pradesh	39	0.85	3.23	5.91	1.05	9.5	1.13	14.72	10.48
Punjab	47.8	0.27	8.31	12.31	0.67	7.01	2.6	32.89	12.97
West Bengal	21.34	2.94	8.19	7.69	0.33	3.9	1.47	23.87	16.17
Orissa	25.24	0.07	1.2	4.98	0.88	4.21	1.05	14.62	6.97
Maharashtra	35.11	0.53	1.95	6.93	4.05	11.64	2.37	12.96	19.66
Kerala	14.23	2.21	15.72	28.09	3.08	14.83	0.89	39.74	20.65
Tamilnadu	21.52	0.36	3.39	6.02	0.86	3.11	1.26	10.61	4.42
Place of residence									
Rural	31.1	0.92	5.5	8.8	1.63	8.05	1.47	19.98	13.1
Urban	24.32	1.2	6.8	13.84	1.4	6.92	1.72	23.94	12.32
Age- Group									
60-69	26.31	0.79	5.32	10.16	1.52	6.61	1.47	19.36	8.31
70-79	32.15	0.83	7.02	10.49	1.21	8.55	1.52	23.95	18.68
80 & Above	39.25	2.56	5.84	9.05	2.72	12.23	1.91	23.17	24.44
Sex									
Male	24.35	1.09	6.55	10.26	1.92	8.9	1.46	17.78	12.16
Female	33.77	0.9	5.2	10.01	1.25	6.71	1.61	23.94	13.55
Education Level									
Illiterate	36.02	0.83	4.03	6.61	1.41	7.29	1.48	18.11	13.76
0-5	25.31	1.54	7.09	12.29	2.15	9.43	1.23	24.32	13.58
6-8	22.01	0.86	7.65	11.93	1.93	7.81	1.9	19.23	9.57
9-12	18.46	0.89	8.61	16.23	1.24	7.78	1.4	26.66	11.24
12+	20.37	1.1	8.52	19.42	0.59	4.15	3.71	28.08	12.14
Marital status									
Currently not Married	31.82	1.06	5.41	9.7	1.24	7.68	1.38	23.17	15.72
Currently Married	27.69	0.95	6.12	10.4	1.78	7.79	1.64	19.64	11.06
Religion									
Hindu	28.1	0.83	4.46	8.21	1.57	7.29	1.53	17.98	11.74
Muslim	23.81	2.32	12.85	17.66	1.48	11.83	1.69	27.07	15.99
Sikh	47.39	0.31	8.02	12.52	0.6	6.23	1.94	35.03	14.79
Others	23.54	2.87	12.86	25.56	3.8	11.38	0.49	35.09	23.96
Caste									
SC/ST	29.77	0.97	3.87	6.56	1.27	6.73	1.45	15.91	12.77

OBC	24	0.88	6.03	11.1	1.75	7.6	1.28	20.41	11.87
NOA	34.13	1.05	6.88	11.84	1.61	8.59	1.74	25.74	14.3
Wealth Quintile								
1st quintile	28.5	0.84	2.9	3.72	1.98	6.38	1.72	11.58	11.49
2nd quintile	31.35	0.72	3.53	6.33	1.72	7.41	1.11	15.76	13.57
3rd quintile	29.89	1.09	5.97	11.29	1.88	8.05	1.61	22.27	12.45
4th quintile	26.58	1.26	8.12	12.05	1.22	9.19	1.58	24.25	13.27
5th quintile	30.3	1.21	11.13	22.36	0.61	8.38	1.72	38.73	14.36

Table 2. Association between the number of chronic NCDs and socio-demographic characteristics: BKPAI-2011

	No Morbidity	1 Morbidity	≥2 Morbidity	Chi-square p-value
State				
Total	**4150 (41.98)**	**3369 (34.39)**	**2333 (23.64)**	
Himachal Pradesh	641 (41.63)	534 (38.39)	307 (19.97)	
Punjab	414 (29.01)	482 (35.22)	474 (35.78)	
West Bengal	566 (43.04)	432 (33.81)	277 (23.15)	
Orissa	801 (55.05)	485 (32.73)	195 (12.22)	
Maharashtra	510 (35.91)	593 (40.68)	332 (23.42)	
Kerala	334 (24.32)	439 (33.65)	592 (42.02)	
TamilNadu	884 (63.03)	404 (26.13)	156 (10.84)	
Place of residence				
Rural	2138 (41.43)	1842 (35.54)	1158 (23.03)	<0.001
Urban	2012 (43.49)	1527 (31.17)	1175 (25.34)	
Age- Group				
60-69	2975 (47.33)	2038 (32.84)	1226 (19.82)	<0.001
70-79	894 (35.49)	939 (36.34)	768 (28.17)	
80 & Above	281 (27.77)	392 (38.26)	339 (33.97)	
Sex				
male	2124 (45.42)	1554 (32.92)	994 (21.66)	<0.001
female	2026 (38.88)	1815 (35.7)	1339 (25.42)	
Education Level				
Illiterate	1847 (40.65)	1691 (37.61)	990 (21.73)	<0.001
0-5	788 (39.5)	684 (34.49)	529 (26.01)	
6-8	575 (48.74)	348 (29.16)	247 (22.11)	
9-12	707 (45.64)	446 (26.96)	415 (27.4)	
12+	216 (40.81)	179 (31.41)	135 (27.78)	
Marital status				
Currently not Married	1525 (38.67)	1415 (36.06)	1026 (25.27)	<0.001
Currently Married	2625 (44.12)	1954 (33.3)	1307 (22.58)	
Religion				
Hindu	3492 (45.38)	2674 (34.39)	1615 (20.23)	<0.001
Muslim	273 (31.66)	272 (35.53)	259 (32.81)	
Sikh	246 (29.12)	294 (35.06)	286 (35.82)	
Others	139 (27.31)	129 (30.58)	173 (42.11)	
Caste				
SC/ST	1091 (45.8)	840 (35.37)	452 (18.83)	<0.001
OBC	1514 (45.63)	1079 (32.31)	760 (22.06)	
NOA	1420 (35.32)	1372 (35.9)	1074 (28.78)	
Wealth Quintile				
1st	989 (50.98)	682 (34.17)	283 (14.84)	<0.001
2nd	893 (43.59)	714 (36.96)	367 (19.45)	

3rd	820 (40.3)	649 (34.5)	469 (25.19)
4th	799 (39.92)	651 (33.6)	512 (26.48)
5th	644 (29.53)	672 (31.75)	702 (38.72)
NCD	**4150 (41.98)**	**5702 (58.02)**	
Multi- morbidity	**4150 (41.98)**	**3369 (34.49)**	**2333 (23.64)**

Table 3. Multinomial logistic regression analysis for the outcome of multimorbidity (Chronic NCDs): BKPAI- 2011

	1 Morbidity	2 + Morbidity
Place of residence	RRR	RRR
Rural ®		
Urban	0.842 (0.745-0.951)	0.827 (0.720-0.950)
Age- Group		
60-69 ®		
70-79	1.358* (1.186-1.555)	1.908* (1.640-2.220)
80 & Above	1.732* (1.402-2.141)	2.852* (2.267-3.590)
Sex		
Male ®		
Female	1.155 (1.008-1.323)	1.479* (1.267-1.728)
Education Level		
Illitrate ®		
0-5	0.970 (0.829-1.132)	1.262 (1.054-1.511)
6-8	0.674* (0.553-0.821)	0.923 (0.733-1.163)
9-12	0.644* (0.523-0.792)	1.079 (0.858-1.357)
12+	0.742 (0.534-1.034)	0.963 (0.653-1.418)
Marital status		
Currently not Married ®		
Currently Married	0.955 (0.833-1.095)	0.984 (0.843-1.149)
Religion		
Hindu ®		
Muslim	1.513 (1.195-1.915)	2.446* (1.927-3.106)
Sikh	1.250 (1.006-1.553)	1.989* (1.575-2.514)
Others	1.575 (1.166-2.129)	2.862* (2.149-3.813)
Caste		
SC/ST ®		
OBC	0.926 (0.798-1.075)	0.973 (0.812-1.167)
NOA	1.221 (1.047-1.427)	1.253 (1.040-1.508)
Wealth Quintile		
1st ®		
2nd	1.347 (1.139-1.594)	1.581* (1.274-1.963)
3rd	1.442* (1.201-1.732)	2.113* (1.690-2.642)
4th	1.470* (1.207-1.790)	2.132* (1.685-2.698)
5th	1.901* (1.509-2.394)	3.915* (3.002-5.105)

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