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Effect of Living Arrangement on the Health Status of Elderly in India: Findings from a national cross sectional survey

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Abstract

Epidemiological studies show strong association between lack/inadequate family support with increased mortality and poor health among the elderly. This study examined the effect of living arrangement on elderly health status by analysing the data of 39,694 persons aged 60 and above included in India's second National Family Health Survey conducted in 1998–1999. Results indicate that elderly who are living alone are likely to suffer more from both chronic illnesses, such as asthma and tuberculosis, and acute illnesses, such as malaria and jaundice, than those elderly who are living with their family, even after controlling for the effects of a number of socio-economic, demographic, environmental and behavioural confounders. The findings have important programme and policy implications for countries such as India, which has the second largest elderly population in the world. There is a strong need for the implementation of specific public support systems and health care strategies focused on the elderly population in general and elderly living alone in particular.

Keywords

elderly; living alone; asthma; tuberculosis; jaundice; malaria

Introduction

Most countries around the world are in the midst of demographic ageing (Kinsella & Gist 1998) and a vast and growing number of aged people are posing enormous health care threat and social challenges (Lim & Ng 2010). This has been especially true in the case of developing countries like India, where the elderly population is increasing rapidly, both in absolute numbers as well as in proportion to the general population. On one hand, the number of elderly aged 60 and above in India has increased sharply from 71 million in 2001, is expected to multiply more than two-fold to 179 million in 2031, and further to 301 million in 2051 (Rajan *et al.* 2003). On the other hand, due to recent sociological trends towards the nuclearisation of family structure and the resultant decline of extended families, falling fertility rates, increasing life expectancy, widowhood, singlehood or strained inter-generational relationships, an increasing number of elderly are living alone in India. In India, elderly living alone has increased from three per cent during the period 1998–1999

(International Institute for Population Sciences & ORC Macro 2000) to five per cent during the period 2005–2006 (International Institute for Population Sciences & Macro International 2007). The number of the elderly people living alone in India will increase more in the coming years, with increasing urbanisation and migration of young people coupled with decreased cohesiveness in family bonds. Therefore, the effect of living alone on the health and well-being of the elderly people is of grave societal concern.

Elderly people living alone have been described as an ‘at risk’ group by the World Health Organization (World Health Organization 1977). Living alone in later life is often seen as an undesirable state and as a potential health risk (Kharicha *et al.* 2007) and needs specific attention (Iliffe *et al.* 1992). The study of the elderly living alone is important in a developing country like India where public institutions are weak and social security for the elderly, absent (Sen & Noon 2007).

Rather fragmentary evidence, obtained from studies conducted mostly in developed countries, shows that living alone may be associated with various health-related disadvantages and undesirable health events among the elderly (Dean *et al.* 1992) such as dietary inadequacy (Davis *et al.* 1990), chronic illnesses (Murphy 1997), higher mortality risk (Welin *et al.* 1985) and higher risk of functional decline (Mor *et al.* 1989; Sarwari *et al.* 1998). Epidemiological and clinical studies from numerous Asian and Western countries have reported that elderly living alone are more likely to be depressed (Dean *et al.* 1992; Mui 1998; Chou & Chi 2000), more likely to report poorer mental health and quality of life (Chou & Chi 2000; Gee 2000; Iwasa *et al.* 2006), more likely to report more functional impairment, poor diet, excessive smoking risk, hazardous alcohol use, risk of social isolation, worse memory and mood, lower physical activity and chronic conditions, such as arthritis and/or rheumatism, glaucoma and cataracts, than those living with a spouse or partner (Kharicha *et al.* 2007).

In India, a micro-level study found significant gender differentials in socio-demographic characteristics as well as in the health status of the elderly (Mini 2009). However, there is a general dearth of well-established evidence on the association between the elderly’s living arrangement and their health status in the Indian population. The present study has been designed to respond to the existing gap in knowledge.

In India, the understanding of the health status of the elderly living alone is limited because of the paucity of population-based representative demographic data. Also, due to numerous methodological problems related to the determination of health status at older ages (Ebrahim 1996), older persons have been routinely excluded from large-scale studies. Reluctance to study health status in later life has also been attributed to difficulties surrounding the multiplicity of pathological conditions that exist in old age, and also to ageism (Sen 1996). Though in the past, the Government of India paid little attention to the health problems of the elderly, now, with a growing aged population, the situation is beginning to change. India’s second National Family Health Survey (NFHS-2) collected data from 92,486 households. There were more than 500,000 people residing in these households. The survey covered more than 99 per cent of India’s population and provides a unique opportunity to study the various correlates of the health status of the elderly, and its household and societal

determinants. The household questionnaire included questions on morbidity and collected information on chronic ailments, such as asthma and tuberculosis, and acute ailments, such as jaundice and malaria, for all members of the household. In this study, we examined the effect of living arrangement of persons aged 60 and above on reported prevalence of asthma, tuberculosis, jaundice and malaria in India.

Materials and Methods

Data

The data for the study comes from India's second NFHS-2 conducted during the period 1998–1999. This survey was designed along the lines of the Demographic and Health Surveys that had been conducted in many developing countries since the 1980s. NFHS-2 is a cross-sectional, nation-wide survey, which collected demographic, socio-economic and health information from a nationally representative probability sample of 92,486 households. Details of sample design, including sampling framework and sample implementation, are provided in the basic survey report for all India (International Institute for Population Sciences & ORC Macro 2000). The household data were obtained from face-to-face interviews conducted in the respondents' homes. The survey was conducted using an interviewer-administered questionnaire in 18 languages. The analysis presented here is based on 39,694 persons aged 60 and above living in the sample households as a usual resident.

Predictor Variable

The variable, 'living arrangement', is constructed based on the information regarding the household members living in the household and has been divided into two categories, 'living alone' and 'living with family'. The elderly are considered to be 'living alone' if they live alone without the spouse and other kin. The elderly are considered to be 'living with family' if the old person lives with at least one kin, including spouse, children, and other relatives and non-relatives. Living arrangement is the principal predictor variable in this study.

Response Variables

The survey asked several questions relating to the current health status of the household members including whether each member suffered from asthma, tuberculosis, jaundice or malaria. The following questions were asked for all household members listed in the household schedule: 'does anyone listed suffer from asthma?', 'does anyone listed suffer from tuberculosis?', 'does anyone listed suffer from malaria at any time during the last three months?' and 'does anyone listed suffer from jaundice at any time during the last twelve months?' The household head or other knowledgeable adult in the household reported on the morbidity for all household members. A commonly understood local term for the above ailments was used in the survey. However, no clinical tests were done to check for any of the morbidities.

It is important to recognise that reported ailments among the elderly are not as accurate as clinical measures. As diseases such as tuberculosis carries a stigma, reported prevalence may be underestimated because of intentional concealment. Also, lack of knowledge about a disease might also lead to under-reporting. For the elderly, however, there is not much

stigma attached to the disease, so under-reporting due to intentional concealment should not be a major problem. There is also a possibility of over-reporting because some other disease conditions with similar symptoms, such as chronic bronchitis or chronic obstructive pulmonary disease, may be reported as asthma, or common flu may be reported as malaria. However, in India, where clinical data on chronic and acute ailments are not available, especially for the older population, the reported prevalence of asthma, tuberculosis, jaundice and malaria from a representative national sample provides a unique opportunity to examine the factors associated with their prevalence among the elderly and the effect of the elderly's living arrangement on this prevalence.

Control variables included in this study were age, sex, marital status, education, urban/rural residence, religion of household head, caste/tribe of household head, living standard of the household, house type, availability of a separate kitchen in the house, purification of drinking water, type of fuel used for cooking, tobacco-smoking, tobacco-chewing and alcohol-drinking. Variable definitions are provided in Table 1.

Analysis

Bivariate as well as multivariate techniques have been used for data analysis. From the bivariate analysis, cross-tabulation was done, and Chi-Square test was used to test for significance. As our response variables—prevalence of asthma, tuberculosis, malaria and jaundice—is dichotomous, binary logistic regression has been used to see the adjusted effect of elderly living arrangement and other factors on the elderly's health status. Results are presented in the form of odds ratios (ORs) with 95 per cent confidence intervals (95 per cent CI). The estimation of confidence intervals takes into account design effects due to clustering at the level of the primary sampling unit.

In the survey, certain states and certain categories of households were oversampled. In all our analysis, weights are used to restore the representativeness of the sample. All the analysis was done in STATA software version 10 (Stata Corporation 2003).

Results

Profile of the Elderly

Table 1 shows the distribution of elderly people by selected characteristics. There are equal numbers of male and female elderly in the sample. Overall, three per cent of the elderly population are living alone in India, almost two per cent among male elderly and five per cent among female elderly. Sixty-two per cent of the elderly are currently married (81 per cent of men and 41 per cent of women) and more than one-third are widowed. Three out of four elderly live in rural areas. About two-thirds of the elderly are illiterate; only 12 per cent have middle school education or higher. Illiteracy is higher among female elderly (82 per cent) than male elderly (50 per cent). Religion and caste/tribe distribution shows that more than four out of five elderly belong to the Hindu religion, and one out of four elderly belongs to a scheduled caste or scheduled tribe. Two out of five elderly live in households with a low standard of living, and one out of five lives in a household with a high standard of living. About one-third of the elderly live in pucca (higher-quality) houses, and about half of the

elderly live in houses without a separate kitchen. More than 75 per cent of the elderly live in households using unclean fuels (wood, dung cakes, crop residues, coal/coke/lignite or charcoal) and only 23 per cent live in households using cleaner fuels (kerosene, liquid petroleum gas, bio-gas or electricity). Among the elderly, 23 per cent smoke, almost one-third chew tobacco and one out of ten elderly drinks alcohol.

Prevalence of Asthma, Tuberculosis, Malaria and Jaundice among the Elderly

Table 2 shows the reported prevalence of asthma, tuberculosis, malaria and jaundice among the elderly in India. Prevalence of all the above mentioned ailments is higher among elderly living alone than among elderly who are living with their family (14.5 per cent versus 10.3 per cent for asthma, 2.7 per cent versus 1.3 per cent for tuberculosis, 10.2 per cent versus 4.0 per cent for malaria, and 2.3 per cent versus 0.8 per cent for jaundice). Prevalence is also higher among elderly men than women, and higher in the rural areas than in the urban areas. Elderly living in households using unclean fuels are more likely to suffer from all the morbidities than are those living in households using cleaner fuels. Prevalence is also higher among elderly who smoke or chew tobacco, or drink alcohol than among their counterparts. Elderly with middle school education or more are less likely to suffer from all the morbidities than are those with lesser or no education. The prevalence of all morbidities is considerably lower among the elderly living in households with a separate kitchen and among elderly living in households with a high standard of living. Prevalence is also somewhat lower among elderly living in pucca houses and among those who use purified drinking water. The prevalence of all morbidities does not vary much by other characteristics such as marital status, religion and caste/tribe status, except that scheduled tribes and Muslim elderly are more likely to suffer from malaria.

Effect of Living Arrangements on Asthma, Tuberculosis, Malaria and Jaundice

Table 3 presents the unadjusted and adjusted effects of living arrangements and selected characteristics on asthma, tuberculosis, malaria and jaundice among the elderly from logistic regression models. The unadjusted results show that elderly living alone are 1.5 times more likely to suffer from asthma than elderly living with family. In the next model which adjusts for various social and demographic factors, the odds of suffering from asthma are higher for those living alone. Considering tuberculosis, the unadjusted model shows that elderly living alone are two times more likely to suffer from tuberculosis than elderly living with family, which remains significant in the adjusted model (aOR, 2.76; 95 per cent CI, 1.91–4.01). Considering malaria, unadjusted results show that elderly living alone are 2.8 times more likely to suffer from malaria than elderly living with family, which has remained significant (aOR, 2.50; 95 per cent CI, 2.04–3.08) in the adjusted model. Considering jaundice, unadjusted results show that elderly living alone are three times more likely to suffer from jaundice than elderly living with family, which has also remained unchanged (aOR, 2.90; 95 per cent CI, 1.91–4.42) in the adjusted model.

Effect of Control Variables on Asthma, Tuberculosis, Malaria and Jaundice

The discussion of the adjusted effects of the control variables focuses on all four adjusted models in Table 3. With other variables controlled for, age has a significant positive effect on the prevalence of asthma (aOR, 1.26; 95 per cent CI, 1.17–1.36), but not on tuberculosis,

malaria and jaundice. Women have a significantly lower prevalence of asthma (aOR, 0.58; 95 per cent CI, 0.53–0.63) and tuberculosis (aOR, 0.43; 95 per cent CI, 0.34–0.54) than men. Elderly men and women with middle school education or higher have significantly lower prevalence of asthma, tuberculosis and malaria than do those with lesser or no education. Both smoking and chewing tobacco have a significant positive effect on the prevalence of all the morbidities among the elderly. As expected, elderly living in households with a separate kitchen and/or who use clean fuels for cooking have a significantly lower prevalence of asthma, tuberculosis and jaundice than do those living in households without a separate kitchen. Also, as expected, household living standard has a significant negative effect on prevalence of all the morbidities among the elderly. The effect of marital status, residence, religion, caste/tribe status and alcohol-drinking among the elderly is not statistically significant.

Sex Differences in Effects

The adjusted effect of living arrangement on the prevalence of asthma, tuberculosis, malaria and jaundice is large and statistically significant for both elderly men and women. However, the adjusted effect is larger for women than for men (results not shown).

Conclusion and Discussion

Results from this study suggest that the living arrangements of the elderly are strongly associated with adverse health outcomes such as asthma, tuberculosis, malaria and jaundice among the elderly. The effect of living arrangements is independent of age, sex, education, living standard, and other environmental and behavioural factors. Elderly living alone are significantly more likely to suffer from these chronic as well as acute ailments than elderly living with their family. These findings are consistent with similar earlier studies from the developing world, which have found positive associations between socio-economic status, living arrangement and the health of elderly (Albert & Cattell 1994; Ross & Wu 1996; Knodel & Debavalya 1997; Zimmer & Amornsirisomboon 2001; Mba 2005; Gu *et al.* 1997; Chen & Short 2008; Song *et al.* 2008; Wu & Schimmele 2008; Zimmer 2008; Li *et al.* 2009). Some recent research at a micro level on population ageing in India have also found living arrangements, and care and support for older adults to be an important determinant of their health status (Bongaarts & Zimmer 2001; Gupta & Sankar 2002; Chaudhuri & Roy 2007; Sheela & Jayamala 2008; Lena *et al.* 2009).

This study has led to an important policy implication that elderly living alone should be given more care with a stronger public support system, especially for those who belong to the weaker sections of society such as the elderly who belong to scheduled caste or tribe categories.

The study has both strengths and limitations. The population-based approach makes its results generalisable to the elderly living in the country. However, self-reported data are subjected to recall bias and reporting errors, and therefore, a sole reliance on such responses might not accurately capture the relationship between the living condition and morbidities of the elderly. Respondents may under-report diseases such as tuberculosis, as they may be unaware of their own morbidities status or that of their other household member's. However,

consistent efforts have been made to ensure data quality. Despite efforts being made in the self-reporting of morbidities, with the exception of clinical verification, there may be other confounding factors in the data, such as respondents mistaking some other morbidities they have for one of the listed morbidities, which could contribute to a possible overestimation of the prevalence of the morbidities under study. However, regardless of whether there is under-reporting or over-reporting, the pattern of morbidities would be consistent for living arrangements, and socio-economic and demographic factors. Lastly, the most recent National Family Health Survey (NFHS-3, 2005–2006) could not be used for the present study as the morbidity-related data were not collected at the household level in that survey. Only eligible men (aged 15–54) and women (aged 15–49) were independently asked to self-report about specific morbidities. However, NFHS-2 data, used in this study, provide rich information on the modifiable and non-modifiable risk factors on the pattern of prevalence of the above-discussed chronic and acute ailments among all the household members, including the elderly living alone, and this pattern, and the factors determining it, are quite unlikely to change in the recent survey.

In conclusion, this study shows that elderly who are living alone have poorer health status, in terms of self-reported prevalence of acute and chronic ailments, than elderly who are living with their family. Therefore, there is a strong need for interventions to ensure the health of this most vulnerable group, and to create a policy to meet the care and needs of the elderly who are living alone. However, more sociological, epidemiological and qualitative research, with data based on a wider range of living arrangements, is needed to explore the influence of living arrangements on the health of the elderly.

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Table 1

Distribution of elderly (60 years old) by living arrangement and selected characteristics, India, 1998–1999.

Characteristics	Male	Female	Total	Total number
<i>Living arrangement</i>				
Living alone	1.7	4.5	3.0	1196
Living with family	98.3	95.5	97.0	38,498
<i>Socio-economic and demographic factors</i>				
<i>Age</i>				
60–69	60.1	64.6	62.2	24,706
70–79	29.7	25.3	27.6	10,953
80	10.2	10.1	10.2	4036
<i>Marital status</i>				
Married	81.3	40.6	62.0	24,612
Separated/widowed/divorced/deserted	17.4	58.7	37.0	14,689
Never married	1.3	0.7	1.0	395
<i>Education</i>				
Illiterate	49.8	82.3	65.2	25,869
Literate, <middle school complete	31.5	13.7	23.0	9139
Middle school complete	5.6	1.7	3.7	1486
High school complete or more	13.1	2.4	8.0	3169
<i>Residence</i>				
Urban	23.3	25.1	24.2	9598
Rural	76.7	74.9	75.8	30,096
<i>Religion</i>				
Hindu	82.4	82.6	82.5	32,760
Muslim	10.7	10.6	10.6	4221
Others	6.9	6.8	6.8	652
<i>Caste/tribe</i>				
Scheduled caste	18.2	17.4	17.8	6775
Scheduled tribe	8.4	8.0	8.2	3108
Other backward class	34.3	34.3	34.3	13,027
Others	39.1	40.3	39.7	15,082
<i>Standard of living^a</i>				
Low	30.1	32.3	31.1	12,226
Medium	46.9	44.7	45.8	17,991
High	23.1	23.0	23.0	9043
<i>Environmental factors</i>				
<i>Type of house^b</i>				
Pucca	31.5	33.2	32.3	12,810
Semi-pucca/kachcha	68.5	66.8	67.7	26,812
<i>Separate kitchen</i>				
Yes	55.1	55.8	55.4	21,968

Characteristics	Male	Female	Total	Total number
No	44.9	44.2	44.6	17,676
<i>Drinking water</i>				
Purified	30.7	32.9	31.8	12,604
Non-purified	69.3	67.1	68.2	27,087
<i>Cooking fuel^c</i>				
Clean	21.9	23.5	22.6	30,700
Unclean	78.1	76.5	77.4	8984
<i>Behavioural factors</i>				
<i>Smokes tobacco</i>				
No	61.7	94.7	77.3	30,676
Yes	38.3	5.3	22.7	8991
<i>Chews tobacco</i>				
No	62.5	75.0	68.4	27,152
Yes	37.5	25.0	31.6	12,531
<i>Drinks alcohol</i>				
No	81.4	96.9	88.8	35,222
Yes	18.6	3.1	11.2	4455
<i>Number of elderly^d</i>	20,849	18,846	39,694	39,695

^aStandard of living index (SLI) is provided in the dataset. The index was constructed using information on household assets (for more information on the index, see International Institute for Population Sciences & ORC Macro 2000).

^b*Pucca* houses are made from high-quality materials, i.e. bricks, tiles, cement and concrete, throughout including roof, walls and floor; *kachcha* houses are made from mud, thatch or other low-quality materials. Semi-*pucca* houses are made from a combination.

^cClean fuels: kerosene, petroleum gas, bio-gas or electricity; unclean fuels: wood, dung, crop residues, coal/coke/lignite, charcoal or others.

^dNumber of elderly varies slightly for individual variables depending on the number of missing values

Table 2

Reported prevalence of asthma, tuberculosis, malaria and jaundice among the elderly (≥ 60 years old) in India by living arrangement and selected characteristics, 1998–1999.

Characteristics	Asthma	Tuberculosis	Malaria	Jaundice
<i>Living arrangement</i>	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$
Living alone	14.5	2.7	10.2	2.3
Living with family	10.3	1.3	4.0	0.8
<i>Socio-economic and demographic factors</i>				
<i>Age</i>	$p < 0.0001$	$p = 0.112$	$p = 0.533$	$p = 0.732$
60–69	9.2	1.3	4.2	0.9
70–79	12.4	1.6	4.0	0.8
80	12.3	1.4	4.0	0.9
<i>Sex</i>	$p < 0.0001$	$p < 0.0001$	$p = 0.465$	$p = 0.011$
Male	12.1	1.8	4.1	1.0
Female	8.6	1.0	4.2	0.7
<i>Marital status</i>	$p = 0.152$	$p = 0.391$	0.160	$p = 0.194$
Married	10.6	1.4	4.3	0.9
Separated/widowed/divorced/deserted	10.0	1.3	4.0	0.8
Never married	9.4	1.0	2.8	0.3
<i>Education</i>	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$	$p = 0.031$
Illiterate	10.8	1.3	4.7	0.9
Literate, <middle school complete	10.9	1.8	3.9	0.8
Middle school complete	8.1	0.9	2.5	0.5
High school complete or more	6.9	0.7	1.2	0.4
<i>Residence</i>	$p < 0.0001$	$p = 0.013$	$p < 0.0001$	$p = 0.001$
Urban	8.3	1.1	1.9	0.6
Rural	11.1	1.5	4.9	0.9
<i>Religion</i>	$p = 0.007$	$p < 0.0001$	$p < 0.0001$	$p = 0.385$
Hindu	10.4	1.3	4.5	0.9
Muslim	11.5	2.3	2.4	0.9
Others	9.1	1.0	3.3	0.6
<i>Caste/tribe</i>	$p = 0.003$	$p = 0.028$	$p < 0.0001$	$p < 0.0001$
Scheduled caste	11.4	1.5	4.6	0.8
Scheduled tribe	10.7	1.7	9.9	1.5
Other backward class	10.2	1.4	4.0	0.8
Others	9.8	1.2	3.1	0.8
<i>Standard of living</i>	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$
Low	12.1	2.0	6.2	1.0
Medium	10.6	1.3	4.0	1.0
High	7.4	0.7	1.8	0.5
<i>Environmental factors</i>				
<i>Type of house</i>	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$

Characteristics	Asthma	Tuberculosis	Malaria	Jaundice
Pucca	8.9	0.9	2.1	0.5
Semi-pucca/kachcha	11.1	1.6	5.1	1.0
<i>Separate kitchen</i>	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$
Yes	9.1	1.2	3.0	0.7
No	12.0	1.6	5.6	1.0
<i>Drinking water</i>	$p = 0.009$	$p < 0.0001$	$p = 0.087$	$p = 0.197$
Purified	9.9	1.1	4.1	0.8
Non-purified	10.6	1.5	4.4	0.9
<i>Cooking fuel</i>	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$
Clean	7.6	0.8	1.7	0.5
Unclean	11.2	1.6	4.9	0.9
<i>Behavioural factors</i>				
<i>Smokes tobacco</i>	$p < 0.0001$	$p = 0.234$	$p = 0.001$	$p < 0.0001$
No	9.7	1.4	4.0	0.7
Yes	12.8	1.5	4.8	1.2
<i>Chews tobacco</i>	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$
No	9.7	1.2	3.5	0.7
Yes	11.9	1.8	5.6	1.1
<i>Drinks alcohol</i>	$p < 0.0001$	$p < 0.0001$	$p < 0.0001$	$p = 0.005$
No	10.2	1.3	3.9	0.8
Yes	12.1	2.0	6.0	1.2
<i>Number of elderly</i>	4126	549	1651	336

Note: For variable definitions, see Table 1.
All p values are chi-square p values.

Unadjusted and adjusted effects [ORs, 95 per cent CIs] of living arrangement and other characteristics on health status among the elderly (≥ 60 years old), India, 1998–1999.

Characteristics	Asthma [ORs and 95 per cent CIs]		Tuberculosis [ORs and 95 per cent CIs]		Malaria [ORs and 95 per cent CIs]		Jaundice [ORs and 95 per cent CIs]	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
<i>Living arrangement</i>								
With family <i>R</i>	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Alone <i>R</i>	1.51 (1.28–1.78) **	1.74 (1.46–2.07) **	2.04 (1.42–2.94) **	2.76 (1.91–4.01) **	2.80 (2.31–3.40) **	2.50 (2.04–3.08) **	2.98 (2.01–4.42) **	2.90 (1.91–4.42) **
<i>Socio-economic and demographic factors</i>								
Age								
60–69 <i>R</i>		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]
70–79 <i>R</i>		1.26 (1.17–1.36) **		1.05 (0.86–1.28)		0.98 (0.87–1.11)		0.90 (0.69–1.17)
80 and above <i>R</i>		1.20 (1.08–1.34) *		0.88 (0.65–1.19)		1.01 (0.85–1.21)		1.08 (0.74–1.58)
Sex								
Male <i>R</i>		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]
Female <i>R</i>		0.58 (0.53–0.63) **		0.43 (0.34–0.54) **		1.09 (0.96–1.24)		0.86 (0.65–1.14)
Marital status								
Currently married <i>R</i>		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]
Separated/divorced/widowed <i>R</i>		0.94[0.88–1.01]		0.90[0.75–1.07]		0.93[0.84–1.03]		0.86[0.69–1.08]
Never married <i>R</i>		0.89[0.63–1.24]		0.73[0.28–1.93]		0.64[0.35–1.17]		0.40[0.08–2.09]
Education								
Illiterate <i>R</i>		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]
Literate, < middle school complete <i>R</i>		0.94 (0.87–1.03)		1.32 (1.07–1.63) *		0.98 (0.86–1.12)		1.02 (0.77–1.36)
Middle school complete <i>R</i>		0.76 (0.62–0.93) *		0.77 (0.44–1.35)		0.80 (0.57–1.13)		0.59 (0.27–1.30)
High school complete or more <i>R</i>		0.62 (0.53–0.73) **		0.53 (0.32–0.88) *		0.45 (0.32–0.64) **		0.68 (0.37–1.23)
Residence								
Urban <i>R</i>		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]
Rural <i>R</i>		1.06 (0.95–1.18)		0.81 (0.61–1.06)		1.41 (1.16–1.71) *		0.96 (0.66–1.39)
Religion								

Characteristics	Asthma [ORs and 95 per cent CIs]		Tuberculosis [ORs and 95 per cent CIs]		Malaria [ORs and 95 per cent CIs]		Jaundice [ORs and 95 per cent CIs]	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Hindu ^R	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Muslim	0.98 (0.87–1.11)	1.66 (1.26–2.20) **				0.67 (0.53–0.84) *	1.07 (0.71–1.60)	
Others	0.89 (0.77–1.02)	0.70 (0.46–1.06)				0.79 (0.63–0.99)	0.67 (0.39–1.15)	
<i>Caste/tribe</i>								
Scheduled caste ^R	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Scheduled tribe	0.94 (0.82–1.08)	1.16 (0.83–1.63)				1.95 (1.64–2.30) **	1.68 (1.12–2.51) *	
Other backward class	0.94 (0.86–1.04)	0.97 (0.76–1.25)				0.93 (0.81–1.08)	1.00 (0.72–1.41)	
Others	0.97 (0.88–1.07)	0.85 (0.65–1.10)				0.92 (0.79–1.08)	1.25 (0.89–1.75)	
<i>Standard of living</i>								
Low ^R	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Medium	0.85[0.79–0.92] **	0.65[0.54–0.78] **				0.62[0.56–0.69] **	1.03[0.81–1.30]	
High	0.57[0.52–0.63] **	0.33[0.25–0.43] **				0.27[0.23–0.33] **	0.49[0.34–0.70] **	
<i>Environmental factors</i>								
<i>Type of house</i>								
Pucca ^R	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Semi-pucca/kachcha	1.02 (0.93–1.12)	1.26 (0.98–1.63)				1.60 (1.37–1.87) **	1.69 (1.20–2.37) *	
<i>Separate kitchen</i>								
Yes ^R	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
No	1.22 (1.13–1.31) **	1.17 (1.01–1.42) **				1.42 (1.28–1.59) **	1.12 (0.88–1.42)	
<i>Drinking water</i>								
Purified ^R	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Non-purified	0.93 (0.86–1.00) **	1.24 (1.00–1.53) *				0.72 (0.65–0.81) **	0.89 (0.69–1.14)	
<i>Cooking fuel</i>								
Clean ^R	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]	1.00 [Reference]
Unclean	1.37 (1.24–1.52) **	1.33 (1.01–1.76) *				1.98 (1.65–2.38) **	1.16 (0.81–1.66)	
<i>Behavioural factors</i>								
<i>Smokes tobacco</i>								

Characteristics	Asthma [ORs and 95 per cent CIs]		Tuberculosis [ORs and 95 per cent CIs]		Malaria [ORs and 95 per cent CIs]		Jaundice [ORs and 95 per cent CIs]	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
<i>No R</i>		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]
Yes		1.36[1.27–1.47] **		1.08[0.89–1.31]		1.21[1.08–1.35]		1.57[1.25–1.98] **
<i>Chews tobacco</i>								
<i>No R</i>		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]
Yes		1.26[1.17–1.34] **		1.47[1.24–1.75] **		1.65[1.50–1.83] **		1.59[1.28–1.98] **
<i>Drinks alcohol</i>								
<i>No R</i>		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]		1.00 [Reference]
Yes		1.03 (0.92–1.14)		1.35 (1.05–1.76) **		1.08 (0.93–1.25)		1.00 (0.71–1.40)
<i>Number of elderly</i>		37,043		37,040		37,041		37,036

Note: For variable definitions, see Table 1.

R₀ Reference category; significance level: **p* < 0.01; ***p* < 0.001.

Dependent variables: suffering from asthma—yes = 1 and no = 0; suffering from tuberculosis—yes = 1 and no = 0; suffering from malaria—yes = 1 and no = 0; suffering from jaundice—yes = 1 and no = 0.

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