



# Changing Patterns of One-Person and One-Couple-Only Households in India

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## Abstract

Familial composition has always occupied the center stage in sociological research and is linked with different socio-economic and demographic transitions. This study examines the change in the pattern of one-person (OP) and one-couple-only (OC) households in India for the period 1993–2050. Household-level data was obtained from three rounds of the National Family Health Survey and closely matched with the estimates of the Census. We adopted the spline method for age smoothing, the ordinary least squares regression method for examining the factors affecting OP and OC households, and the logistic curve for making projections. The findings show that during 2015–16, 4% of the households in India were OP households, which figure is expected to become 5.5% (4.9%–5.6%) by 2030 and 6.7% (5%–7%) by 2050. The percentage of OC households was 8% in 2015–16, which will increase to 10.4% (9.2%–10.8%) by 2030 and 12.6% (9.8%–14.2%) by 2050. In 2015–16, the proportion of OP households ranged between 1.54 in Jammu & Kashmir and 8% in Arunachal Pradesh, while that of OC households ranged from 3.3% in Meghalaya to 14.4% in Andhra Pradesh. The demographically advanced state of Kerala is projected to have the highest proportion of OC households in the coming years. One-man households were concentrated in the younger ages, while one-woman households dominated in the older ages. The share of OP households was higher among older persons from rural areas than those from urban areas. The increasing share of OP and OC households among the elderly may accelerate the already-underway processes of feminisation and ruralisation of ageing. The ongoing increase in urbanisation and decline in the Total Fertility Rate (TFR) would lead to an increase in the share of both OP and OC households in India in the future.

**Keywords** Household composition · Household projection · One-person household · Population ageing · Living arrangement

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## Introduction

Traditionally in India, family members are bounded by intergenerational and interpersonal relationships by virtue of living in joint families and sharing responsibilities with each other. However, the country has been experiencing a rapid demographic transition for the past few decades, with significant state-level variations in achieving different stages of the transition (James, 2011; Ponnappalli et al., 2013). The demographic and economic changes – such as emergence of new household structures, rapid urbanisation, increase in years of schooling, longevity improvements, late marriage, and selective out-migration of younger adults, particularly from rural areas – are often associated with a rise in nuclear living and a diminishing preference for intergenerational co-residence (Adams, 2010; Bongaarts, 2001; Bongaarts & Zimmer, 2002; Nayak & Behera, 2014; Dhillon et al., 2016).

According to the Census of India (2011), a household consists of one or more persons who live together and share a common kitchen for food (RGI, 2011). The definition of household structure varies across studies but is usually derived from the information on household size, co-residence, marital status of members, and the relationship between members of households. According to the United Nations, a household consists of one or more persons living together who make common provisions for food and other essentials for a living (Kamiya & Hertog, 2020). As defined by Monostori and Murinko, a household consisting of one or more families resembles the family household structure (Monostori & Murinkó, 2015). Including different categories of relatives makes the structure of the households more complex since adding one relative means adding one or more relationships. For instance, the term ‘co-residence’ is used when living with at least one person (child/spouse/any other relative). By contrast, the term ‘living alone’ is used when it is a completely single-member household, though a few elderly studies also use the term for living with spouse only (Palloni, 2001). However, single person household is also known as one person household, and a two-person household with only one couple is known as one-couple only household respectively.

Until recently, no prior research has assessed the age pattern of persons living in one-person households and one-couple-only households in India. We attempted to unearth this by asking some research questions, including: What is the average household size in India, and how has it changed over time? What are the regional patterns of one-person and one-couple households in India and its states, and how will they change in the future? Therefore, the present study aims to assess the trend of ‘one-person’ households and ‘one-couple-only’ households in India and its states, to assess the age pattern of the household head of the same by sex and place of residence, to study the impact of three basic demographic indicators on the prevalence of the two household structures under study and to make projections for the upcoming years in the country at the national and state levels to provide valuable insights for socioeconomic policies.

## Review of Literature

### Global Context and Scenario

Long time series available from the past censuses are often the main source of descriptive work on household demography, indicating a dominant trend of a steady decline in household size and an increase in the proportion of single-person household in several European countries as well as the United States (Bongaarts, 2001; He et al., 2005; Yi et al., 2008). In most of the developed countries, more than one-third of households contain only one person, whereas in Asia, the prevalence is generally lower. Earlier on, it was estimated that four Asian countries would be leading the trend by 2020, including China and India (Euromonitor International, 2012; Yeung & Cheung 2015). The one-person living arrangement has been rapidly increasing in the United States (Vespa et al., 2013). Iacovou & Skew (2011) found evidence of the changing traditional family setup in nuclear or single-parent settings across the European Union. The most economically developed societies of East Asia like Japan, South Korea, and Taiwan have the highest proportion of one-person households at 32.4%, 23.9%, and 22%, respectively, whereas in other Asian regions, the proportion of one-person households is substantially lower (10% or less) (United Nations Statistics Division, 2014). In countries like China and Japan, the proportion of older persons living independently (alone or with spouse only) is rising, whereas the practice of persons living with adult children is becoming less common. In addition to this, one-couple-only households and one-person households are the dominant types of one-generation households in these countries (Yi, 2002; Yi & Wang, 2003; Hu & Peng, 2015; Yi et al., 2008; Yi et al. 2013).

### Indian Context and Scenario

In the context of India, we can categorise the family into nuclear and joint setups. Like most of the agrarian societies, the joint family is a common feature in India (Gore, 1965). However, in the last few decades, the household structure and family composition have undergone several changes and developments. Rapid industrialisation and urbanisation have resulted in the expansion of the nuclear family setting, which previously existed in most of the developed countries (Cohen, 1981). Over the years, nuclear households have been on the rise in almost all Indian states (Niranjan et al., 1998; D'cruz & Bharat, 2001). Demographic transition, migration, urbanisation, and economic growth have had a vast impact on the living arrangements of single-person and one-couple households, especially with respect to widows, females, and older persons (Chaudhuri & Roy, 2009; Croll, 2006). Various socio-demographic factors are yielding new patterns and distributions of family household structures, which vary from population to population. Changes in the pattern of living arrangements and household structures are linked with different socio-economic and demographic transitions either directly or indirectly and affect the life of the aged (Dhillon et al., 2016; Niranjan et al., 1998; Rajan & Kumar, 2003).

The literature on the household family structure in India has grown immensely in the last two decades, although such studies are from different perspectives (Sonawat, 2001). The proportion of nuclear family households has increased significantly and more dominantly in rural areas over the years in India with the presence of a strong wealth gradient, indicating that richer individuals are less likely to live alone or with their spouse only as compared to the economically disadvantaged individuals (Jadhav et al., 2013; Niranjana et al., 2005). The increasing number of nuclear and one-person households may be a major concern, especially from the perspective of old age. Rajan and Kumar (2003) suggested that co-residence with other family members reduces the economic and social security concerns of the elderly. This would further lead to a scenario of similarity in reshaping the household structures in India with other Asian countries like China, Japan, South Korea, Taiwan (Dommaraju, 2015; United Nations Statistics Division, 2014). As compared to rest of the Asian countries showing higher prevalence of one-person households the prevalence in India is lower but the number of such households is large due to its large population size resulting in large number of households. However the prevalence of one-person households is expected to grow in the next few decades, further following the pattern of China and Japan (Dommaraju, 2015). However, Nayak and Behera (2014) found that household size has been continuously declining in India. However, the pace and magnitude of this decline vary across the regions. Their study found that north-western India has a very slow decline in the size of the household, while the north-eastern part of the country has a constant household size. The most interesting pattern has been observed in the southern part of the country, where the average household size has been falling continuously and one-member households have been increasing rapidly in number.

## Materials and Methods

### Data

Data on different household structures and average household size were taken from different rounds of the Census (1991, 2001, and 2011), the National Family Health Survey (rounds 1, 3, and 4 conducted in 1992–93, 2005–06, and 2015–16 respectively), and the National Sample Survey Organization (52<sup>nd</sup> round of 1996, 60<sup>th</sup> round of 2004, and 71<sup>st</sup> round of 2014). The reason for using data from the Census is to see the pattern of different household structures in the country, and to decide which data source to use out of NSSO and NFHS because these are the only representative data that gives information on living arrangement or household structure of the people of different age-groups in the country. The change in the pattern of household structure observed from the NFHS data followed more or less the same pattern as in the case of the Census. As a result, it was decided to take data for the study from the three rounds of NFHS. However, the data for the second round of NFHS was dropped from the analysis, in order to maintain a gap of 10–12 years between the dataset and capture a clear comparative scenario between the decades.

NFHS is a large-scale multistage survey conducted in a representative sample of households all over India. It is conducted under the stewardship of the Ministry of Health and Family Welfare (MoHFW), Government of India, and coordinated by the International Institute for Population Sciences (IIPS). Four rounds of the survey have been conducted so far, including NFHS-1 in 1992–93, NFHS-2 in 1998–99, NFHS-3 in 2005–06, and NFHS-4 in 2015–16. The survey provides information on fertility, mortality, family planning, maternal and child health indicators, child nutrition, domestic violence, etc. at the national, state and district levels. The sample size in the three rounds of the survey that we restricted our study to was 88,512 households in NFHS-1, 108,944 households in NFHS-3, and 601,137 households having usual residents in NFHS-4.

### Description of Variables

This study defined one-person (OP) households as households with only one usual resident and one-couple-only (OC) households as households, where only one couple was enumerated as usual residents. Since no direct question regarding the respondents' living arrangements was asked in the survey, we created the above-defined household structure variable using the person identifier, relationship to household head, and household size based on whether the individual was a usual resident of the household or not.

### Analytical Approach

We first assessed the prevalence of different household compositions in different nationally-representative surveys and matched them with the Census of the comparative year. Then, we analysed the trends in the prevalence of OP and OC households from 1992–93 to 2015–16 in India and its states using the NFHS data. Next, we conducted a statistical test for the proportion of two populations to compare the prevalence of these two different household structures at three different time points. To identify the significant change in the prevalence of a given household structure from one decade to another, we pooled the data from three rounds of NFHS, using variables containing only the necessary information. We have shown the trends of OP and OC households by age, sex of household head, and place of residence, that is, rural or urban area, as defined in the Census. Apart from this, we adopted a semi-parametric smoothing method called regression spline smoothing to assess the age distribution of OP households. In spline smoothing, one can use polynomial equations instead of linear ones and can decide the degree of the polynomial after comparing smoothed and observed values.

The mathematical form of regression spline is given by Racine (2014) as:

$$\hat{r}(x) = \sum_{j=1}^{m+k+1} \hat{\beta}_j g_j(x)$$

where  $g_j$  s are the truncated power basis functions for the  $k^{\text{th}}$  order splines over the knots  $t_1, \dots, t_m$ , and  $\beta_j$  s are the coefficients of the regression function estimated by least squares. Basically, here we spline regression to highlight the smooth curve of the age pattern of the head of different household structures under study.

We carried out a multiple linear regression analysis to understand and predict the role of demographic indicators with respect to OP and OC households in India. We took total fertility rate (TFR), infant mortality rate (IMR), percentage urban, and life expectancy at birth as the independent variables and compiled state-level data for three different time points.

Formally, the model for multiple linear regression given  $n$  observations is:

$$Y_i = \beta_1 + \beta_2 X_{2i} + \beta_3 X_{3i} + \dots + \beta_k X_{ki} + U_i; i = 1, 2, 3, \dots, n$$

where  $i$  represents state,  $X$ s represent the independent variables,  $Y$  is the dependent variable, and  $U_i$  s are the stochastic disturbance terms.  $\beta_1$  is the intercept term or constant term in the model.  $\beta_2, \beta_3, \dots, \beta_k$  s are the coefficients to be estimated.

After that, the logistic curve was fitted to project the different household structures for the population of India and the selected states. Here, the spreadsheet for 'logistic curve fitting', given in the Population Analysis System Software by the US Census Bureau, was used. Based on the pattern of different household structures in the Indian states, we fixed the different asymptotes for this logistic model to be fitted.

The mathematical form of the logistic curve given by Pearl and Reed is as follows:

$$f(x) = L_1 + \frac{1}{e^{-k(x-x_0)}}$$

where  $L$  = maximum value,  $k$  = logistic growth rate,  $x_0$  = value of sigmoid mid-point, and  $x$  lies between  $-\infty$  and  $\infty$ . Here the maximum value was the assumed asymptotes, growth rate was obtained from the calculated prevalence rates.

The assumptions for the asymptotes of the logistic growth model are mentioned in the Appendix.

## Results

Table 1 depicts the comparative scenario of household size and household composition as derived from three different data sources viz. Census of India, NFHS, and NSSO over the period. The findings suggest that according to the Census data, there was a decline of 0.7 points in the average household size from 5.5 persons in 1991 to 4.8 persons in 2011. This trend was more or less similar in both rural and urban households, though rural areas had a greater household size than urban areas throughout the period. The percentage of one-person households and two-person households increased during this period, whereas the percentage of households with five or more persons declined by 16%. As per the three rounds of NFHS, the average household size decreased from around 5.9 persons

**Table 1** Average household size and distribution of households by size over time: A comparison from different data sources

	Total									
	Census			NFHS			NSSO			
	1991	2001	2011	1992–93	2005–06	2015–16	1995	2004	2014	
Average HH size	5.5	5.40	4.80	5.91	4.98	4.76	4.9	4.11	4.51	
One person HH	[11.07]	3.93	4.10	2.56	4.84	3.86	6.18	6.59	5.47	
Two-person HH		8.24	9.72	6.45	10.04	10.84	9.0	9.09	11.01	
HH with 5 or more usual members	65.7	56.96	49.46	66.33	52.39	47.28	53.29	51.03	44.79	
	Urban									
	Census			NFHS			NSSO			
	1991	2000	2011	1992–93	2005–06	2015–16	1995	2004	2014	
Average HH size	5.3	5.1	4.6	5.64	4.71	4.44	4.57	4.38	4.15	
One person HH	[11.45]	3.82	3.78	2.97	5.26	4.21	10.66	11.6	8.84	
Two-person HH		7.91	9.47	6.39	9.98	11.38	8.09	8.33	11.47	
HH with 5 or more usual members	64.04	52.57	44.07	62.81	46.82	41.2	47.78	42.98	36.52	
	Rural									
	Census			NFHS			NSSO			
	1991	2001	2011	1992–93	2005–06	2015–16	1995	2004	2014	
Average HH size	5.6	5.3	4.9	6.01	5.11	4.82	5.04	4.99	4.68	
One person HH	[10.76]	3.97	4.26	2.4	4.63	4.63	4.6	4.65	3.85	
Two-person HH		8.37	9.83	6.47	10.07	10.07	9.32	9.39	10.79	
HH with 5 or more usual members	66.57	58.73	52.04	67.66	55.09	50.54	55.22	54.15	48.78	

in 1992–93 to 4.8 persons in 2015–16. The pattern of household sizes revealed by the NFHS data was quite similar to that revealed by the Census. The percentage of households with one or two persons increased, while that of households with five or more members showed a steady decline over 20 years, that is, from 1992 to 2015. The results obtained from the NSSO data did not show any kind of steady decline or increase in the share of different household structures over the period. It showed a decline in the average household size from 1995 to 2004, followed by an increase from 2004 to 2014. Therefore, this preliminary analysis suggested relying on the NFHS data for further detailed analysis of trends and patterns of household structure.

Findings from Tables 2 & 3 gives the trends of OP & OC households in the country and states. The prevalence of OP households in India and its states during 1992–2015 is depicted in Table 2. In 2015–16, the prevalence of OP households in India was around 4.1%. The state of Arunachal Pradesh (8%) was at the top of the list, followed by the states of Nagaland (7.6%), Goa (6.3%), and Himachal Pradesh (6.1%), whereas Jammu and Kashmir (1.5%) was at the bottom. Across the three rounds of the survey, the prevalence of OP households in India was

**Table 2** Prevalence of 'one-person' households in India and states, over period 1992–2015

States	One-person households				
	Prevalence			Absolute Change	
	1992–93	2005–06	2015–16	1992–93 to 2005–06	2005–06 to 2015–16
India	2.94	4.83	4.09	1.89**	-0.74*
Jammu & Kashmir	1.63	1.76	1.54	0.13	-0.22
Himachal Pradesh	4.59	6.31	6.07	1.72*	-0.24
Punjab	1.96	3.17	2.44	1.21	-0.73
Haryana	1.39	2.77	2.4	1.38	-0.37
NCT of Delhi	6.83	7.32	5.53	0.49	-1.79
Rajasthan	2.33	4.73	3.55	2.4	-1.18
Uttar Pradesh	2.46	3.68	3.91	1.22**	0.23*
Bihar	2.21	4.58	2.99	2.37	-1.59
Arunachal Pradesh	4.68	8.08	8.01	3.4	-0.07
Nagaland	0.19	9.37	7.56	9.18	-1.81
Manipur	1.57	2.58	2.89	1.01***	0.31**
Mizoram	2.39	5.31	5.47	2.92	0.16
Tripura	2.9	3.6	4.75	0.7*	1.15***
Meghalaya	1.51	5.97	3.25	4.46**	-2.72
Assam	3.84	3.76	3.49	-0.08	-0.27
West Bengal	3.64	4.21	3.43	0.57	-0.78
Odisha	3.42	4.35	3.75	0.93	-0.6
Madhya Pradesh	2.76	4.76	3.84	2	-0.92
Gujarat	4.34	4.01	4.06	-0.33	0.05
Maharashtra	3.08	4.24	4.8	1.16**	0.56**
Andhra Pradesh	2.33	6.21	5.64	3.88	-0.57
Karnataka	2.98	4.89	5.8	1.91**	1.09**
Goa	4.82	5.21	6.28	0.39**	1.07***
Kerala	2.74	3.01	3.19	0.27	0.18**
Tamil Nadu	4.27	10.3	5.05	6.03**	-5.23**

found to have increased significantly by 1.89 percentage points from 1992–93 to 2005–06 and to have marginally declined by 0.74 percentage points between 2005–06 and 2015–16. In Uttar Pradesh, Manipur, Tripura, Maharashtra, Kerala, and Goa, the percentage of OP households showed an increment during both the decades. Tamil Nadu showed an exceptional change over the three rounds of surveys by registering the largest increase of 6 percentage points in the prevalence of OP households among all the states from 1992 to 2006; however, in the 2015–16 round, it showed a decline of 5.3 percentage points.

The prevalence of OC households in India increased from 4.7% in 1992–93 to 8.1% in 2015–16 (Table 3). It is noteworthy that the increase in the overall percentage of OC households slowed down in the latest decade. The highest prevalence of

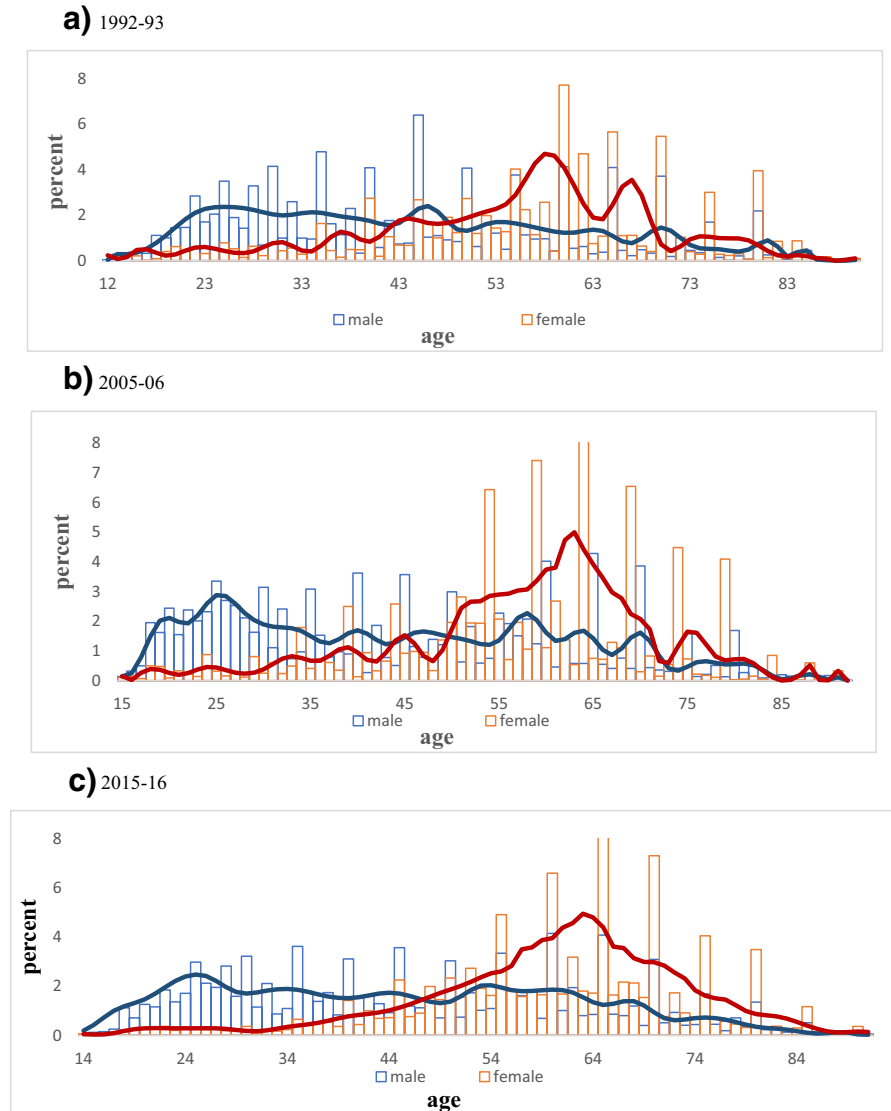


**Table 3** Prevalence of 'one-couple only' households in India and states, over period 1992–2015

States	One-couple only households				
	Prevalence			Absolute Change	
	1992–93	2005–06	2015–16	1992–93 to 2005–06	2005–06 to 2015–16
India	4.71	6.74	8.05	2.03**	1.31***
Jammu & Kashmir	3.85	2.41	3.9	-1.44	1.49
Himachal Pradesh	3.62	5.88	9.39	2.26**	3.51*
Punjab	3.98	4.26	4.94	0.28	0.68
Haryana	2.66	3.16	4.86	0.5*	1.7*
NCT of Delhi	4.05	4.53	5.82	0.48**	1.29**
Rajasthan	4.65	6.45	7.56	1.8	1.11
Uttar Pradesh	4.06	4.41	6.18	0.35	1.77**
Bihar	4.06	5.36	5.85	1.3	0.49
Arunachal Pradesh	4.37	3.77	9.3	-0.6	5.53
Nagaland	4.15	6.13	8.97	1.98***	2.84**
Manipur	3.23	3.65	4.19	0.42	0.54
Mizoram	3.77	3.95	4.67	0.18*	0.72*
Tripura	3.07	4.43	7.02	1.36**	2.59**
Meghalaya	4.64	4.42	3.31	-0.22	-1.11
Assam	2.97	4.11	4.68	1.14	0.57
West Bengal	3.62	5.79	7.74	2.17*	1.95*
Odisha	6.44	7.16	9.15	0.72**	1.99**
Madhya Pradesh	5.67	6.3	7.59	0.63**	1.29**
Gujarat	5.07	6.25	8.74	1.18**	2.49**
Maharashtra	4.75	6.33	8.16	1.58**	1.83**
Andhra Pradesh	6.35	12.32	14.35	5.97**	2.03*
Karnataka	3.87	5.97	7.8	2.1**	1.83***
Goa	3.99	5.99	7.14	2	1.15
Kerala	3.67	5.92	11.62	2.25**	5.7***
Tamil Nadu	7.65	13.83	10.98	6.18**	-2.85*

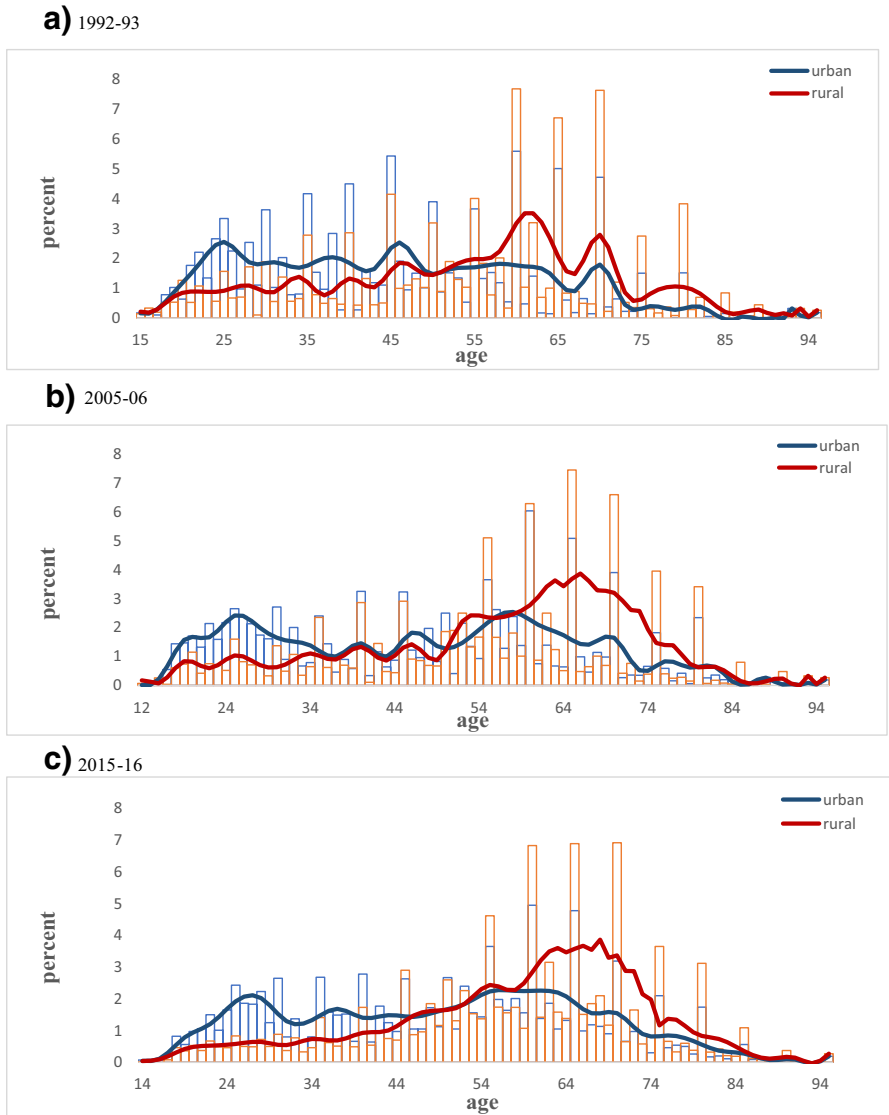
OC households in 2015–16 was observed in the state of Andhra Pradesh (14%), followed by Kerala and Tamil Nadu (11% each), whereas it was the lowest in Jammu and Kashmir (3.4%). During 2005–2015, Kerala showed the highest increase (6%), followed by Arunachal Pradesh (5.5%), Himachal Pradesh (3.5%), and Nagaland (2.8%). In contrast to this, there were two states, Tamil Nadu and Meghalaya, which observed a decline in the percentage of OC households during 2005–15. Similar to the case of OP households, Tamil Nadu showed the highest significant increase in the prevalence of OC households from 1992–93 to 2005–06 and a substantial decline from 2005–06 to 2015–16.

The age pattern of OP & OC households by sex and place of residence across all the three rounds of NFHS is shown in Figs. 1, 2 and 3 respectively. The age pattern



**Fig. 1** One-Person households by age and sex over time, India

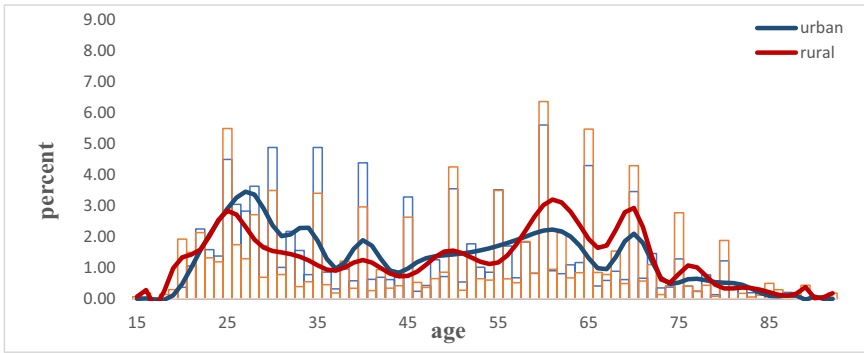
of OP households by sex across all three NFHS rounds is portrayed in Fig. 1. In the younger age groups (specifically in the age group of 15–40/45), the percentage of OP households was higher among males as compared to females in all three rounds of the survey. While considering female residents, there was a gradual increase in the percentage of OP households with an increase in age, with the highest prevalence being in the age of 60–65 years, after which there was a noticeable decline. The peak among females was at age 60 in 1992–93, which increased to 65 years in



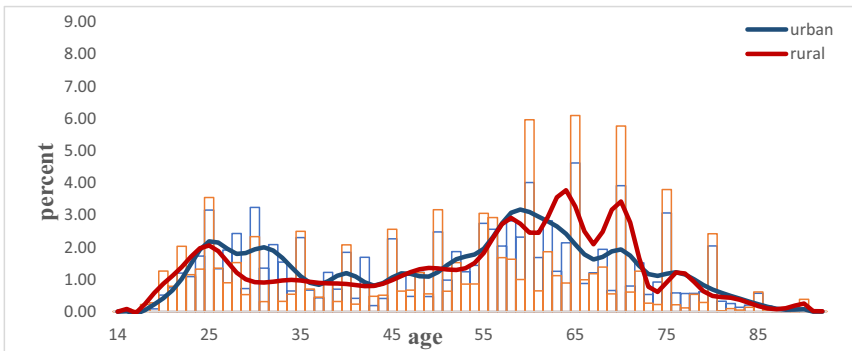
**Fig. 2** One-Person households by age and place of residence over time, India

2015–16. In 2015–16, the age pattern of OP households by sex was similar to the one observed in 2005–06, with a slight decrease in all ages. In 2015–16, about 4.4% of females of age 65 years were residing in single households compared to only 1.2% of men of the same age. From 1992–93 to 2015–16, there was a clear increase in OP households among females, particularly in older ages. In the case of males, the proportion of those who lived in OP households was higher among the younger ones and working-age men.

a) 1992-93



b) 2005-06



c) 2015-16

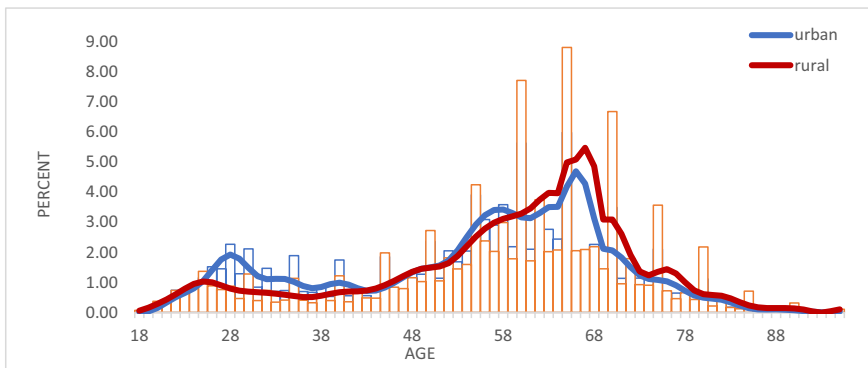


Fig. 3 OC households by age of the head of the households by place of residence over time, India

Figure 2 shows that a higher percentage of younger urban adults (peak at 25 years of age) were living in OP households compared to their rural counterparts in all three rounds of the survey. On the other hand, a higher proportion of older adults from rural areas were living alone as compared to urban residents. After age 80,

the rural–urban differentials in OP households disappeared. Compared to 1992–93, in the other two rounds of the survey, the percentage of older adults living in OP households increased in rural areas and became considerably higher than that of those living in urban areas.

The pattern of OC households by age of head of household in rural and urban areas over time (Fig. 3) suggests that in 1992–93, a higher percentage of urban adults in the age group 25–35 were living in OC households as compared to rural adults. However, when considering older adults and the elderly, the situation was the reverse. In 2005–06, the percentage share of people living in one-couple-only households was more or less equal among urban and rural dwellers. In 2015–16, the proportion of those living in OC households was higher among older adults and the elderly than any other age group. This proportion was also higher than in the previous rounds of the survey and was slightly rural dominating. In the age group of 28–38 years, a higher percentage of urban adults were living in OC households compared to rural adults.

Table 4 shows the results of the multiple linear regression models that account for the impact of the demographic indicators and the three time points on OP and OC households. The TFR was significantly and negatively associated with OP households, indicating that a one-child-per-woman increase in TFR would have significantly reduced the percentage of OP households by 0.95 percentage points. The decline in TFR contributed to the increase in the percentage of OP households in India. A one-year increase in life expectancy would have increased the percentage of OP households by 0.013 percentage points ( $p < 0.10$ ). However, the relationship between percent-urban OP households was not significant. After controlling for the demographic factors, the prevalence of OP households increased significantly from 1992–93 to 2005–06 (coefficient: 1.74,  $p < 0.001$ ) and then again in 2015–16 (coefficient: 1.03,  $p < 0.10$ ). The model depicting OC households as the response variable suggested that a one-child-per-woman increase

**Table 4** Role of demographic indicators on the prevalence of OP and OC households, in India: Result from OLS

Variables	OP Households		OC Households	
	coefficients	probability	coefficients	probability
TFR	-0.956	0.011	-1.4913	0.013
Urban percent	0.0014	0.941	0.0532	0.092
Life expectancy	-0.1322	0.079	-0.2764	0.033
<b>Time</b>				
1992–93®	1.7401	0.001	2.0394	0.009
2005–06	1.0325	0.055	3.7801	0.000
2015–16	14.4260	0.017	25.5538	0.009
<b>Constant</b>				
number of observations	45		45	
Adjusted R square	0.3931		0.5131	
Prob > F	0.0012		0.0000	

in the TFR contributed to reducing OC households by 1.49 percentage points ( $p < 0.05$ ). Apart from this, a one-year increase in life expectancy at birth would have decreased the prevalence of OC households by 0.28%. Percentage urban had a significant and positive effect on the prevalence of OC households. After controlling for the demographic factors, the prevalence of OC households increased significantly from 1992–93 to 2005–06 (coefficient: 2.03,  $p < 0.05$ ) and then again in 2015–16 (coefficient: 3.78,  $p < 0.001$ ).

The projected prevalence of OP and OC households in the country for the years 2030 and 2050 at national as well as subnational levels is presented in Tables 5 & 6 respectively. The projected percentage of OP households in India and the selected states by making three assumptions regarding the asymptotes of the S-curve (logistic) is shown in Table 5. Considering the experience of the Indian states, the base asymptotic value of OP households was taken at a 5% level. The projection was done only for those states where the change in the prevalence of OP households followed a significant trend. The prevalence of OP households in India is projected to reach 5.5% (4.9%–5.6%) by 2030 and 6.7% (5%–7%) by 2050. The results show the highest prevalence of OP households would be in Mizoram (9.1% in 2030, 10.0% in 2050), followed by Goa (7.2% in 2030, 7.7% in 2050), assuming the upper bound of the asymptote to be at 10% level. On the other hand, among the selected states, Kerala would have the lowest prevalence of OP households at 3.5% (3.48%–3.74%) in 2030 and at 4.0% (3.8%–4.3%) in 2050.

Table 6 presents the projected percentage of OC households in India and the selected states by taking three different asymptotes of the S-curve (logistic). The prevalence of OC households in India would reach 10.4% (9.2%–10.8%) by 2030 and 12.6% (9.8%–14.2%) by 2050. The highest prevalence of OC households would be in the state of Kerala at 14.0% by 2030 and 14.9% by 2050, followed by Himachal Pradesh at 12.4% in 2030 and 14.3% in 2050, assuming a 15% upper asymptotic value.

**Table 5** Projection of OP households in India and States by taking three different asymptotes of S-curve (logistic)

States	5%		10%		15%	
	2030	2050	2030	2050	2030	2050
India	4.94	5	5.48	6.65	5.62	7.13
NCT of Delhi	NA	NA	5.14	3.96	5.14	4.16
UP	4.55	4.86	5.43	6.75	5.43	7.41
Manipur	3.81	4.49	4.42	6.06	4.42	6.71
Mizoram	NA	NA	9.08	9.96	9.08	12.23
Tripura	4.94	4.99	6.19	7.53	6.19	8.4
Maharashtra	3.73	3.22	6.36	7.56	6.36	8.41
Karnataka	4.99	5	6.9	7.92	6.9	9.21
Goa	NA	NA	7.17	7.67	8.01	8.57
Kerala	3.48	3.82	3.54	3.99	3.74	4.3

NA Not Applicable, the logistic curve fit was not applicable for those states where the prevalence of OPHH is

**Table 6** Projection of OC Households in India and States by taking three different asymptotes of S-curve (logistic)

States	Asymptotic values					
	10%		15%		20%	
	2030	2050	2030	2050	2030	2050
India	922	9.79	10.38	12.6	10.84	14.15
Himachal Pradesh	9.9	9.99	12A1	1433	13.69	17.68
Haryana	6.19	7.93	6A6	9.1	6.57	9.73
NCT of Delhi	6.77	7.99	6.96	8.76	7.04	9.1
Rajasthan	822	9.6	9.69	11.91	10.03	13.11
Uttar Pradesh	7.18	8.46	7A4	9.51	7.54	9.99
Nagaland	9.75	9.97	11.69	1325	12.58	16.51
Manipur	428	5.75	49	5.98	4.92	6.06
Mizoram	117	198	521	6.14	5.22	621
Tripura	8.66	9.67	9.81'	12.77	10.36	1484
Assam	6.02	7A8	624	832	6.34	8.74
West Bengal	9.18	9.83	10.66	1321	11.35	15.47
Odisha	9.66	9.93	lass	12.3	10.8	1324
Madhya Pradesh	8.4	9.2	8.75	10.36	8.86	las
Gujarat	933	9.91	10.77	12.94	11.22	1458
Maharashtra	923	9.8	1034	12.59	10.77	14.11
Andhra Pradesh	NA	NA	14.71	1498	17.33	1924
Karnataka	9.17	921	10.55	13.05	11.18	15.12
Goa	8.65	935	9.59	12.07	10	13.51
Kerala	NA	NA	13.97	1487	16.11	19.1

NA Not Applicable, the logistic curve fit was not applicable for those states where the prevalence of OCHH is already higher than the 10% asymptotic value

### Conclusion

This paper has documented a significant increase in the share of OP and OC households in India throughout 1992–2015. At present, the prevalence of OP households in India is around 4%, which is much less than compared to other South Asian and East Asian countries (United Nations Statistics Division, 2014; Yeung et al., 2015; Desai et al., 2010). But because of India’s huge population, the number of people living in OP households is large (Hall et al., 1997; Dommaraju, 2015). A recent report of the Longitudinal Ageing Study in India (LASI) reported that 3.4% of those above age 45 years were living alone in 2017–18 (IIPS and MoHFW). The rising prevalence of OP and OC households supports some of the sociological studies that have provided the evidence of a decline in joint family households in India (Gubhaju, 2008; Barik et al., 2017).

This study observed a significantly increasing trend in the prevalence of OC households throughout 1992–2015, which is almost similar for most of the states in the country. The southern states of Andhra Pradesh, Kerala, and Tamil Nadu

are at the top of the list. These states are in the advanced stage of the demographic transition with low fertility and mortality rates (Munshi et al., 2016; Ponnappalli et al., 2013). The state of Kerala has the highest significant increase in the share of OC households and is followed by the state of Arunachal Pradesh. This study revealed that the percentage share of OP and OC households is maximum among the southern states and some of the north-eastern states of India. Migration, low fertility level, and rapid urbanisation could be cited as some of the reasons behind the greater prevalence of OP and OC households in the southern states of India (Chandrasekhar & Sharma, 2015; Ponnappalli et al., 2013; Sadashivam & Tabassu, 2016), which further supports the study showing the role of household transitions through migration, marriage or cohabitation, fertility, separation or divorce and ageing (Hall et al., 1997). Tamil Nadu is the state with the highest level of percent urban. This state has also been found to have the highest proportion of nuclear family households (Dhillon et al., 2016) and the highest percentage of elderly living alone (16%) and with spouse only (28%) in prior research (Alam et al., 2012). The LASI reported that around 15% of elderly aged 60+ from Tamil Nadu were living alone in 2017–18 (IIPS et al., 2020).

A higher percentage of Indian females were living in OP households in the older ages, whereas in the younger ages, males dominated this trend. This huge gender gap in the prevalence of OP households is due to the higher male migration for work and education in the younger age and feminization of ageing because of higher longevity of women than men (Agarwal et al., 2020; Kishore et al., 2018). The age distribution of persons living in OP households by place of residence in the country highlighted a higher proportion of young adults living alone in urban areas as compared to rural ones and a higher proportion of older rural dwellers living alone as compared to their urban counterparts. A higher proportion of older adults and elderly were found to be living in OC households, with the trend being slightly rural dominating, supporting a few prior studies in this area that have also evidenced a higher proportion of rural elderly living alone or with spouse only in the country (Alam et al., 2012; IIPS et al., 2020).

The declining TFR in India has significantly increased the percentage of OP and OC households in India. India's TFR declined from 3.39 children per woman in 1992–93 to 2.18 in 2015–16 (IIPS and ICF, 2017). A one percentage point increase in urban population would significantly increase the prevalence of OC households in India. India's population has been continuously progressing to urbanisation, as evidenced by the growth of the urban population from 25.72% in 1991 to 31.16% in 2011 (Bhagat, 2018). However, we found a negative effect of longevity improvement on both OP and OC households. The prevalence of OP households in India is projected to increase considerably in the near future at varying rates in different states.

Government schemes/programmes in India are implemented at the household level. Therefore, this study, accounting for the prevalence of OP and OC households and changes in their age patterns, would serve as a useful database for the planning and implementation of healthcare programmes, specifically for those who are aged 60 or above. This study provides evidence on the changing pattern of OP and OC households in India and select states from the past (1992–93) to the recent years (2015–16) to the future (2050). The paper documented a significant increase in the



share of OP and OC households in India throughout 1992–2015. The finding on the increasing number of OP and OC households, particularly among older adults and the elderly, has implications for geriatric care policies. If these trends follow in the future, we would require more social support to provide for the greying population in India. In the present scenario, the prevalence of OP households in India is around 4%, which may reach 5.5% (4.9%–5.6%) by 2030 and 6.7% (5%–7%) by 2050. The prevalence of OC households, on the other hand, will increase from 8.1% in 2015–16 to 10.4% (9.2%–10.8%) by 2030 and 12.6% (9.8%–14.2%) by 2050. The continuous decline in TFR and the continuous increase in urbanisation would lead to an increase in OP and OC households in India. However, the increasing longevity would increase the prevalence of OP but may suppress the prevalence of OC households to some extent. Longevity improvements in India may have increased the percentage of elderly living alone but has failed to reduce the risk of widowhood unlike in other countries (Bongaarts & Zimmer, 2002), resulting in the negative association between longevity and OC households. However, this association needs further explanation and exploration.

Regarding the key limitations of the analysis, one was the non-availability of an appropriate statistical method for the projection of different household structures for different scenarios in the Indian context unlike countries like China, Japan, and the Netherlands that use the Profamy and Lipro models (Keilman, 2015; Yi et al., 2006, 2008). Pre-assumptions regarding the asymptotes of the fitted logistic curve may not always be true. The household structures are also influenced by some socio-economic and development indicators, which were not taken into account in this study. Consequently, a simple logistic curve was fitted to get the projection figures, keeping in mind that rates are generally projected using the same.

## Declarations

**Conflict of Interest** The authors declare no conflict of interest.

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