



Working Paper Series

Population Ageing in India: Assessing Inter-State Variations

Sunil Rajpal¹, Shreya Ronanki¹

November 21, 2023

FLAME Working Paper Volume 1, Number 3

The views expressed in this paper are those of the author(s) and do not necessarily reflect those of the
FLAME University.

Affiliations

1. Department of Economics, FLAME University, Pune, India

Corresponding Author

Sunil Rajpal
Assistant Professor
Department of Economics,
FLAME University, Pune, India
Email: sunil.rajpall@flame.edu.in

Acknowledgement: The authors extend sincere thanks to FLAME University, Pune for giving the opportunity.

Declaration of Conflicting Interest: The authors declare no conflict of interest.

Funding: Not applicable

Abstract

With the rapid decline in fertility and improving life expectancy at all ages in India, ageing populations are projected to increase substantially in the future. Given India's rapidly growing population, this translates into a large number of elderly individuals in terms of absolute numbers. Further, due to substantial variations in economic growth, income and wealth distribution, health infrastructure as well as the pace of the demographic transition across Indian states, understanding the differentials in population ageing across states becomes imperative for targeted resource allocation from a policy perspective. This study used data obtained from secondary sources such as the Census of India, Sample Registration System, and the United Nations World Population Prospects (2015 Revision) to provide a comprehensive overview of the trends and variations in population ageing across Indian states over the years using a range of indicators. The findings revealed a relatively higher proportion of elderly populations in southern states with Kerala reporting the highest proportion of elderly population, old age dependency, median age as well as life expectancy (at birth and old age). This is followed by other southern states and Punjab, Maharashtra and Odisha. In contrast, Uttar Pradesh, Rajasthan and Madhya Pradesh reported the biggest lags in experiencing bulging elderly populations. Findings also indicated an increase in the range (highest minus lowest) of elderly share in the total population implying significant differences in the timings at which states will experience a bulge in their old age populations.

Introduction

According to United Nations (World Population Prospects 2017), the share of elderly population (60+ years) in India has increased from 5.4% in 1950 to about 9% in 2015 and is further projected to cross 20% in 2050 and 34% by the end of this century. Although India does not fit into the United Nations' definition of ageing countries (above 11%) with its current proportion of elderly (9%), having the second highest population base in the world, the estimated number of old people in India is about 103 million (Census of India, 2011). This is further projected to increase manifold in the future. With the rapid decline in fertility and persistent increase in longevity at all ages, the absolute figures for old age population (330 million) will outnumber the child population (326 million) by 2050 (UNWPP, 2017). Given the intrinsic demographic differentials across Indian states, the timing and pace of population ageing, its implications are also expected to vary across regions (Subaiya & Bansod, 2011; Visaria, 2001).

Existing studies have assessed the variations in the fertility and mortality transition across states in India (Alagarajan, 2003; Alagarajan & Kulkarni, 1998; Bongaarts, 2003; Casterline, 2001; Guilmoto & Rajan, 2001). In addition, there are widely known and acceptable differences across states in terms of economic growth, income and wealth distribution, poverty and deprivation, literacy and educational levels, employment levels, nutritional status and health infrastructure (Deaton & Dreeze, 2002, 2009; Jayaraj & Subramanian, 2015; Navaneetham, Mishra, & Joe, 2008; Sen, 1972, 1973). Additionally, the pace of change in the age structure of the population – the phenomenon commonly known as demographic transition – also varies substantially across states (Goli & Arokiasamy, 2013; Lee & Reher, 2011). Recent studies have also proposed a novel method to measure the pace of population ageing termed “Prospective measures of ageing” (or characteristics-based ageing measures) (Sanderson & Scherbov, 2010, 2013, 2015). With the valid argument that the age-specific characteristics of the population tend to change overtime, they asserted that being young and old are relative notions and therefore the threshold for old age should be determined based on certain health characteristics (like blood pressure) rather than chronological age. Besides, they further argued that conventional measures of ageing

(mainly the proportion of elderly (65+ years) in total population) are solely based on number of years already lived (i.e., retrospective phenomenon) which can potentially ignore the overtime improvements in the length of life.

However, there is a dearth of studies on understanding the variations in the pace of population ageing across Indian states using recent data. A thorough understanding on the interstate variations in population ageing can offer valuable insights for effective allocation and distribution of resources primarily from the targeting perspective.

Therefore, this study aims to understand the differentials in population ageing across major states in India via examining conventional measures of ageing. The study also attempts to understand the current and future policy implications of interstate variations in ageing indicators.

Data and Methodology

Data

The present analysis is based on data obtained from secondary sources including Census of India, Sample Registration System and United Nation's World Population Prospects (UNWPP) (2015 revision). To understand the overtime trends and interstate variations in various ageing indicators across Indian states, this study focuses on 15 major states (Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal) which comprise about three-fourth of the Indian Population. The data from Census is available on decadal basis; mainly for five time points i.e., 1971, 1981, 1991, 2001 and 2011. Further, Census projections based on 2001 population (as base years) are available on five-yearly basis up to 2026. The data on projected life expectancy and age specific population for India has been taken from UN World Population Prospects (2015th Revision) on five-yearly basis for the period of 1950 to 2100. Further, information on life expectancy (five yearly moving average) is taken from SRS (Sample Registration System) abridged life tables from 1970-75 to 2011-15. It is also to be noted that the Census wasn't conducted in Bihar and Assam in 1981.

Outcomes

To understand the trends and variations in population ageing across Indian states, this study focuses on a range of demographic indicators including age-specific population growth rate, age composition of population (proportion of elderly and very elderly population i.e., 60+ years and 70+ years), old age dependency ratios, median age, and life expectancy (at birth, at 60 years, and at 70 years).

Analysis

The overtime trajectory in ageing indicators across major Indian states and regions is presented through simple cross tables and bar graphs along with differences between highest and lowest observations. Further, box-and-whisker plots are used to further the understanding on the variations in population ageing across Indian states for different time-points. Box plots are non-parametric and are used to display variations in samples of a statistical population through quartiles. The line inside the box shows median of the population. The size of the boxes reflects the variations across the populations and tails at the top and bottom of boxes show the range or skewness in the population. The position of the boxes in the plot region shows the range of sample overtime. This section is followed by the results describing the trends and variations in each indicator.

Results

Elderly Population in India

The growth rate of population by broad age groups for India is presented in Table 1. While there is substantial increase in the share of adult and elderly population, the growth rate of child population has been declining in India since 1971. It can be observed from the table that the growth rate of elderly cohort is highest across all age groups. For instance, the decadal growth rate of elderly population in India has increased from 32.3% in 1971 to 35.5% in 2011. Similarly, the decadal growth rate of adult (15-59) population has also increased from 21.8% to about 25% during the period 1971 to 2011. However, since 1991 the growth has been declining from 29.6% in 1991 to 25.9% in 2001. Contrastingly, the decadal growth in child population has declined substantially from 27.9% to just 0.4% between 1971 and 2011. Since last

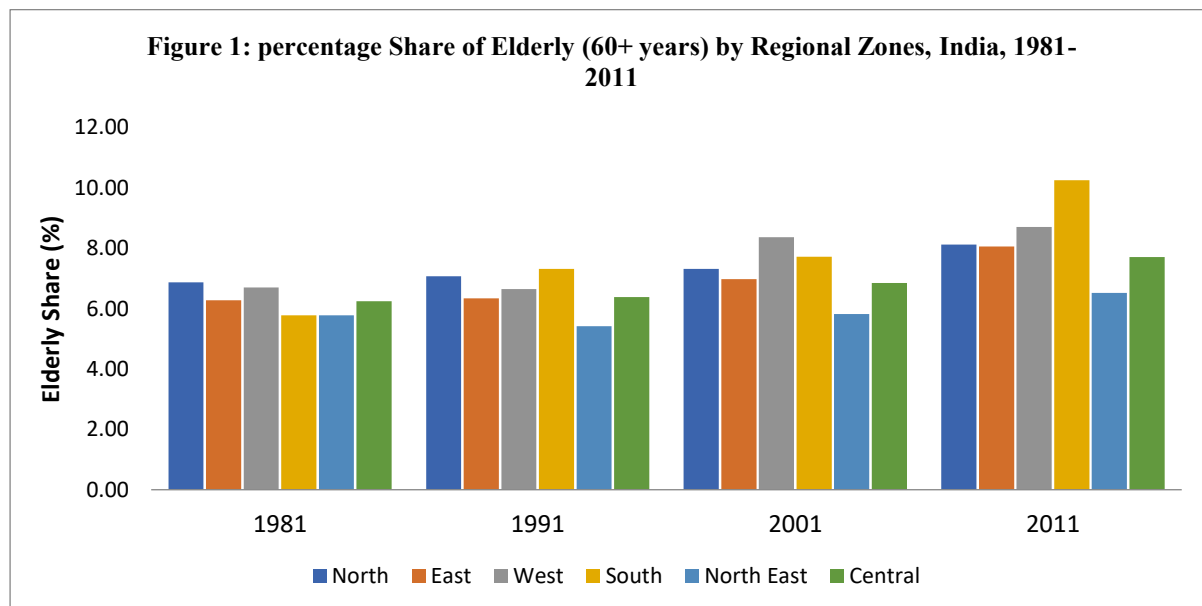
decade, only elderly population have experienced higher growth rate in 2011 as compared to child and adult population.

Table 1: Decadal Growth Rate of Population by Age Groups for India: 1971-2011

Year	0-14	15-59	60+
1971	27.91	21.81	32.34
1981	14.27	25.90	32.04
1991	18.72	29.59	31.31
2001	16.41	25.99	35.18
2011	12.43	24.66	35.53

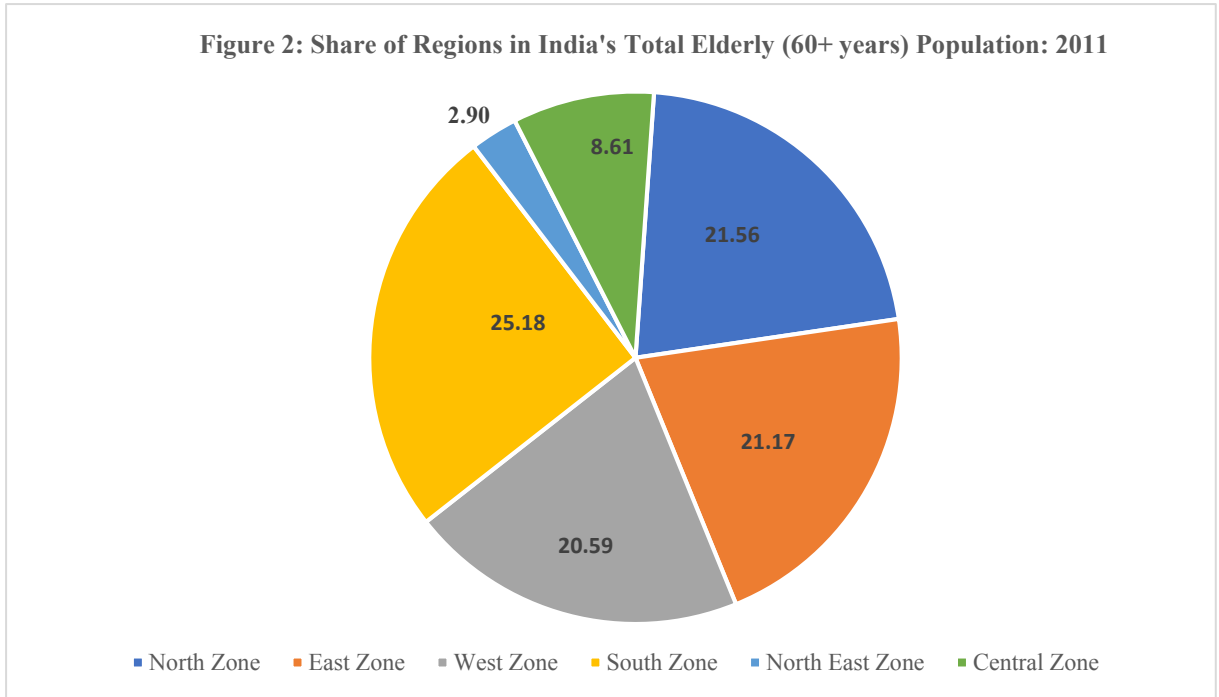
Source: Compiled by Author from Census Rounds

Figure 1 shows the percentage share of elderly group in total population by regional zones in India for 2011. In 1981, the share of elderly population was highest (6.87%) in the northern region. According to Census 2011, the proportion of elderly are clearly highest in the southern zone with total share of 10.25% in population. This is followed by western zone with second highest share (8.71%) of elderly in total population. Importantly, relative growth in the share of elderly population have been consistently higher among southern states compared to other regions. Central and north zones have relatively lower proportion of elderly in their state.



Source: Census of India

Figure 2: Share of Regions in India's Total Elderly (60+ years) Population: 2011



Source: Census of India

Further, Figure 2 depicts the percentage distribution of elderly population across major regions in India for 2011. The estimates from Census 2011 data clearly display that more than a quarter of total elderly population in India are agglomerated in southern states. However, contrary to expectations, northern states also have more than one fifth of total elderly population. Besides, the share of western zone in India's total elderly population is about 20.59% in 2011.

Table 2 shows proportion of old age (60+ years) population for selected Indian states from 1981 to 2011. According to the Census 2011 estimates, about 12.57% of total population in Kerala is old (60+ years) and has the highest proportion of elderly population. In addition to this, the proportion of elderly cohort is significantly high in Tamil Nadu (10.42%), Punjab (10.35%), Himachal Pradesh (10.26%) and Andhra Pradesh (9.88%). On the contrary, the share of elderly population in 2011 is much lower in Arunachal Pradesh (4.60%), and Assam (6.66%). Interestingly, the proportion of old age population in Uttar Pradesh is about 8% in 2011.

Kerala has experienced highest increase in the share of old age population of about 5 percentage points (7.51% to 12.57%) between 1981 and 2011 (Table 2). However, most-part of this increase in Kerala is experienced between 2001 and 2011. In addition to this, substantial rise in the old age population can be observed in Tamil Nadu (4.01 percentage points), and Maharashtra (3.53 percentage points).

Table 2: Percentage Share of Elderly (60+) for Major Indian States: 1981-2011

State	1981	1991	2001	2011
Andhra Pradesh	6.65	6.80	7.61	9.88
Arunachal Pradesh	4.76	4.37	4.55	4.60
Assam	**	5.35	5.86	6.66
Bihar	6.80	6.32	6.45	7.37
Delhi	4.49	4.68	5.20	6.84
Gujarat	4.98	6.42	6.91	7.95
Haryana	6.34	7.70	7.52	8.66
Himachal Pradesh	7.50	8.15	9.03	10.26
Karnataka	6.63	7.10	7.69	9.49
Kerala	7.51	8.84	10.48	12.57
Madhya Pradesh	6.45	6.69	7.11	7.88
Maharashtra	6.39	7.01	8.74	9.92
Odisha	6.39	7.24	8.27	9.52
Punjab	7.81	7.88	9.03	10.35
Rajasthan	6.03	6.31	6.78	7.49
Tamil Nadu	6.41	7.48	8.89	10.42
Uttar Pradesh	6.84	6.91	7.07	7.85
West Bengal	5.55	6.08	8.50	8.49
Range (H – L)	3.05	3.51	5.93	7.97

Source: Census of India-1981, 1991, 2001, 2011

** Census was not conducted in Assam and J&K in 1981

However, most of the states have experienced an increase of about 1 to 2 percentage points in the share of old age population over the last four decades. Interestingly, the difference between the state with the highest and lowest share of elderly population have increased overtime from 3.05 percentage points in 1981 to 7.97 percentage points in 2011.

The interstate variations in the share of child population (0-14 years), adult (15-59 years) and elderly (60+ years) population is presented through box plots. Figure 3 shows the same for the child populations via box plots. It is apparent from the Figure 3 that the interstate variation in the share of child population across Indian states have increased between 1981 and 2011. Further, the median share of children in total population across states have shown a clear and substantial reduction. It can be also be observed that the skewness in the share across states have also increased overtime.

Figure 3: Box Plot for Percentage share of Child Population (0-14 years) across states, India, 1981-2011

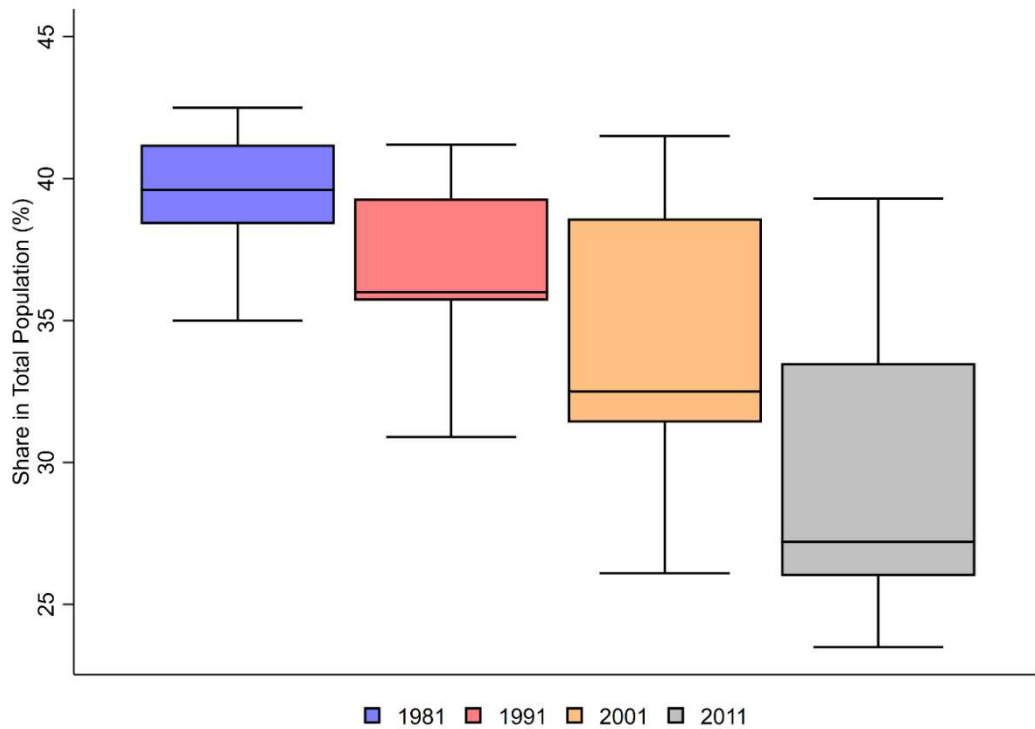


Figure 4 displays the box plots for the share of adult population across Indian states between 1981 and 2011. Clearly, the median share of adult population has increased notably from about 55% in 1981 to about 63% in 2011. Further, decrease in the size of boxes overtime clearly indicates that interstate variations in the share of adult population have decreased significantly since 1981. It may be noted that the overall share as well as variation in the share of adult population across states have been increased significantly between 1991 and 2001.

Figure 5 displays the box plots for the share of old age population across major states in India for 1981, 1991, 2001 and 2011. Unlike child and adult population, the median share of elderly cohort has increased persistently from about 6.5% in 1981 to above 9% in 2011. The increasing size of the box plots clearly suggests that interstate variations in the share of old age cohort in India has increased significantly between 1981 and 2011. However, not much change in the skewness is observed during same period of time. While the median share of elderly population has been increasing persistently since 1981, a substantial rise in the median share can be observed between 2001 and 2011.

Figure 4: Box Plot for Percentage share of Adult Population (15-59 years) across states, India, 1981-2011

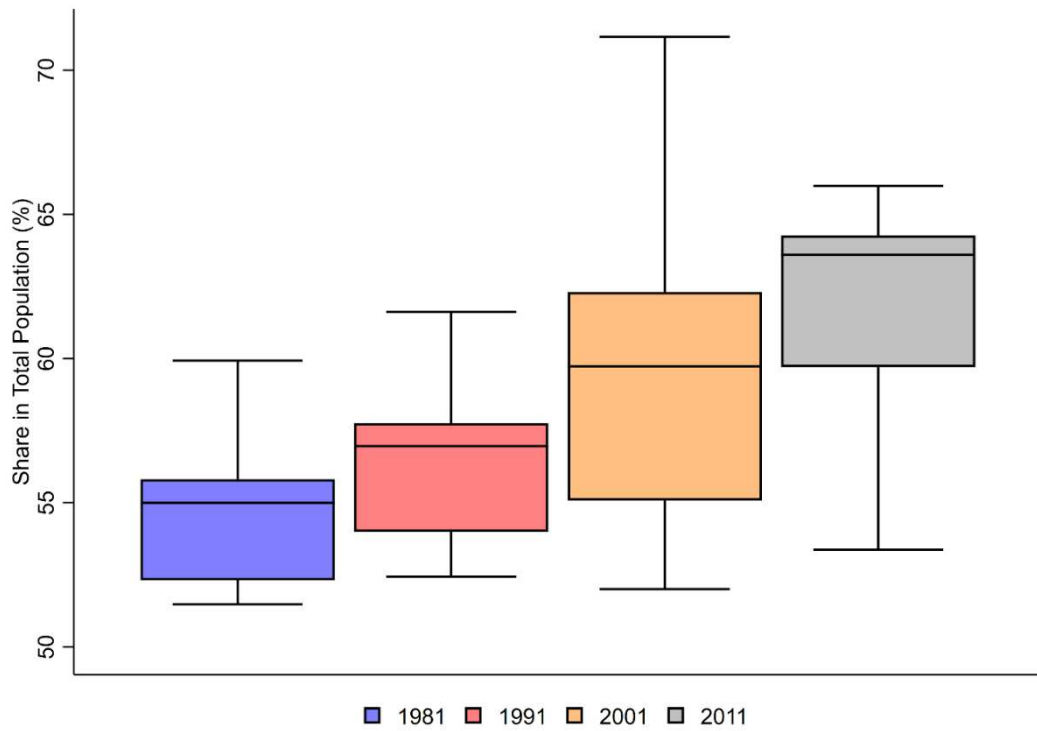
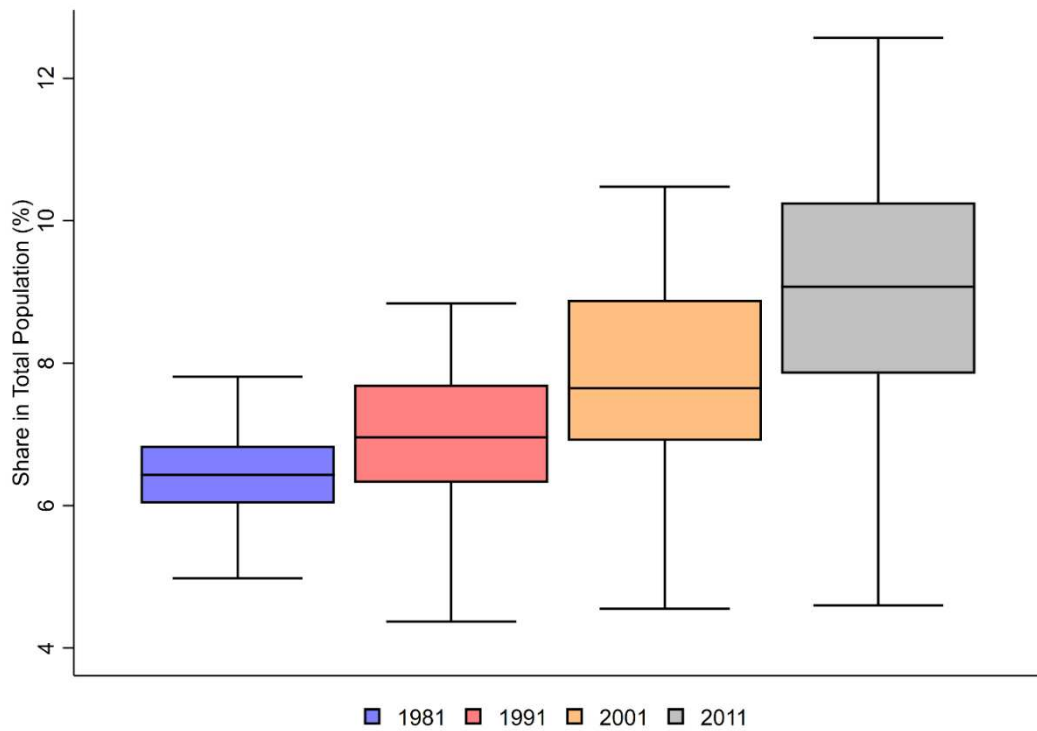


Figure 5: Box Plot for Percentage share of Elderly Population (60+ years) across states, India, 1981-2011



Old age Dependency Ratio

The old age dependency ratios for India from 1950 to 2015 are depicted in Figure 6. Clearly, the dependency ratio for elderly has increased substantially from 9.4% in 1950 to 14.3% in 2015. A major increase in dependency ratio is evident during 2010 (12.7%) and 2015 (14.3%) indicating a higher pace of ageing in coming decades. On the other hand, Arunachal Pradesh has least proportion of dependent elderly (7.7%) (Table 3).

Figure 6: Old Age Dependency Ratio (%) in India, 1950-2015

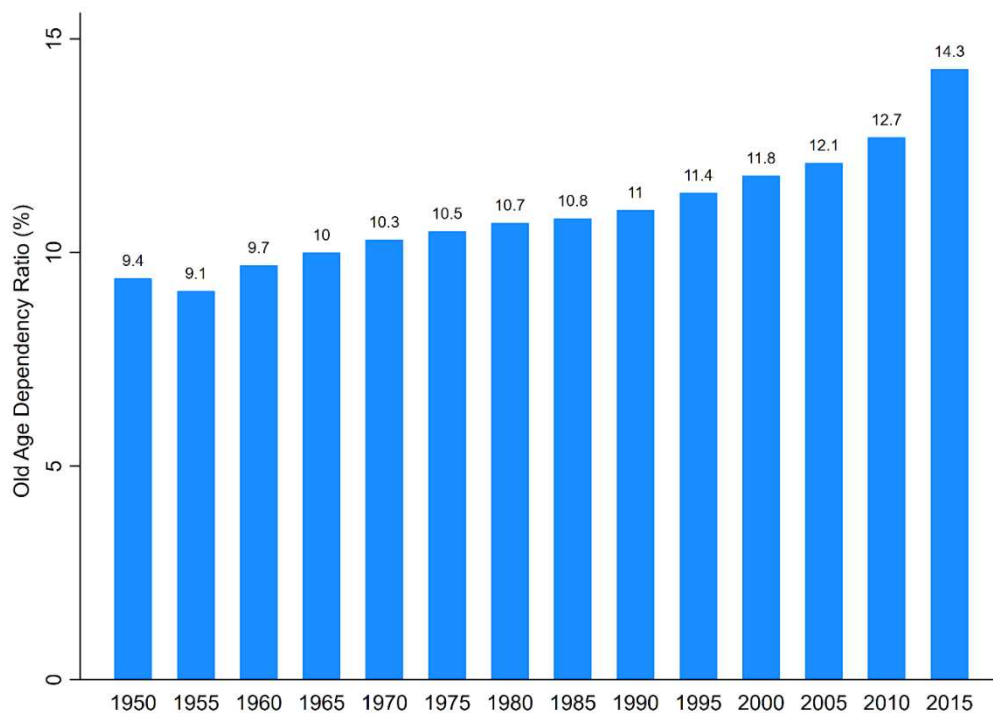


Table 3 displays the dependency ratio for elderly across major states in India for 1981, 1991, 2001 and 2011. Expectedly, Kerala with the highest share of elderly population has highest elderly dependency ratio (19.6%) followed by Himachal Pradesh (16.1%) and Punjab (16.1%) in 2011. Besides, according to Census 2011, the old age dependency ratio is significantly higher for Tamil Nadu (15.8%), Maharashtra (15.7%) and Andhra Pradesh (15.4%). It is worth noting that dependency ratios for elderly is also higher for populous states like Uttar Pradesh (13.9%). Evidently, Kerala experienced highest increase in the old age dependents (6.6 percentage points) between 1981 and 2011. However, in 1981, Himachal Pradesh had the highest elderly dependency ratio of about 14.2%, which increased to about 16.1% in 2011. In

addition to this, Tamil Nadu (4.9 percentage points) and Maharashtra (4.1 percentage points) have also experienced a significant rise the elderly dependency ratio between 1981 and 2011.

Table 3: Old Age Dependency Ratio (%) across major states, India, 1950-2015

State	1981	1991	2001	2011
Andhra Pradesh	12.1	11.9	12.6	15.4
Arunachal Pradesh	8.5	7.9	8.3	7.7
Assam	**	9.9	10.3	11.0
Bihar	13.2	12.0	12.4	13.8
Delhi	7.5	7.7	8.4	10.4
Gujarat	9.0	11.1	11.5	12.6
Haryana	12.2	14.5	13.3	14.1
Himachal Pradesh	14.2	14.5	15.1	16.1
Karnataka	12.3	12.6	12.7	14.8
Kerala	13.0	14.4	16.5	19.6
Madhya Pradesh	12.3	12.4	13.1	13.4
Maharashtra	11.6	12.2	14.8	15.7
Odisha	11.8	12.7	14.1	15.4
Punjab	14.1	13.8	15.2	16.1
Rajasthan	11.7	12.0	12.8	13.0
Tamil Nadu	10.9	12.1	13.9	15.8
Uttar Pradesh	13.3	13.2	13.6	13.9
West Bengal	10.0	10.7	11.9	13.2
Range (H – L)	6.6	6.7	8.2	11.9

Source: Census of India-1981, 1991, 2001, 2011, ** Census was not conducted in 1981

Median Age

The estimated and projected median age for Indian states is presented in Table 4. Estimates from Census 2011 shows that the median age of population in Kerala is highest at 31.8 years followed by Tamil Nadu (31.1 years). In addition to this, median age of population in several states like Haryana, Himachal Pradesh, Odisha and Andhra Pradesh is close to 30 years. In fact, the median age of Tamil Nadu's population is notably lower than populous states like Uttar Pradesh (21.9 years).

Table 4 clearly shows that the median age across all major states in India is increasing since 2001 and is further projected to rise in coming decade as well. According to the Census projections, by 2026, the median age of population in Kerala will remain highest (37.7) in the country followed by Tamil Nadu (37.3 years). Additionally, median age of Uttar Pradesh's Population is projected to be lowest (26.9 years) across all the major states in 2026. Besides, most of the major states are projected to

experience a rise in median age by about 10 years between 2001 and 2026. While the median age for several states like Kerala, Tamil Nadu, Himachal Pradesh and Andhra Pradesh is already above 35 years, states like Gujarat, Karnataka, Maharashtra, Odisha and West Bengal are their loggerheads.

Life Expectancy at Birth

Table 5 presents estimated and projected life expectancy at different ages for India. According to the United Nations World Population Prospects (2017 Revision) estimates, the life expectancy at birth for India has increased from 36.6 years in 1950-55 to 69.1 years in 2015-20 and is further projected to increase to 76.9 years and 84.6 years by the mid and end of this century respectively. It is however important to note that in last 60 years, life expectancy at birth in India has almost doubled.

Table 4: Estimated and Projected Median Age for Selected Indian States

State/Year	2001	2006	2011	2016	2021	2026
Andhra Pradesh	24.2	26.0	28.0	30.1	32.3	34.6
Assam	21.3	22.8	24.5	26.5	28.6	30.8
Bihar	19.1	20.1	22.1	24.2	26.6	29.1
Delhi	23.4	25.2	27.1	28.7	30.1	31.4
Gujarat	23.6	25.3	27.2	29.1	31.3	33.3
Haryana	21.7	23.4	25.3	27.4	29.6	31.9
Himachal Pradesh	24.4	26.4	28.4	30.6	32.9	35.1
Karnataka	24.1	26.0	28.0	30.0	32.2	34.4
Kerala	28.1	29.9	31.8	33.8	35.8	37.7
Maharashtra	24.2	25.6	27.3	29.1	31.0	32.9
Madhya Pradesh	20.7	21.8	23.3	24.9	26.8	28.8
Odisha	23.9	25.4	27.2	29.1	31.3	33.6
Punjab	24.2	26.1	28.0	30.1	32.4	34.8
Rajasthan	19.9	21.3	23.0	25.0	27.2	29.5
Tamil Nadu	27.2	29.1	31.1	33.2	35.3	37.3
Uttar Pradesh	19.4	20.4	21.9	23.4	25.1	26.9
West Bengal	23.8	25.6	27.8	29.9	32.2	34.5
Range (H – L)	9.0	9.7	10.0	10.4	10.7	10.8

Source: Ministry of Health and Family Welfare, Govt of India

Table 6 displays life expectancy at birth for major Indian states in India for the period of 1975-80 to 2011-15. Kerala has the highest life expectancy at birth (78.2 years) in 2011-15 at birth followed by Punjab (74.2 years). On the other hand, Uttar Pradesh has lowest life expectancy birth at 65.6 years for 2011-15.

Table 5: Projected Life Expectancy for India: 1950-2100

Year	e ₀	e ₆₀	e ₈₀	Year	e ₀	e ₆₀	e ₈₀
1950-1955	36.6	12.1	4.8	2025-2030	71.7	18.9	7.5
1955-1960	39.7	12.7	5.0	2030-2035	72.9	19.3	7.7
1960-1965	42.7	13.2	5.3	2035-2040	73.9	19.8	7.9
1965-1970	46.0	13.7	5.5	2040-2045	74.9	20.4	8.1
1970-1975	49.4	14.2	5.6	2045-2050	75.9	20.9	8.3
1975-1980	52.6	14.7	5.8	2050-2055	76.9	21.4	8.5
1980-1985	55.0	14.7	5.8	2055-2060	77.8	22.0	8.7
1985-1990	56.8	14.8	5.8	2060-2065	78.7	22.5	9.0
1990-1995	59.2	15.5	6.1	2065-2070	79.6	23.1	9.3
1995-2000	61.6	16.3	6.4	2070-2075	80.5	23.7	9.5
2000-2005	63.6	16.7	6.6	2075-2080	81.4	24.3	9.8
2005-2010	65.5	17.1	6.7	2080-2085	82.2	24.9	10.1
2010-2015	67.5	17.7	7.1	2085-2090	83.1	25.6	10.4
2015-2020	69.1	18.1	7.3	2090-2095	84.0	26.2	10.8
2020-2025	70.5	18.5	7.4	2095-2100	84.6	26.7	11.0

Source: UN-World Population Prospects, 2015 revision

It is evident from Table 6 that almost all the major states in the country have experienced a significant increase in the life expectancy at birth between 1975 and 2015. Demographically backward states like Uttar Pradesh have experienced highest increase (by about 52%) in life expectancy at birth from 43 years to 65.6 years between 1975 and 2015. The life expectancy at birth for Kerala has increased by about 25% from 62 years in 1970-75 to about 78.2 years in 2011-15. Besides, some southern states have experienced substantial increase in life expectancy at birth between 1975 and 2015. For instance, life expectancy at birth has increased by about 47% in Tamil Nadu and 46% in Andhra Pradesh. It can be observed from table 6 that the jump in life expectancy at birth has been highest between 2006-10 to 2011-15 across all states. It is important to mention here that demographically backward states like Uttar Pradesh have experienced highest increase (by about 52%) in life expectancy at birth from 43 years to 65.6 years between 1975 and 2015.

Evidently, the difference between the highest and lowest life expectancy at birth across states has decreased, which clearly implies that states are persistently converging in terms of longevity. For instance, Table 6 displays that the difference between the highest and lowest life expectancy for 1970-75 was about 19 years which has decreased to about 21.6 years in 2011-15. The range in life expectancy at birth across states has fallen considerably higher since 1996-2000. However, further

regression analysis is required to test whether the states are converging in life expectancy after adjusting for regional heterogeneities in terms of population size, socioeconomic conditions, and human capital. It is also imperative to mention that Odisha have also shown noticeable improvements (by about 50%) in life expectancy at birth between 1970-75 and 2011-15.

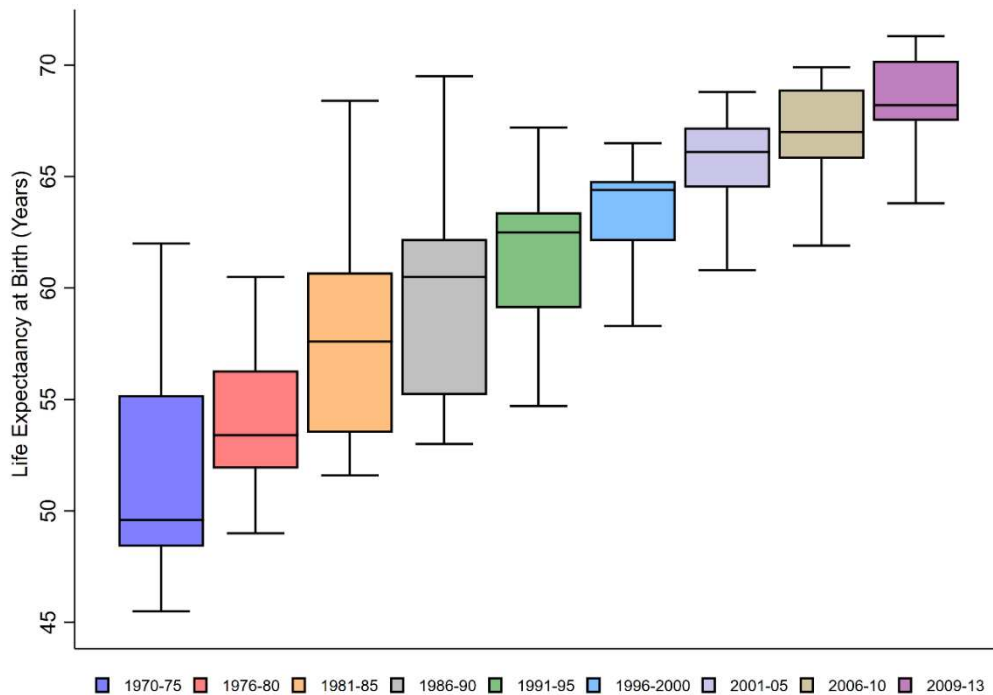
Table 6: Life Expectancy at Birth for Selected Indian States: 1970-2015

State	1970	1976	1981	1986	1991	1996	2001	2006	2011
	-75	-80	-85	-90	-95	-00	-05	-10	-15
Andhra Pradesh	48.8	53.1	58.4	59.1	61.8	62.7	65.0	65.8	71.2
Assam	45.5	51.1	51.9	53.6	55.7	57.4	59.2	61.9	66.2
Bihar	**	**	52.9	54.9	59.3	60.5	64.2	65.8	68.3
Gujarat	48.8	52.4	57.6	57.7	61.0	64.4	65.7	66.8	71.6
Haryana	57.5	54.8	60.3	62.2	63.4	64.4	66.5	67.0	71.9
Karnataka	55.2	56.3	60.7	61.1	62.5	64.5	66.1	67.2	70.9
Kerala	62.0	65.5	68.4	69.5	72.9	71.6	73.6	74.2	78.2
Madhya Pradesh	47.2	49.0	51.6	53.0	54.7	57.1	59.7	62.4	66.5
Maharashtra	53.8	56.3	60.7	62.6	64.8	65.9	68.0	69.9	73.9
Odisha	45.7	49.4	53.0	54.4	56.5	58.3	60.8	63.0	68.3
Punjab	57.9	60.5	63.1	65.2	67.2	66.5	68.8	69.3	74.2
Rajasthan	48.4	51.9	53.5	55.2	59.1	62.1	64.5	66.5	70.4
Tamil Nadu	49.6	53.4	56.9	60.5	63.3	64.8	67.2	68.9	73.0
Uttar Pradesh	43.0	46.2	50.0	53.4	56.8	58.6	59.8	62.7	65.6
West Bengal	**	**	57.4	60.8	62.1	64.3	67.2	69.0	71.8
Range (H-L)	19	19.3	18.4	16.5	18.2	14.5	14.4	12.3	12.6

Source: Sample registration System, Census of India **Census was not conducted.

Figure 7 depicts the box plots for the life expectancy at birth across major Indian states for 1981 to 2011. It is clear from the figure that the median LE at birth has increased substantially between 1975 and 2015. Besides, it is also evident from the plots that interstate variations in the life expectancy at birth is decreasing and therefore states are converging in terms of expected longevity at birth. Also, skewness and range in distribution of life expectancy at birth across states is lower in 2011-15 compared to previous years.

Figure 7: Box Plot for Percentage Life Expectancy at Birth across Indian States: 1975-2015



Life Expectancy at 60 (Elderly Life Expectancy)

The estimated and projected elderly life expectancy (at 60 years) for India from 1950-55 to 2095-2100 is depicted in table 5. Elderly life expectancy in India is projected to increase from 12.1 years in 1950-55 to 18.1 years in 2015-20 and further to 20.9 years and 26.7 years by the mid and end of this century respectively (Table 5). Projected increase in elderly life expectancy in India is higher for the next two to four decades.

Table 7 displays elderly life expectancy (at 60 years) for selected major Indian state for 1970-75 to 2011-15. Clearly, the life expectancy at 60 is highest for Karnataka and Kerala at 22.1 years for 2011-15 followed by Punjab (21.4 years). On the other hand, the elderly life expectancy is estimated to be lowest in Bihar at 17 years followed by Assam (17.3 years) and Uttar Pradesh (17.5 years). While the elderly life expectancy in 2011-15 is estimated to be lowest in Bihar at 17 years, it was lowest in Odisha at 11.4 years in 1970-75.

Table 7: Life Expectancy at age 60 years for Selected Indian States: 1970-2015

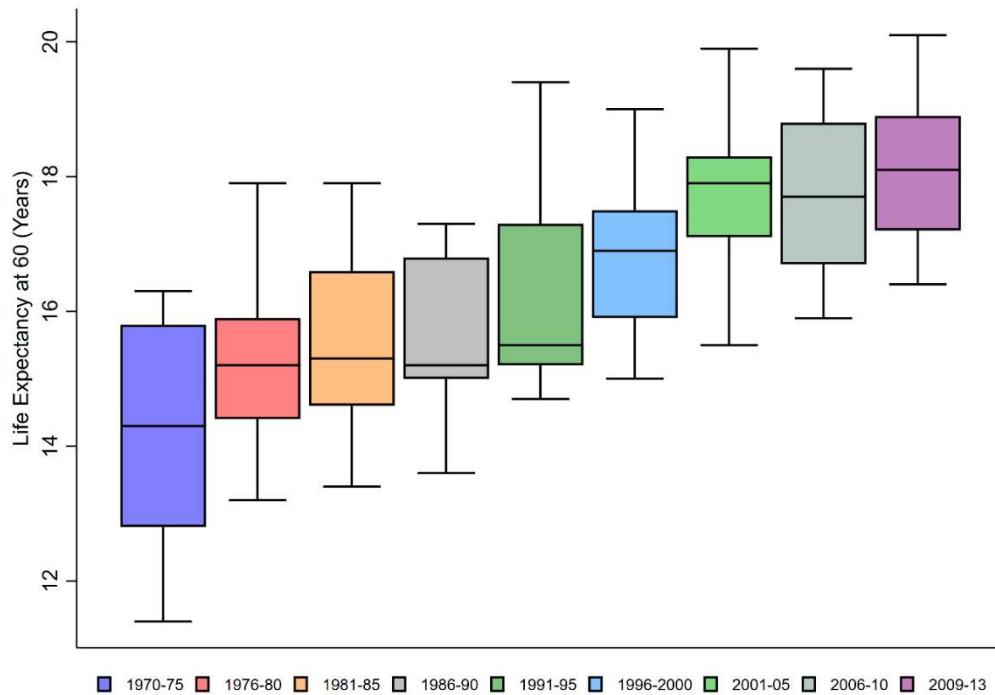
State	1970 -75	1976 -80	1981 -85	1986 -90	1991 -95	1996 -00	2001 -05	2006 -10	2011 -15
Andhra Pradesh	12.8	14.3	15.1	14.7	14.9	15.9	17.6	16.8	19.4
Assam	11.6	13.2	13.4	13.6	14.7	15.0	15.5	15.9	17.3
Bihar	**	**	15.1	14.6	16.6	16.5	17.2	17.3	17.0
Gujarat	13.8	16.0	16.4	15.0	15.2	17.5	17.9	18.0	20.4
Haryana	16.0	15.2	17.2	17.3	18.0	18.7	19.4	18.8	20.5
Karnataka	15.8	15.6	16.6	16.8	16.5	17.3	17.9	17.7	18.5
Kerala	15.8	16.3	17.9	17.1	19.4	18.0	19.1	19.4	22.1
Madhya Pradesh	14.3	14.6	14.5	14.9	15.0	15.4	16.3	16.3	17.8
Maharashtra	14.3	14.8	16.2	15.5	17.3	16.9	18.2	18.4	19.7
Odisha	11.4	13.5	14.3	15.3	15.8	15.4	16.2	16.7	18.7
Punjab	16.3	17.9	17.9	19.5	20.8	19.0	19.9	19.6	21.4
Rajasthan	14.6	15.9	15.3	15.2	15.5	17.5	18.3	18.8	20.5
Tamil Nadu	12.8	14.4	14.6	15.1	15.4	15.9	17.4	17.6	19.3
Uttar Pradesh	13.6	15.4	14.8	15.2	15.3	16.5	17.1	16.5	17.5
West Bengal	**	**	15.1	15.8	15.6	16.2	17.1	17.6	18.7
Range (H-L)	4.9	4.7	4.5	5.9	6.1	4	4.4	3.7	5.1

Source: Sample registration System, Census of India.

**Census was not conducted.

There are substantial improvements in elderly longevity across all the major states in India between 1970-75 and 2011-15 (Table 7). Interestingly, the improvements in elderly life expectancy are estimated to be highest in Odisha (by about 64%) from 11.4 years in 1970-75 to 18.7 years in 2011-15. In 1970-75, life expectancy at 60 was highest in Punjab (16.3 years) followed by Haryana (16.0 years), whereas Kerala has the highest elderly life expectancy at present. The life expectancy at 60 in populous states like Uttar Pradesh has also improved by about 28% (i.e. from 13.6 years in 1970-75 to 17.5 years in 2011-15). Besides, Gujarat has also experienced about 48% rise in elderly life expectancy between in last 4 decades. Further, it is clear from Table 7 that range of elderly life expectancy across states have decreased overtime signifying the convergence in elderly longevity across states.

Figure 8: Box Plot for Life Expectancy at 60 across states, India, 1975-2015



To further identify the interstate variations in elderly longevity, Figure 8 displays the box plots for life expectancy at 60 across Indian states for 1970-75 to 2011-15. The decreasing area of box plots across time period indicates that states are converging in terms of elderly life expectancy. Also, it can be observed that the median life expectancy has increased significantly overtime.

Life Expectancy at 70 years

To further the understanding on the interstate variation in ageing prospects, it is imperative to identify the trends in longevity at very old age (70 years) (Table 8). At very old age, Kerala (14.3 years) has the highest life expectancy followed by Punjab (14.1 years) and Haryana (14 years). On the contrary, Assam (11 years) has the lowest life expectancy at 70 followed by Madhya Pradesh (11.1 years) and Uttar Pradesh (11.3 years). Surprisingly, life expectancy at 70 in Rajasthan is estimated to be high at 13.5 years.

Clearly, there is a diverging trend across states in terms of longevity at higher ages (Table 8). For instance, the difference between highest and lowest life expectancy (at 70 years) has increased from 4 years in 1970-75 to about 10.8 years in 2011-15.

Further, all the major states have experienced significant improvements in the elderly longevity since 1970-75. Improvements in life expectancy at 70 are estimated to be highest in Odisha (80%) between 1970-75 and 2011-15. However, states like Gujarat (56%), Punjab (47%) and Kerala (46%) have shown noticeable increase in life expectancy at very old age between 1970-75 and 2011-15.

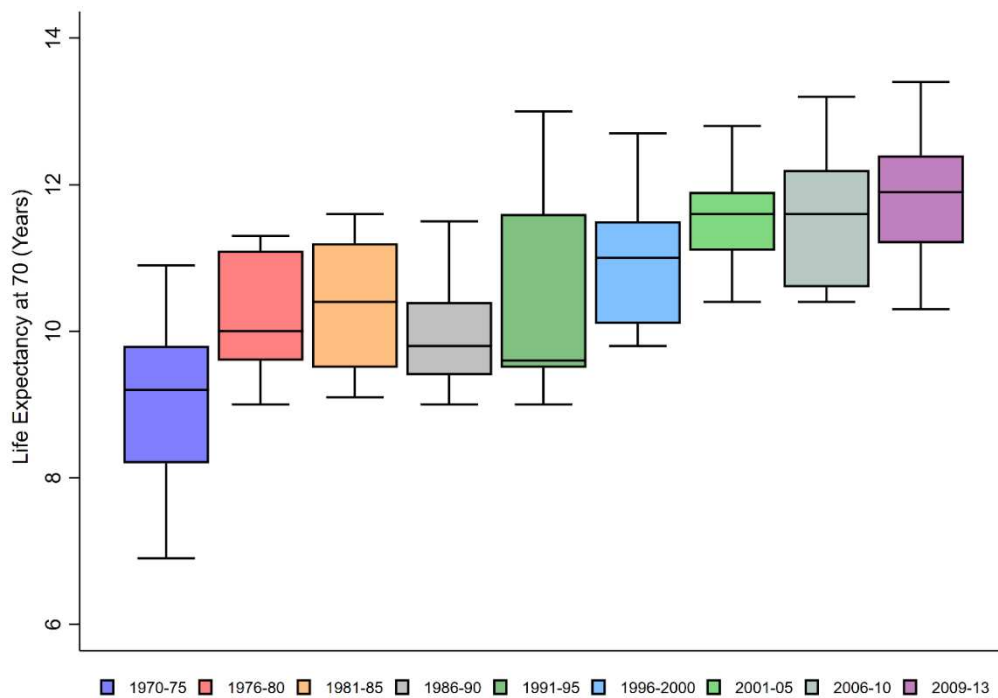
Table 8: Life Expectancy at 70 years for Selected Indian States: 1970-2015

State	1970 -75	1976 -80	1981 -85	1986 -90	1991 -95	1996 -00	2001 -05	2006 -10	2011 -15
Andhra Pradesh	8.0	9.8	9.9	9.1	9.1	10.1	11.6	10.9	12.9
Assam	7.6	9.4	9.1	9.0	9.6	9.8	10.4	10.5	11.0
Bihar	**	**	10.0	9.0	11.4	11.4	11.4	11.1	10.2
Gujarat	8.5	11.2	11.2	9.5	9.3	11.5	11.8	11.7	13.3
Haryana	9.9	9.3	11.6	11.5	11.7	12.0	12.8	12.3	14.0
Karnataka	10.9	10.8	11.3	11.0	10.8	11.5	11.6	11.6	11.4
Kerala	9.8	10.9	11.4	10.4	13.0	11.5	12.2	12.3	14.3
Madhya Pradesh	9.2	10.0	9.4	9.8	9.5	9.9	10.5	10.4	11.1
Maharashtra	9.2	9.6	10.9	9.4	11.6	11.0	11.9	11.8	12.6
Odisha	6.9	9.0	9.5	10.1	10.6	9.9	10.4	10.6	12.4
Punjab	9.6	11.1	11.1	13.1	15.1	12.7	13.4	13.2	14.1
Rajasthan	10.0	11.3	10.4	9.5	9.0	11.6	11.9	12.2	13.5
Tamil Nadu	8.2	9.8	9.5	9.4	9.6	10.1	11.1	11.3	12.2
Uttar Pradesh	9.4	11.1	9.8	9.9	9.5	10.8	11.4	10.6	11.3
West Bengal	**	**	9.8	10.3	10.0	10.5	11.2	11.4	12.0
Range (H-L)	4	2.3	2.5	4.1	6.1	2.9	3	2.8	10.8

Source: Sample Registration System, Census of India

**Census was not conducted.

Figure 9: Box Plot for Life Expectancy at 70 across states, India, 1975-2015



The box plots for life expectancy at 70 years for selected major Indian states in Figure 9 clearly show a significant increase in the median life expectancy (at very old age) in the last four decades. However, there is no evidence of clear trends in the interstate variations in the distribution of life expectancy at 70 across states between 1970-75 to 2011-15.

Discussion and Conclusion

The present study aims at identifying trends and trajectories in population ageing across major Indian states using secondary information on a range of demographic indicators from several sources. Additionally, the study also compiles and presents evidence for interstate variations in population ageing using a similar set of indicators. It is important to mention that the only intent of this study is to provide a comprehensive description of trends and variations in ageing indicators across states. However, a detailed analysis on demographic and social factors driving the pace of population ageing is also desirable.

The evidences clearly suggest that population ageing in southern states is relatively higher compared to other regions in India. Across all major states, Kerala has the

highest proportion of elderly population, highest old age dependency ratio, median age and highest life expectancy (at birth as well as old age). Following this, Karnataka, Tamil Nadu and Andhra Pradesh also have a substantially higher share of elderly population and median age. Along with the demographically advanced states in southern India, population ageing is considerably rapid in states like Punjab, Maharashtra, and Odisha. In contrast, populous states like Uttar Pradesh, Rajasthan and Madhya Pradesh are yet to experience bulging of elderly population. However, it may be noted that the distribution of elderly population (60+ years) across Indian states shows that a large proportion of total elderly population are from the northern and eastern zones.

Importantly, the box plot suggests increasing interstate disparities in the proportion of elderly group (60+ years) in the total population. Further, the range (highest – lowest) of elderly share in the total population has also increased significantly across major states implying significant differences in timing at which states will experience a bulge in their old age populations.

References

- Alagarajan, M. (2003). An analysis of fertility differentials by religion in Kerala state: a test of the interaction hypothesis. *Population Policy and Research review*, 22, 557-574.
- Alagarajan, M., & Kulkarni, P. M. (1998). Religious differentials in fertility in India: is there a convergence? *Economic and Political Weekly*, 43(48), 44-53.
- Arokiasamy, P., & Goli, S. (2012). Fertility Convergence In Indian States: An Assessment of Changes in Averages and Inequalities in Fertility. *Genus*, 68(1), 65-88.
- Barro, R. J., & Sala-i-Martin, X. (1992). Convergence. *The Journal of Political Economy*, 100(2), 223-251.
- Baumol, W. J. (1986). Productivity Growth, Convergence and Welfare: What the Long-run Data Show. *American Economic Review*, 76, 1072-1085.
- Bhattacharya, B. B., & Sakhivel, S. (2004). Regional Growth and Disparity in India: Comparison of Pre- and Post-Reform Decades. *Economic and Political Weekly*, 39(10), 1071-1077.
- Bongaarts, J. (2003). Completing the fertility transition in the developing world: the role of educational differences and fertility preferences. Retrieved from New York:
- Casterline, J. B. (2001). The pace of fertility transition: national patterns in the second half of the twentieth century. *Population and Development Review*, 27(17-52).
- Dasgupta, D., Maiti, P., Mukherjee, R., Chakrabarti, S., & Sarkar, S. (2000). Growth and Interstate disparities in India. *Economic and Political Weekly*, 35(27), 2413-2422.
- Deaton, A., & Dreeze, J. (2002). Poverty and Inequality in India: A Reexamination. *Economic and Political Weekly*, 37(36), 3729-3748.
- Deaton, A., & Dreeze, J. (2009). Food and Nutrition in India: Facts and Interpretations. *Economic and Political Weekly*, 44(7), 42-65.
- Galor, O. (1996). Convergence? Inferences from Theoretical Models. *The Economic Journal*, 106, 1056-1069.
- Goli, S., & Arokiasamy, P. (2013). Demographic Transition in India: An Evolutionary Interpretation of Population and Health Trends Using "Change Point Analyses". *PLOS ONE*, 8(10).
doi:<https://doi.org/10.1371/journal.pone.0076404>
- Guilmoto, C. Z., & Rajan, S. I. (2001). Spatial Patterns of fertility Transitions In Indian Districts. *Population and Development Review*, 27(4), 713-738.
- Happich, M., & Lengerke, T. V. (2007). Convergence of Life Expectancy in European Union: A Markov Approach. *Applied Economic Letters*, 14, 175-178.
- Islam, N. (1995). Growth Empirics: A Panel Data Approach. *Quarterly journal Of Economics*, 110, 1127-1170.
- Jayaraj, D., & Subramanian, S. (2015). Growth and Inequality in the Distribution of India's Consumption Expenditure: 1983 to 2009-10. *Economic and Political Weekly*, 50(32), 39-47.
- Lee, R. D., & Reher, D. S. (Eds.). (2011). Demographic transition and its consequences. New York: Oxford University Press.
- Mackenbach, J. P. (2013). Convergence and Divergence of Life Expectancy In Europe. *European Journal of Epidemiology*, 28, 229-240.

- Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics*, 107(2), 407-437.
- Marjit, S., & Mitra, S. (1996). Convergence in Regional Growth Rates: Indian Research Agenda. *Economic and Political Weekly*, 31(33).
- Navaneetham, K., Mishra, U. S., & Joe, W. (2008). Health Inequality in India: Evidence from NFHS3. *Economic and Political Weekly*, 43(31), 41-48. doi:43
- Neumayer, E. (2004). HIV/AIDS and Cross National Convergence in Life Expectancy. *Population and Development Review*, 30(4), 727-742.
- Quah, D. (1996). Twinn Peaks: Growth and Convergence in Models of Distribution Dynamics *The Economic Journal*, 106, 1045-1055.
- Rajpal, S., & Joe, W. (2017). On The Convergence Puzzle. *Economic and Political Weekly*, 52(12), 149-150.
- Rao, M. G., Shand, R. T., & Kalirajan, K. P. (1999). Convergence of Income across Indian States *Economic and Political Weekly*, 34(13).
- Sala-i-Martin, X. (1996a). The Classical Approach to Convergence Analysis. *The Royal Economic Society*, 106(437), 1019-1036.
- Sala-i-Martin, X. (1996b). Regional Cohesion: Evidence and Theories of Regional Growth and Convergence. *Europeann Economic Review*, 40, 1325-1352.
- Sanderson, W., & Scherbov, S. (2010). Remeasuring Aging. *Science*, 329, 1287-1288.
- Sanderson, W., & Scherbov, S. (2013). The Characteristics Approach to the Measurement of Population Ageing. *Population and Development Review*, 39(4), 673-685.
- Sanderson, W., & Scherbov, S. (2015). Faster Increase in Human Life Expectancy could Lead to Slower Population Ageing. *PLOS ONE*, 10(4).
- Seligman, B., Greenberg, G., & Tuljapurkar, S. (2016). Convergence in Male and Female Life Expectancy: Directions, Age Pattern and Causes. *Demographic Research*, 34(38), 1063-1074.
- Sen, A. (1972). Utilitarianism and Inequality. *Economic and Political Weekly*, 7(6), 343-344.
- Sen, A. (1973). Poverty, Inequality and Unemployment - Some conceptual issues on Measurement. *Economic and Political Weekly*, 8(33), 1457-1464.
- Singh, A., & Ladusingh, L. (2013). Increasing Life Expectancy and Convergence of Age at Death in India. *Genus*, 69(1), 83-99.
- Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal Of Economics*, 70(1), 65-94.
- Subaiya, L., & Bansod, D. N. (2011). Demographics of population Ageing in India: Trends and Differentials. Retrieved from New Delhi:
- Visaria, P. (2001). Demographics of Ageing in India. *Economic and Political Weekly*, 36(22), 1967-1975.
- Willson, C. (2011). Understanding Global Demographic Convergence. *Population and Development Review*, 37(2), 375-388.