Who Reaches Old Age? Socioeconomic Inequality in Survival and Its Implications for Ageing in India

Amrit Jose John[#], Udaya Shankar Mishra[*], T V Sekher[*]

The discourse on Population Ageing is mostly premised on the rising share of older adults in the population that overlooks the heterogeneous pace of attaining this age by different population sub-groups. The exceptionality of surviving to older ages affects the distribution of the population subgroups over the life course, leading to an 'unequal ageing experience'. To address this knowledge gap, this study considers ageing as a survival experience at the individual and the population level and tries to exposit the volume of unequalness in the ageing experience and its significance while reading the speed of population ageing. Using NFHS-5 (2019–21) data, we employ period life table techniques to examine socioeconomic gradients in survival to age 60, using adult survival probabilities and temporary life expectancy as outcome measures. Among adults, 59.3% of deaths in the richest quintile occurred above the median age, compared to 40.6% in the poorest. Scheduled Tribes and Scheduled Castes had 4.4% and 3.3% lower survival to older ages than the national average, while Higher Castes and the Richest Quintile had 3.0% and 6.4% higher survival, respectively. Only 72.2% of the poorest reached older ages, compared to 86.2% of the richest. The study illustrates the need to accommodate this heterogeneity in survival experience in the assessment of population ageing, given the differential survival experience of population subgroups to make attaining older ages not a privilege for a few.

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Population aging represents a scenario in which the share of older individuals tends to increase as a consequence of declining fertility and increasing longevity. With advances in health and gains in survival, it is necessary to acknowledge the phenomenon of population ageing and understand its varying dimensions with long-term implications. The global experience of this count has been unprecedented since the mid-twentieth century, with its clear manifestation in the developing world reflected in the evolving imbalance in the population age structure. This imbalance can be gauged in terms of the growth rate of older adults being systematically higher than that of the population (Giridhar et al., 2014). Although the phenomenon of population ageing has been of limited concern in the Global North, its onset in the developing region since the first decade of the twentieth century has received renewed emphasis, given the rapid ageing in Asia in contrast with the European trajectory of population ageing (Balachandran, 2020). The speed of ageing in countries such as India is alarming, as ageing occurs before the poor become rich (James, 2011; Chakrabarti & Sarkar, 2011), which has coined a quote 'getting older before getting richer'.

In India, the proportion of the population aged 60 years and above was 7 per cent in 2001 and is projected to increase to 15 per cent by 2036 (ORGI, 2020). In absolute numbers, the number of older adults in 2001 was approximately 76 million and is expected to increase sharply to more than 227 million by 2036. Even more significant in its implications for population ageing, life expectancy at age 60 has also increased dramatically, rising from approximately 12 years in 1950 to 18 years in 2015, and that at age 65 is projected to increase further to more than 18 years by 2050, with a median age of 38.1 (United Nations, 2022).

Population ageing could have significant societal consequences. Population ageing could result in higher dependency ratios, which in turn could economically burden the working population, increase long-term care expenditures (Muszyńska & Rau, 2012), increase public expenditures on the basis of pensions and welfare schemes (Abramson, 2015; Borsch-Supan, 2003) and raise a debate on increasing retirement ages.

The phenomenon of ageing could either be evaluated with a segmentation approach by assigning a specific cut-off age to designate the onset of ageing or by considering the changes in the propensity of survival to advanced ages from a specific age during the life course. Despite this dual construct of evaluating the ageing phenomenon, the dramatic and complex nature of demographic shifts in India and its resulting ageing remains limited in its comprehension with a chronological age-based approach. With its population size and pace of transition, Indian ageing needs an evolving approach in its comprehension that should go beyond its count to characterisation. This type of comprehension needs to consider the role of mortality reduction in shaping the process of ageing, which varies across population groups. The experience of survival gains varies with age; therefore, the

dynamic count of the aged population should never equate today's older adults with tomorrow's older adults. Therefore, any measure of ageing needs to account for such differences to make it temporally comparable. Recognition of the differences in survival from older ages remains fundamental to comprehension of ageing, which makes its experience unequal among individuals of a given population.

The exceptionality of surviving to a particular threshold age should serve towards analysing the disparities in ageing. In diverse populations, the onset and pace of the first demographic transition are highly affected by socioeconomic factors that could trigger the demographic transition (Willekens, 2014). As population Ageing is a phase in the transition, the differences in the onset and pace among different groups within the population could affect the representation of the population in the advanced age stage. The existence of considerable heterogeneity in the process of population ageing should be addressed when discussing population ageing and its inherent inequalities. The fundamental premise of differentiating the aged population rests on the fact that all are not equally likely to survive to older ages (Holman & Walker, 2021).

Among academics, the debate over defining old age can be traced back to the period when the Global North experienced the phenomenon of the 'ageing of the population'. In a study of the 1990s in India (Rajan et al., 1999), the criterion of defining old age was asked to select a set of 'aged' respondents, and a good proportion of the respondents shared the opinion that old age cannot be defined by numerical ages (chronological age); instead, it needs to be associated with their functional disabilities. This opinion was put forward much prior to formulation of the characteristic approach (Sanderson & Scherbov, 2013). While the median age is frequently employed as a summary threshold for assessing the overall level of population ageing, it has been widely critiqued for its insensitivity to underlying heterogeneities and its limited compatibility with characteristic-based approaches. A similar revision to the count of older adults on the basis of chronological threshold age was made, accounting for the intensity of ageing (Mishra & Dash, 2011).

In the genre of the revised outlook on comprehension of ageing, the survival aspect of ageing measures accommodates the remaining life expectancy (RLE), also known as Prospective Age (Sanderson & Scherbov, 2007, 2008, 2010) which has received universal recognition in ageing studies of the Global North and in policymaking. Chronological age-based measures are discrete approaches with their inherent shortcomings for comparison; the survival-based approach is a dynamic one to account for concurrent changes in the survival regime. Countries such as Denmark, Estonia, Finland and the Netherlands use the RLE as the threshold for fixing the retirement age (Alvarez et al., 2021). The advantage of prospective age over chronological age is that the former considers the number of years a person is expected to live more (Sanderson & Scherbov, 2008). From a policy standpoint, this methodology could address the sustainability of pension systems, as in Denmark.

The primary defect of using the RLE methodology is that it cannot exist as a measure to compare the level of ageing among populations. It is not necessary that the concerned populations will experience a comparable mortality level, as in India. Studies suggest that life expectancy significantly differs with respect to the social and economic characteristics of the population (Subramanian et al., 2006; Mohanty & Ram, 2010; Po & Subramanian, 2011; Asaria et al., 2019;Saikia et al., 2019; Kumari & Mohanty, 2020; Vyas et al., 2022; Gupta & Sudharsanan, 2022). Mortality selection takes place within the population on the basis of social, economic and educational characteristics (Saikia et al., 2019). Personal endowments from wealth and social privileges also influence health-related behaviors, with Caste, in India, playing a major role in this (Preston & Paul, 1994; Thorat & Attewell, 2007). Considerable heterogeneity exists in premature mortality (survival to age 70 from age 40) among the states, where the risk of dying for males ranges from 351 per 1000 in Kerala to 558 per 1000 in Chhattisgarh, and for females, it ranges from 198 per 1000 in Himachal Pradesh to 409 per 1000 in Assam (Rao et al., 2021).

To include mortality impacts in this approach, Balachandran et al. (2017) developed the comparative prospective old age threshold (CPOAT), which adjusts the RLE for the adult survival ratio (ASR). While comparing ageing among populations with differential mortality patterns, the CPOAT can provide a robust threshold (Balachandran et al., 2020). As Sanderson and Scherbov (2013) suggested, health characteristics associated with ageing could be included along with mortality adjustment, which could explain the multidimensional approach to measuring ageing (Balachandran & James, 2021).

Mortality selection, where individuals with lower survival prospects are more likely to die at younger ages, leaving a select group of individuals who are more resilient to survive into old age. This means that as people age, they become a more selective group of individuals who have already survived many of the risks and challenges that contribute to mortality (Kannisto, 2001). The pool of surviving individuals becomes healthier over time, and the age-specific survival disparities decrease among the heterogeneous groups within the population (Rehnberg et al., 2017). The convergence of survival inequalities at older ages is partly due to mortality selection. Those who survive to older ages tend to be a more homogeneous group in terms of survival prospects, regardless of their initial demographic and socioeconomic characteristics.

The heterogeneity in the population distribution due to the differential impacts of socioeconomic development on mortality experiences leads to unequal entry into the general old age threshold of 60, which remains uninvestigated, whereas the inequalities in health and well-being among older adults have been well explored (Alam et al., 2015).

Objectives

During recent decades, mortality improvements have been driven mainly by the decline in young-age mortality, with a majority of the states having witnessed an over 50% reduction in infant and under5 mortality rates between 1992 and 2016 (Bhatia et al., 2019). As a result, the proportion of individuals who reached adulthood and subsequently reached older ages increased significantly. Hence, mortality changes in adulthood form the basis for successful survival to older ages. When population ageing is discussed well with changes in life expectancy at age 60, the underlying force of adult mortality is least discussed within the ageing framework.

While the phenomenon of population ageing is of universal concern and is inevitable, its microlevel experience, which refers to individual experiences of survival that translate into population ageing, remains overlooked. This essentially refers to the differential likelihood of reaching old age. In that sense, the population share beyond 60 years of age is perhaps a limited representation of ageing. It merely counts those who are 60 years of age. However, is it equally likely for everyone to reach the age of sixty, or this privilege is conditioned by some attributes/identities. This particular aspect of differences in survival propensity to reach the age of sixty is itself a dimension overlooked in the discourse on ageing. Hence, the phenomenon of unequal ageing becomes relevant given that everyone neither attains the qualifying age of being designated to be aged nor does one age equally after attaining this age. The point in contention therefore is differential survival propensity.

Considering the vast disparities in survival rates among Indian states and within Indian states, tracing the survival pattern of attaining the age of sixty in different states while examining the ageing process in India becomes imperative. The survival differential undoubtedly makes a difference to attainment of age sixty, and any measure of ageing needs to account for the same. Given the mortality differentials among Indian states, there can be large differences in survival propensity until the age of sixty as well as beyond, which are conditioned by socioeconomic attributes. Hence, this aspect needs accommodation within the comprehension of ageing for eligible comparisons.

Instead of a head-count approach for the assessment of ageing, this study considers ageing as a survival experience at the individual and population levels and aims to explore the volume of unequalness in the ageing experience and its significance while reading the speed of population ageing. Hence, the recognition of heterogeneity in ageing within the population is studied.

Methods and Measures

- **Study setting and data sources**

This analysis aims to derive survival estimates of early adults to a defined threshold age across varying socioeconomic attributes for measuring their unequalness in ageing experience on the basis of the fifth round of the National Family Health Survey (NFHS 5) (International Institute for Population Sciences (IIPS) & ICF International, 2017). NFHS 5 had approximately 636,699 households representing 707 districts and interviewed more than 724,115 women in the eligible age group of 15–45 years and approximately 101,839 men via computer assisted personal interviewing (CAPI) on mini–notebook computers. The survey provided data on the key population and health and nutrition indicators, including fertility, reproductive health and mortality indicators.

NFHS 5 contains mortality information on birth history and in the household file. The birth history from the pregnancy history module of the women's questionnaire is used for extracting mortality rates at infancy and childhood, as it is often considered the most reliable from any DHS data (Moultrie et al., 2013). Similarly, in the household module, the deaths that occurred in the last three years were recorded along with the socioeconomic characteristics of the household, which were used to extract the mortality rates in higher age groups. Since the household questionnaire often responds to the head of the household and child mortality remains a sensitive matter, household heads often fail to point out it under the household mortality category, whereas birth history is a response from women, which is always regarded as a reliable source for under5 mortality. Hence, a birth file is used for the under5 mortality data, and the household death data are used for the mortality data from age 5 onwards. Life tables were constructed for social and economic groups using the mortality rates extracted by creating life lines for three years, which started at the date 3 years prior to the interview and ended at the date of the interview for all living individuals, whereas the life lines ended at the date of death for the dead individuals (Gupta & Sudharsanan, 2022; Gupta, 2022). Using the standard methodology for the construction of a period life table, as mentioned by Preston et al., (2001), life tables were constructed for all the concerned groups under study.

Deaths have been grouped into four broad age groups, namely, child deaths (0–4), later childhood deaths (5–15), adult deaths (16–59) and older adult deaths (60+), and the median age of deaths for all these groups has been estimated to be the distribution of deaths in the oldest 50% of deaths in the respective categories.

Social and economic categories were created as mutually exclusive groups. The study considered wealth quintiles from the NFHS for economic groups on the basis

of information on the availability of household assets and further indexed them via principal component analysis, followed Gupta and Sudharsanan (2022) for social groups, namely, scheduled castes (SC), scheduled tribes (ST), other backwards castes (OBC), Muslims (MUS), Hindu higher castes (HC) and others (Rutstein & Staveteig, 2014). The estimates for the 'Others' group are not shared here, considering the relatively small sample size for constructing the life table (see the supplementary files for the tables in this category).

From each study group–residence– and sex-specific life table, the following summary survival/mortality risk measures were estimated:

1. Distribution of deaths above the median age of death for death groups.
2. Survival rate between age 15 and age 60 (45l15).
3. Survival rate between age 40 and age 60 (20l40).
4. Temporary life expectancy (TLE) between the ages of 15 and 60.
5. Survival differences till age Sixty and Beyond: A Lifetable Derivative.

Using the cluster- bootstrap method with 100 samples, 95% confidence intervals were estimated for each of the above parameters (see appendix in Supplementary Material).

- **Survival rates**

Survival rates for each social and economic group and their intersectional group were calculated between the ages 15 and 60 (45l15) and the ages 40 and 60 (20l40). Here, 45l15 gives the proportion of those living at age 15 who continue to survive until age 60, whereas 20l40 gives it for those alive at age 40 who survive until age 60. The former represents the overall chances of survival from early adulthood to the defined threshold of 60, whereas the latter could reflect the influence of occupational or lifestyle-induced mortality, if any, after passing midway through one's occupational life (Vollset et al., 2006). The deviations of the category-specific survival rates from the country-level survival rates were calculated. Here, age 60 is not considered a threshold to old age but rather a cut-off age in the life cycle as the target age of survival. It is also selected because it is a general retirement age, and population ageing is often read along with the proportion of the population aged 60 and above.

- **Temporary life expectancy (TLE)**

Temporary life expectancy or partial life expectancy (yex) refers to the expected average length of life between exact ages x and y (Arriaga, 1984; Saikia et al., 2010). Life expectancies were estimated conditional on survival to 15 years of age, with the maximal theoretical life expectancy at 15 years of age being 45 years. For

the analysis, mortality experiences between the exact ages of 15 and 60 years are considered, and TLE provides an aggregate mortality measure at ages between 15 and 60 years.

$$_{45}e_{15} = (T_{15} - T_{60}) \; / \; (l_{15})$$

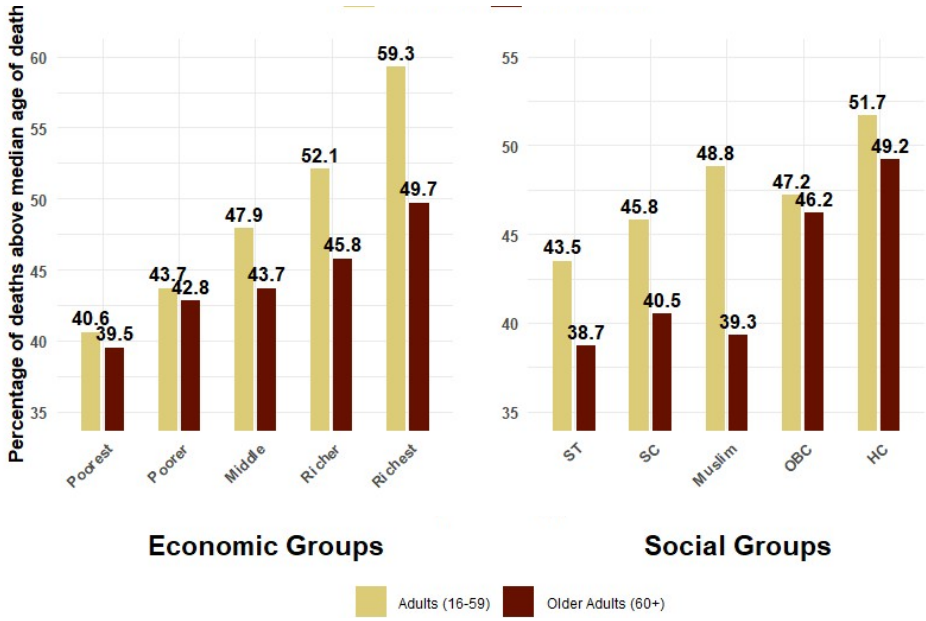
The difference between the TLEs of the groups is considered to be years of life lost (YLL) as a consequence of social or economic differences. TLE excludes mortality experiences outside its age references (here, it is 15-60). The life expectancy at birth is associated with mortality throughout the age groups and is thereby also influenced by early- and late-age deaths. To isolate the survival experiences during a given reference age bracket and convert them into life expectancies and years of life lost, temporary life expectancy is used as a measure here.

Description of the observations

- **Distribution of deaths above the median age of death for death groups.**

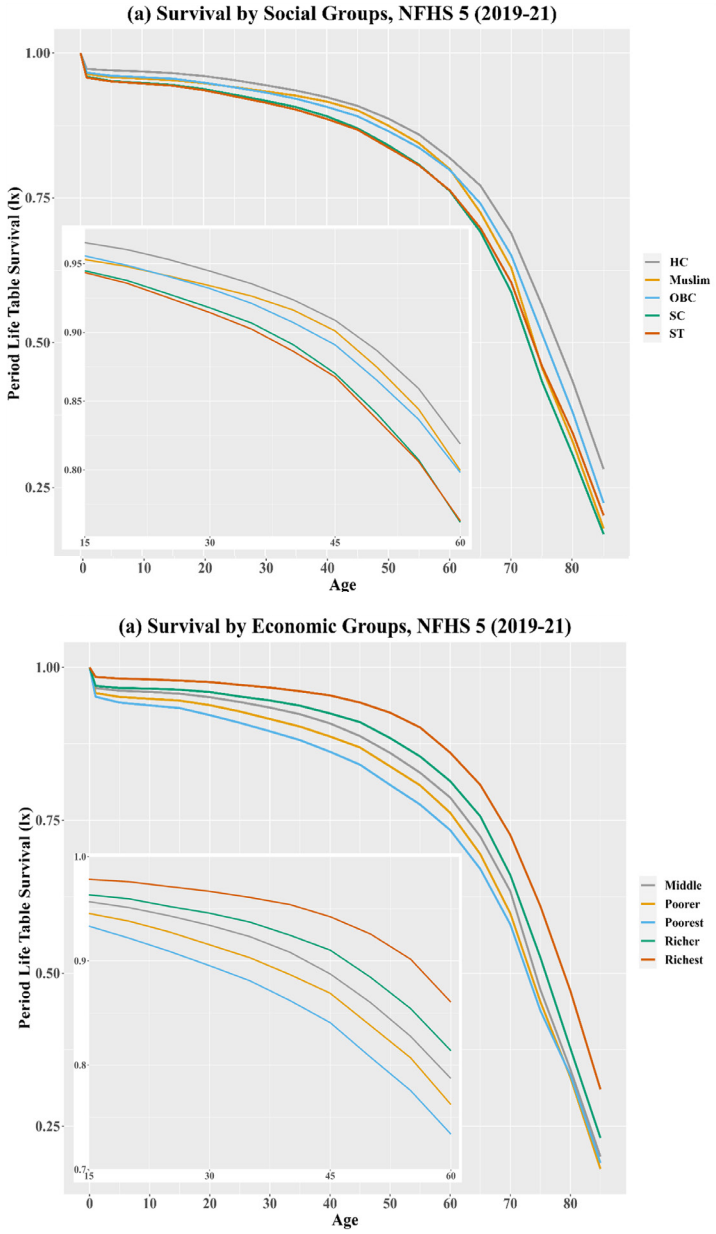
In the primary investigation, the proportion of deaths that occurred at an age above the median age of death for death categories increased significantly with increasing socioeconomic status. Figure 1 shows that while 40.5% of the deaths among the older adults belonging to the SC population are reported to have occurred above

Figure 1. The proportion of deaths that occurred above the median age of death for socioeconomic groups at the national level, NFHS 5 (2019-21), India



the median age of older adult deaths (overall), only 38.7% of the deaths among the ST population and HCs, the most privileged social group, accounted for 49.2% of the deaths. Similarly, those in the poorest quintile had only 39.3% of its deaths in the oldest 50% of the deaths, whereas this figure is 49.7% for the richest quintile. The proportions of adult deaths are more alarming. Among the wealth quintiles,

Figure 2. Period of lifetable survival (lx) at all ages and ages 15–60 by social (a) and economic (b) groups of India, NFHS 5 (2019–21)



the richest quintile had a share of deaths above the median age of 59.3%, whereas the poorest quintile had only a 40.6% share. These distributional abnormalities are investigated further via the life table approach in the following sections.

Table 1 shows the adult survival rates from ages 15-60 and 40-60 years and their deviation from the overall survival rates for corresponding ages at the national level for the social and economic groups under study. The table reveals significant differences in survival among extreme social and economic groups from the ages of 15-60. When 85% (CI 83.8% - 85.4%) of the individuals in the higher castes (HC) at age 15 reached age 60, the same per centage remained at 81% among the SC and ST groups. The survival of the social groups from ages 40-60 also showed a similar trend, where 86% of the SC and ST groups survived to age 60, whereas 89% of the HCs survived. The OBC and Muslim individuals experienced survival chances between the extreme groups. Across the wealth groups, the survival differentials are more evident, as shown in Figure 2. Only 12% of the individuals from the richest quintile households failed to survive to age 60 from age 15, whereas 21% from the poorest quintile experienced such failure. The survival probability increases systematically with the upwards movement in wealth status. Similarly, the survival rate from age 40 to 60 for the poorest remains the lowest, at 85%, whereas the survival rates are 88% and 90% for the richer and richest, respectively.

Compared with the overall survival rates at the national level, the extent of deviations in adult survival to age 60 is revealed (here, the deviation is measured against the overall survival propensity at the national level (for females, $_{45}l_{15}$ = 0.876 & $_{20}l_{40}$ = 0.909; for males, $_{45}l_{15}$ = 0.784 & $_{20}l_{40}$ = 0.837; for total, $_{45}l_{15}$ = 0.830 & $_{20}l_{40}$ = 0.874) and not the group-specific survival at the national level). Such a comparison across caste groups places SCs in the most disadvantaged position. The SCs survived 2.8% less than the overall level, followed by the STs, with a depreciation of 2.6%. All other social groups experienced survival more than the overall national level, with 2.23% more survival for the HCs. In terms of adult survival, Muslims are estimated to be at a more advantageous position than Hindu OBCs are. Among the wealth groups, the poorest quintiles experienced a survival probability that was 5% less than the overall probability, which improved as the wealth status reached the richest quintiles, with a survival rate that was 6% greater than the national average. Only the highest two quintiles observed a positive deviation among the wealth groups.

- **Temporary life expectancy between the ages of 15 and 60 years**

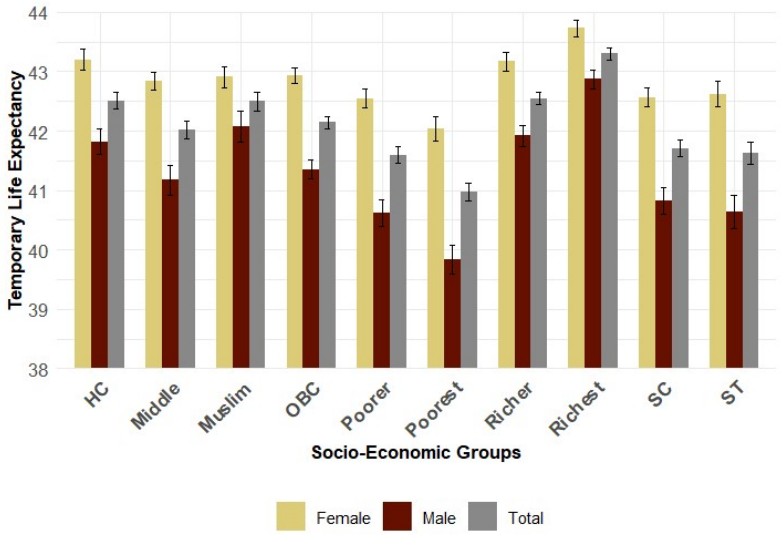
Figure 3 shows the temporary life expectancy (TLE) for individuals aged 15-60 years, which depicts the years of life lost during 45 years. In men and women combined, partial life expectancy at 15 years was reduced by more than 2 years because of low economic status. When the SC group had a TLE of 41.7 years, the

Table 1. Survival rates to age 60 from ages 15 and 40 and their deviations (in %) from the survival propensity at the national level, NFHS 5 (2019–21), India

Social/Economic Groups	Female				Male				Total			
	Survival rates		Deviations (in %)		Survival rates		Deviations (in %)		Survival rates		Deviations (in %)	
	$45\rfloor_{15}$	$20\rfloor_{40}$	$45\rfloor_{15}$	$20\rfloor_{40}$	$45\rfloor_{15}$	$20\rfloor_{40}$	$45\rfloor_{15}$	$20\rfloor_{40}$	$45\rfloor_{15}$	$20\rfloor_{40}$	$45\rfloor_{15}$	$20\rfloor_{40}$
SC	0.86	0.90	−1.88	−1.34	0.75	0.81	−3.92	−3.06	0.81	0.86	−2.83	−2.12
ST	0.86	0.90	−1.53	−0.92	0.76	0.82	−3.63	−2.03	0.81	0.86	−2.57	−1.46
Muslim	0.87	0.90	−0.48	−0.81	0.81	0.84	2.81	0.68	0.84	0.87	1.11	−0.10
OBC	0.88	0.91	0.37	0.30	0.79	0.85	0.89	1.15	0.84	0.88	0.63	0.71
HC	0.89	0.92	1.88	1.27	0.81	0.85	2.76	1.82	0.85	0.89	2.23	1.48
Poorest	0.84	0.89	−3.81	−1.84	0.73	0.81	−7.16	−3.57	0.79	0.85	−5.25	−2.54
Poorer	0.86	0.90	−1.73	−0.97	0.75	0.82	−4.17	−2.41	0.81	0.86	−2.86	−1.62
Middle	0.87	0.91	−0.27	−0.27	0.77	0.83	−1.45	−1.34	0.82	0.87	−0.86	−0.79
Richer	0.89	0.91	1.30	0.62	0.80	0.85	2.45	1.00	0.84	0.88	1.80	0.76
Richest	0.91	0.93	3.87	1.90	0.85	0.88	8.44	4.82	0.88	0.90	6.00	3.24

HCs had 42.5 years, the poorest quintile had 41.0 years, and the richest quintile had 43.3 years. This summary measure could explain life expectancy in a more effective manner, as the target age is fixed at 45 years and increases steadily with improvement in economic status (see Figure 3). Among men, the ST group and the poorest quintile lost 4.4 and 5.2 years, respectively, whereas HCs and the richest quintile lost only 3.2 and 2.1 years, respectively. A difference of 2.3 YLLs exists between the poorest and richest quintiles, and a difference of 0.9 years exists between STs and HCs. In contrast to the health disadvantages of Muslims, the TLE of Muslims is estimated to be similar to that of HCs. TLE excluded those mortality experiences before age 15 and after age 60, making it exclusive for a selected age group. Such exclusion could have given Muslims a greater advantage in the computation of TLE. Life expectancy at birth, which combines mortality experiences throughout the life cycle, depicts the disadvantaged position of Muslims in terms of overall survival (see the Supplementary file).

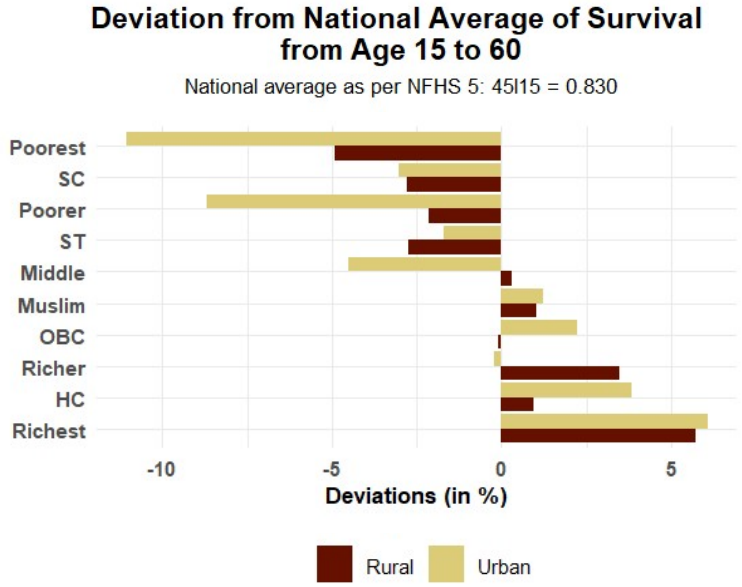
Figure 3. Temporary life expectancy in years (ages 15-60) for socioeconomic groups in India, NFHS 5 (2019-21)



- **Disparities by Residence**

The urban-rural dichotomy, which is often discussed in the context of child survival, clearly persists until adulthood. Table 2 shows the survival rates and their deviations compared with those of the national average. The urban poorest remain the most disadvantaged, whose survival rate is 11% less than the national average, whereas the rural poorest are only 4.9% disadvantaged relative to the national average (see Fig. 4). At the other extreme, the urban richest population has a survival advantage of 6.1% over the aggregate population, and the rural richest population has a similar advantage of 5.7%. Among the urban population, the differences between the survival deviations of the poorest and richest quintiles are 27.2% and 17.2% for males and females, respectively, whereas they are 15.5% and 10.67% for rural men and women, respectively. The survival rates between the ages of 40 and 60 also followed a similar pattern.

Figure 4. Deviations in Survival Disparities by Type of Residence, NFHS 5 (2019--21)



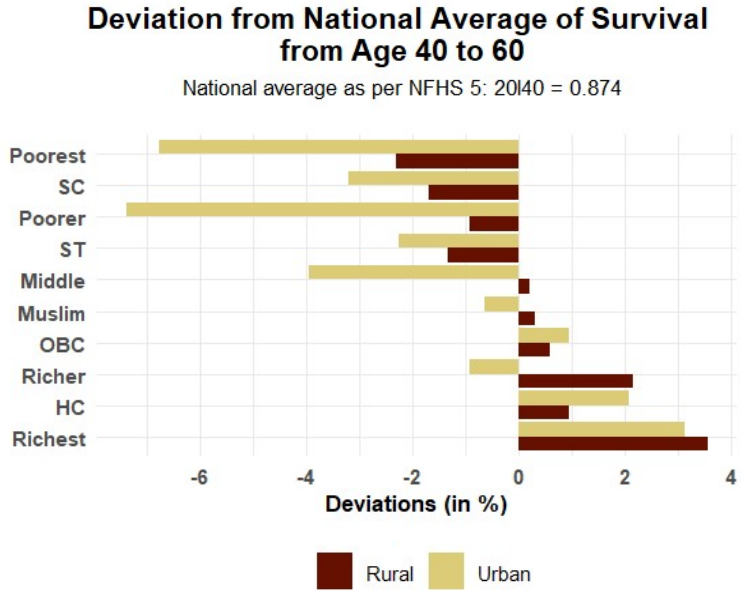


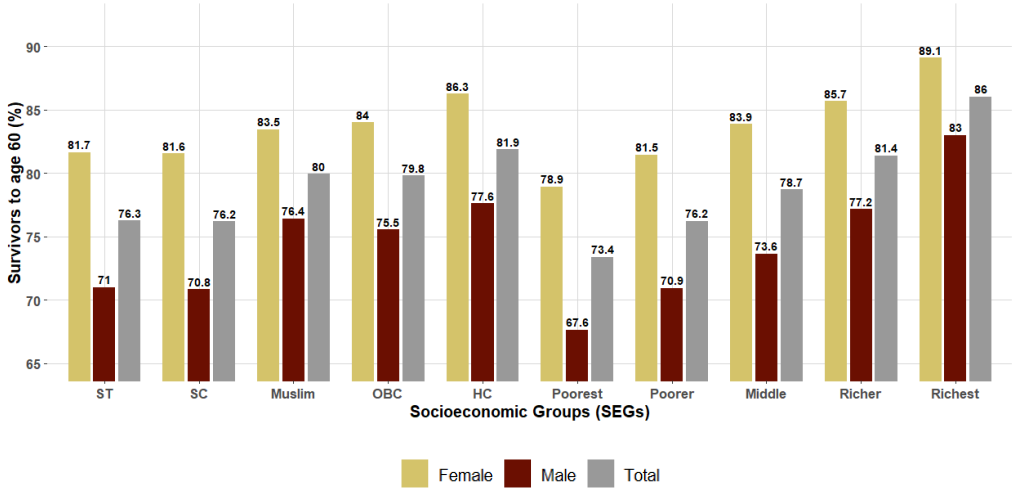
Table 2 Survival disparities by type of residence, NFHS 5 (2019--2021)

Residence	Social/ Economic Groups	Female				Male				Total			
		Survival rates		Deviations (in %)		Survival rates		Deviations (in %)		Survival rates		Deviations (in %)	
		$_{45}q_{15}$	$_{20}q_{40}$	$_{45}q_{15}$	$_{20}q_{40}$	$_{45}q_{15}$	$_{20}q_{40}$	$_{45}q_{15}$	$_{20}q_{40}$	$_{45}q_{15}$	$_{20}q_{40}$	$_{45}q_{15}$	$_{20}q_{40}$
Urban	SC	0.80	0.85	-3.02	-3.15	0.73	0.78	-7.20	-7.07	0.88	0.91	-3.04	-3.21
	ST	0.82	0.85	-1.68	-2.19	0.77	0.81	-2.36	-2.94	0.87	0.90	-1.70	-2.25
	Muslim	0.84	0.87	1.24	-0.58	0.79	0.82	0.92	-1.83	0.89	0.91	1.22	-0.63
	OBC	0.85	0.88	2.26	1.02	0.80	0.84	2.16	0.91	0.90	0.92	2.24	0.96
	HC	0.86	0.89	3.85	2.13	0.82	0.86	4.96	3.02	0.90	0.92	3.83	2.07
	Poorest	0.74	0.81	-11.05	-6.72	0.63	0.74	-19.99	-11.65	0.86	0.89	-11.07	-6.78
	Poorer	0.76	0.81	-8.69	-7.33	0.68	0.74	-13.67	-11.69	0.85	0.88	-8.71	-7.38
	Middle	0.79	0.84	-4.51	-3.90	0.71	0.77	-9.94	-8.58	0.88	0.91	-4.53	-3.96
	Richer	0.83	0.87	-0.18	-0.88	0.78	0.82	-0.81	-2.03	0.88	0.91	-0.20	-0.94
	Richest	0.88	0.90	6.11	3.17	0.85	0.87	8.11	4.27	0.91	0.93	6.09	3.11
Rural	SC	0.81	0.86	-2.77	-1.64	0.76	0.83	-2.63	-1.44	0.85	0.89	-2.79	-1.70
	ST	0.81	0.86	-2.71	-1.27	0.75	0.82	-3.84	-1.85	0.86	0.90	-2.73	-1.33
	Muslim	0.84	0.88	1.04	0.37	0.82	0.86	4.24	2.65	0.86	0.89	1.02	0.31
	OBC	0.83	0.88	-0.07	0.64	0.79	0.85	0.27	1.21	0.87	0.91	-0.09	0.58
	HC	0.84	0.88	0.96	1.01	0.79	0.84	0.93	0.77	0.88	0.92	0.94	0.95
	Poorest	0.79	0.85	-4.91	-2.26	0.73	0.81	-6.41	-3.15	0.84	0.89	-4.93	-2.31
	Poorer	0.81	0.87	-2.12	-0.86	0.76	0.83	-2.94	-1.21	0.86	0.90	-2.14	-0.91
	Middle	0.83	0.88	0.34	0.26	0.79	0.85	1.39	0.98	0.87	0.90	0.32	0.20
	Richer	0.86	0.89	3.50	2.20	0.82	0.87	5.15	3.48	0.89	0.92	3.48	2.14
	Richest	0.88	0.90	5.76	3.62	0.86	0.89	9.34	6.30	0.90	0.92	5.74	3.56

- **Survival differences until age Sixty and Beyond: A Life table derivative**

The life table computed for all potential characteristic groups can indicate differences in survival until the ages of sixty years and older (see Fig. 5). This differential is marked by the poorest quintile having the lowest chances, as only 73.4% of the population survives to older ages when 86.0% of the richest quintile population survives. The SCs among the social groups had the lowest chances, as only 76.2% of the HCs survived, whereas 81.9% of the HCs did. The greatest disparities were observed between the poorest and richest quintiles of men, with a difference of 15.4%. The results suggest that among both social and economic groups, men experience more disparities than women do.

Figure 5. Survival Differences Till Age Sixty and Beyond: A Life-table Derivative



Discussion and Conclusion

Ageing experience and its assessment are commonly performed in terms of the share of the older adult population beyond the age of sixty years. However, this necessarily involves a survival propensity, which is perhaps not common across all individuals of a population and is conditioned by socioeconomic identities. This can give rise to unequal ageing, where ageing is a survival experience and could differ across different socioeconomic identities. This exercise is intended to highlight such unequalness in terms of a select set of characteristic identities. Although inequality in ageing is recognised, it routinely involves inequality among those beyond the ageing threshold, and further, such inequality has a focus on other

welfare aspects of inequality among them. In contrast, inequality in ageing needs to focus on the differential propensity of reaching old age in the first place and later survival beyond that age. This exercise primarily exposes the differential extent of survival, as revealed by a life table across socioeconomic features of the population that depicts the severe gap in survival to the given threshold age (60) among different social and economic groups. Although survival differentials among social groups in India have been discussed in previous studies, this study highlights the need to read them during the population ageing process. When increased survival or life expectancy is responsive to the fertility transition to result in 'population ageing', this phenomenon has its own inherent differences given that survival is not equal for one and all in the population.

Reading an upwards shift in life expectancy loses sight of the differential dynamics of survivorship in the life cycle, wherein differences in survival to age 60 from ages 15 and 40 generate a significant gap in the loss of the workforce due to mortality. While 26.6% of individuals from the poorest quintile fail to survive to or beyond age 60, similar failure is only 14% among those from the wealthiest quintile. Despite the gain in life expectancy, on average, the socially disadvantaged still die substantially younger. Such differential longevity across the economic spectrum might well be shaped via multiple pathways, including better occupational position leading to higher income and reduced occupational hazard, more physical activity, healthier diet, low smoking and increased self-care, and adherence to medical treatments. An additional 2 YLLs were lost between the ages of 15 and 60 years by the economically weakest group, whereas the socially weakest group lost a year of life in the population. Social discrimination and the restriction of opportunities due to social and economic disadvantages could be reasons for such disparities.

Ageing as an individual life-course event depends on an individual's survival to older ages, which are aggregated into a measure of population ageing in the form of the share of the older population implied positively by increasing longevity. However, increased longevity (a parameter without an individual construct) is experienced differently by individuals when it is conditioned by their attributes. Such attrition in terms of length of life could very well differ between individuals and, more so, systematically between rich and poor individuals. This exploration offers evidence regarding differential survivorship until the age of sixty and beyond, where the poorest fail to achieve attainment of sixty years two times more than the richest segment of the population. Therefore, the fast pace of ageing, i.e., the changing proportion of older adults, needs to account for the share of the rich and the poor within the stock of older adults.

These findings have important policy implications. First, conventional ageing indicators based solely on the proportion of older adults may misrepresent the true distribution of ageing by overlooking differential survival across socioeconomic groups. Policy frameworks for ageing, including pension design and social

protection, need to account for the unequal probability of reaching older ages. Second, redistributive mechanisms such as contributory pensions may inadvertently favour socioeconomically advantaged groups who are more likely to survive long enough to benefit, thereby raising equity concerns. Third, targeted interventions to reduce premature adult mortality among disadvantaged groups, through improved access to healthcare, safer working conditions, and preventive health measures, are essential to ensure a more equitable ageing process. Recognising ageing as a stratified survival process is therefore critical for designing inclusive and equitable ageing policies.

Attaining old age need not be an exclusive privilege of a few but should be a general implication of the realised demographic transition. The interpretation of all possible adversity in old age in general and financial hardship in particular may well be a myth in case the rich live longer vis-à-vis the poor. The socioeconomic composition of older adults needs rethinking as to whether the ideal protection offered to this segment of the population is in keeping with the principle of equity. When an eligible segment does not make to this age and another not only makes to this age but also lives longer beyond reaching old age, then a real scene of adversity should come down. In fact, this should prompt the recognition of heterogeneity in the aged population, as all do not survive until this age, and survival until late ages is responsive to socioeconomic identities. Moreover, if individuals with higher socioeconomic status disproportionately represent older adults, the redistribution of income as welfare pensions will take place in opposition to the idea of equity, i.e., those with lower status will survive less to benefit from the schemes for which they have also contributed. Those with high life expectancies will survive long enough to benefit from the entitlements of contributory or social welfare pensions while the disadvantaged fail.

Given the unequal survival of older individuals, inequalities in physical and mental morbidities create multiple burdens on socially disadvantaged groups, as the disadvantages accumulate over the life course (Serrano-Alarcón & Perelman, 2017). Both unequal ageing and ageing under unequal circumstances should be read together to comment on the burden of the increasing magnitude of older adults. Ageing should not be restricted as a process with a proportional increase in older adults; instead, it should be considered a "stratified process that reflects the inequalities that structure our life chances from birth onwards" (Abramson, 2016).

This exposition is not without its limitations given that the National Family Health Survey may not be sufficient to derive mortality experience and, further, socioeconomic stratification. However, this may offer the first opportunity to obtain a socioeconomic stratification of survival experience, which otherwise remained limited to the gender and residence divide. Given the large size and coverage of the survey, the stratification is perhaps reasonable, but the mortality experience inferred therein may well be conditioned by the age composition of the stratified

population as well as the usual recall/reporting bias of reporting mortality. The other limiting aspect of this exercise lies in considering social and economic features independently, although there is a possible connection between the two. Hence, the real magnitude of the characteristic divide in the older adult population may not be possible on the basis of this assessment. In sum, this exercise highlights the survival divide across socioeconomic identities, which has far-reaching implications for conceptualising population-based indicators. One immediate implication is that the number of older adults is heterogeneous not only in terms of their observed characteristic features but also in terms of their propensities for survival. Therefore, the formulation of common indicators with a population in the denominator and an outcome in the numerator needs to recognise mismatches in the characteristic composition of the two. Reading about the ageing phenomenon should recognise differential survival and the implied compositional features of the aged.

References

Abramson, C. M. (2015). The end game: How inequality shapes our final yea. Harvard University Press.

Abramson, C. M. (2016). Unequal Aging: Lessons From Inequality's End Game. Public Policy & Aging Report, 26(2), 68–72. https://doi.org/10.1093/ppar/prw006

Alam, M., Mazumdar, S., & Yadav, P. (2015). Inequalities in Elderly Health and Wellbeing in India: An Exploration (BKPAI Working Paper Series II; No 5).

Alvarez, J.-A., Kallestrup-Lamb, M., & Kjærgaard, S. (2021). Linking retirement age to life expectancy does not lessen the demographic implications of unequal lifespans. Insurance: Mathematics and Economics, 99, 363–375. https://doi.org/10.1016/j.insmatheco.2021.04.010

Arriaga, E. E. (1984). Measuring and explaining the change in life expectancies. Demography, 21(1), 83–96. http://www.ncbi.nlm.nih.gov/pubmed/6714492

Asaria, M., Mazumdar, S., Chowdhury, S., Mazumdar, P., Mukhopadhyay, A., & Gupta, I. (2019). Socioeconomic inequality in life expectancy in India. BMJ Global Health, 4(3), e001445. https://doi.org/10.1136/bmjgh-2019-001445

Balachandran, A. (2020). Population ageing in Europe and Asia: Beyond traditional perspectives [University of Groningen]. https://doi.org/10.33612/diss.135497884

Balachandran, A., de Beer, J., James, K. S., van Wissen, L., & Janssen, F. (2020). Comparison of Population Aging in Europe and Asia Using a Time-Consistent and Comparative Aging Measure. Journal of Aging and Health, 32(5–6), 340–351. https://doi.org/10.1177/0898264318824180

Balachandran, A., & James, K. S. (2021). A multidimensional perspective on the gender gap in health among older adults in India and China: application of a new

ageing measure. Ageing and Society, 41(5), 1000–1020. https://doi.org/10.1017/S0144686X19001521

Bhatia, M., Dwivedi, L. K., Ranjan, M., Dixit, P., & Putcha, V. (2019). Trends, patterns and predictive factors of infant and child mortality in well-performing and underperforming states of India: a secondary analysis using National Family Health Surveys. BMJ Open, 9(3), e023875. https://doi.org/10.1136/bmjopen-2018-023875

Borsch-Supan, A. (2003). Labor Market Effects of Population Aging. Labour, 17(SpecialIssue), 5–44. https://doi.org/10.1111/1467-9914.17.specialissue.2

Chakrabarti, S. , Sarkar, A. (2011). Pattern and trend of population ageing in India. The Indian Journal of Spatial Science, 2(2), 1–11.

Giridhar, G., Sathyanarayana, K. M., Kumar, S., James, K. S., & Alam, M. (Eds.). (2014). Population Ageing in India. Cambridge University Press. https://doi.org/10.1017/CBO9781139683456

Gupta, A. (2022). Replication materials for "Large and persistent life expectancy disparities among India's social groups." https://github.com/lekhajokha/e0_social_disparities_nfhs

Gupta, A., & Sudharsanan, N. (2022). Large and Persistent Life Expectancy Disparities between India's Social Groups. Population and Development Review, 48(3), 863–882. https://doi.org/10.1111/padr.12489

Holman, D., & Walker, A. (2021). Understanding unequal ageing: towards a synthesis of intersectionality and life course analyses. European Journal of Ageing, 18(2), 239–255. https://doi.org/10.1007/s10433-020-00582-7

International Institute for Population Sciences (IIPS) & ICF International. (2017). National Family Health Survey (NFHS-4), 2015-16: India.

James, K. S. (2011). India's Demographic Change: Opportunities and Challenges. Science, 333(6042), 576–580. https://doi.org/10.1126/science.1207969

Kumari, M., & Mohanty, S. K. (2020). Caste, religion and regional differentials in life expectancy at birth in India: cross-sectional estimates from recent National Family Health Survey. BMJ Open, 10(8), e035392. https://doi.org/10.1136/bmjopen-2019-035392

Mishra, Udaya S; Dash, A. K. (2011). Elderly : Does Count or Characteristics Matter ? The Journal of Aging in Emerging Economies, i, 24–35. https://www.researchgate.net/publication/281855838_Elderly_Does_Count_or_Characteristics_Matter

Mohanty, S. K., and Ram, F. (2010). Life Expectancy at Birth Among Social and Economic Groups in India.

Moultrie TA, RE Dorrington, AG Hill, K Hill, I. T. and B. Z. (Ed.). (2013). Tools for Demographic Estimation. International Union for the Scientific Study of Population. demographicestimation.iussp.org

Muszyńska, M. M., & Rau, R. (2012). The Old-Age Healthy Dependency Ratio in Europe. Journal of Population Ageing, 5(3), 151–162. https://doi.org/10.1007/s12062-012-9068-6

Office of the Registrar General and Census Commissioner of India. (2020). Population Projection for India and States 2011-2036. https://main.mohfw.gov.in/sites/default/files/Population Projection Report 2011-2036 - upload_compressed_0.pdf

Po, J. Y. T., & Subramanian, S. V. (2011). Mortality Burden and Socioeconomic Status in India. PLoS ONE, 6(2), e16844. https://doi.org/10.1371/journal.pone.0016844

Preston, S. H., Patrick, H. & Guillot, M. (2001). Demography: Measuring and Modelling Population Processes. Blackwell Publishers Inc.

Preston, S. H., & Paul, T. (1994). Socioeconomic Differences in Adult Mortality and Health Status. In L. G. Martin, S. H. Preston, & N. R. C. (U. S.). C. on Population (Eds.), Demography of Aging. National Academy Press. https://www.ncbi.nlm.nih.gov/books/NBK236675/

Rajan, S. I., Mishra, U. S., & Sarma, P. S. (1999). India's elderly: Burden or challenge? SAGE Publications, New Delhi.

Rao, C., Gupta, A., Gupta, M., & Yadav, A. K. (2021). Premature adult mortality in India: what is the size of the matter? BMJ Global Health, 6(6), e004451. https://doi.org/10.1136/bmjgh-2020-004451

Rutstein, S. O., & Staveteig, S. (2014). Making the demographic and health surveys wealth index comparable (Vol. 9). ICF international Rockville, MD.

Saikia, N., Jasilionis, D., Ram, F., & Shkolnikov, V. M. (2010). Estimates of Mortality under Age 60 in India and its States (No. 19702004; MPIDR Technical Report TR-2010-006). http://www.demogr.mpg.de/papers/technicalreports/tr-2010-006.pdf

Saikia, N., Bora, J. K., & Luy, M. (2019). Socioeconomic disparity in adult mortality in India: estimations using the orphanhood method. Genus, 75(1), 7. https://doi.org/10.1186/s41118-019-0054-1

Sanderson, W. C., & Scherbov, S. (2007). A new perspective on population aging. Demographic Research, 16, 27–58. http://www.jstor.org/stable/26347928

Sanderson, W. C., & Scherbov, S. (2008). Rethinking Age and Aging. Population Bulletin, 63(4). https://www.prb.org/resources/rethinking-age-and-aging/

Sanderson, W. C., & Scherbov, S. (2010). Demography. Remeasuring aging. Science (New York, N.Y.), 329(5997), 1287–1288. https://doi.org/10.1126/science.1193647

Sanderson, W. C., & Scherbov, S. (2013). The Characteristics Approach to the Measurement of Population Aging. Population and Development Review, 39(4), 673–685. https://doi.org/10.1111/j.1728-4457.2013.00633.x

Serrano-Alarcón, M., & Perelman, J. (2017). Ageing under unequal circumstances: a cross-sectional analysis of the gender and socioeconomic patterning of functional limitations among the Southern European elderly. International Journal for Equity in Health, 16(1), 175. https://doi.org/10.1186/s12939-017-0673-0

Subramanian, S. V, Nandy, S., Irving, M., Gordon, D., Lambert, H., & Davey Smith, G. (2006). The mortality divide in India: the differential contributions of gender, caste, and standard of living across the life course. American Journal of Public Health, 96(5), 818–825. https://doi.org/10.2105/AJPH.2004.060103

Thorat, S., & Attewell, P. (2007). The Legacy of Social Exclusion: A Correspondence Study of Job Discrimination in India. Economic and Political Weekly, 42(41), 4141–4145. http://www.jstor.org/stable/40276548

United Nations. (2022). World Population Prospects: The 2022 Revision.

Vollset, S. E., Tverdal, A., & Gjessing, H. K. (2006). Smoking and Deaths between 40 and 70 Years of Age in Women and Men. Annals of Internal Medicine, 144(6), 381. https://doi.org/10.7326/0003-4819-144-6-200603210-00004

Vyas, S., Hathi, P., & Gupta, A. (2022). Social disadvantage, economic inequality, and life expectancy in nine Indian states. Proceedings of the National Academy of Sciences, 119(10). https://doi.org/10.1073/pnas.2109226119

Willekens, F. (2014). Demographic transitions in Europe and the world (MPIDR WORKING PAPER WP 2014-004). https://www.demogr.mpg.de/papers/working/wp-2014-004.pdf