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# Large and Persistent Life Expectancy Disparities between India's Social Groups

AASHISH GUPTA  AND NIKKIL SUDHARSANAN 

*India is one of the most rigidly stratified societies in the world, yet little is known about life expectancy disparities in the country. We provide direct estimates of social differences in life expectancy in India using survey data spanning two decades. We show that individuals from the Scheduled Castes and Scheduled Tribes have drastically and persistently lower life expectancies than high-caste individuals (between 4.2–4.4 years for women and 6.1–7.0 years for men in 2013–2016). While Muslims had a modest life expectancy disadvantage compared to high castes in 1997–2000, this disadvantage has grown substantially over the past 20 years. Mortality disparities between marginalized and privileged social groups are present across the entire life-course and are increasingly driven by older-age mortality. Our findings reveal a pressing need for far greater attention to the health of marginalized populations in India.*

## Introduction

India is one of the most rigidly hierarchical societies in the world. Multiple systems of stratification, such as those rooted in caste, religious identity, or indigenous status determine social privilege and disadvantage. At the bottom of the caste hierarchy are the Scheduled Castes (SCs), also known as *Dalits* or “ex-untouchables” (Ambedkar 1989b). At the next rung are “other backward classes,” (OBCs) a group of castes that were not considered “untouchable,” but which are still socially marginalized (Mandal 1980). At the top are a group of advantaged castes, variously known as the “high,” “upper,” “forward,” or “general” castes (Ambedkar 1936). Scheduled Tribes (STs), who are indigenous peoples also known as *Adivasis* (Xaxa 2008), face similar or worse forms of social disadvantage as SCs (Xaxa

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Committee 2014). Finally, Muslims, who are India's largest religious minority, face persistent and intensifying political and social marginalization (Government of India 2006; Jaffrelot 2021). Collectively, *dalits*, *adivasis*, and Muslims constitute two-fifths of India's 1.37 billion people (Government of India 2013). They are some of the largest marginalized populations in the world.

Caste, religion, and indigenous identities shape all aspects of life and constrain marginalized individuals' economic (Thorat et al. 2017), educational (Borooah et al. 2015), occupational (Vaid 2014; Aggarwal, Drèze, and Gupta 2015), and social opportunities (Allendorf and Pandian 2016; Zahran et al. 2015)—contributing to a persistent gap in human development (Azam and Bhatt 2015). These inequalities have fueled widespread public and academic debate in recent years on the magnitude, causes of, and solutions to disparities in human development and well-being in India (Desai and Dubey 2012).

Longevity is one of the most fundamental dimensions of human development (Alkire 2002). Yet both public discussions and research on social inequalities in India have been slow to examine how caste and religion shape how long individuals live. One potential reason for this is that there are no officially produced estimates of mortality differences across social groups. Vital registration in India is not complete (Rao et al. 2021), and India relies on the Sample Registration System (SRS), a continuous mortality surveillance survey, for mortality estimates (Registrar General of India 2011). Unfortunately, the SRS does not prepare life tables by social group. Contributing to a small but growing body of research on mortality disparities in India (Barik, Desai, and Vanneman 2018; Mohanty and Ram 2010; Saikia, Bora, and Luy 2019; Vyas, Gupta, and Hathi 2021) and low- and middle-income countries broadly (Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014; Sudharsanan 2019), we provide direct estimates of the evolution of social differences in mortality across the life course in India. We do this through a novel use of routine household-survey data spanning a period of two decades.

Using data from two rounds of the National Family and Health Surveys—India's nationally representative Demographic and Health Survey—we answer the following questions: (a) How large are social group differences in life expectancy at birth in India and how have they changed over the past 20 years?; (b) Do mortality disparities persist beyond the childhood ages and in particular which ages contribute the most to the overall life expectancy differences?; and (c) In the context of tremendous geographic heterogeneity in India, how do these differences vary regionally?

## Social disadvantage and mortality disparities in India

A growing body of research seeks to understand social differences in mortality in India by using survey data. A substantial portion of the literature has focused on infant and child mortality, estimated from the birth-history module implemented in several national surveys including the National Family Health Surveys (NFHS; India's Demographic and Health Survey). This literature has documented persistent mortality disadvantages for SC and ST children, despite overall improvements in child health and healthcare provision (Bora, Raushan, and Lutz 2019; Dommaraju, Agadjanian, and Yabiku 2008; Maity 2017; Ramaiah 2015). This literature has also documented a "Muslim mortality paradox": despite relative economic disadvantages, Muslim children have lower mortality risks compared to Hindu children (Bhalotra, Valente, and Van Soest 2010; Guillot and Allendorf 2010). Geruso and Spears (2018) show that this is likely driven by higher use of toilets by Muslims, exposing Muslim children to a less worst disease environment.

A small number of studies have focused on estimating disparities in mortality beyond the childhood ages (Barik, Desai, and Vanneman 2018; Kumari and Mohanty 2020; Mohanty and Ram 2010; Saikia, Bora, and Luy 2019; Subramanian et al. 2006). Our paper builds on these existing studies of caste and tribe differences in life expectancy in India. Our first contribution to the literature is that our estimates of life expectancy and mortality in the adult ages are based on real age-specific data rather than modeled or indirect estimates. Our second main contribution is that our paper provides a comprehensive overview of how caste, tribe, and religious differences in mortality vary across age, geography, and time. Existing papers describe some of these differences but are often missing key dimensions of heterogeneity. Third, the existing literature has not examined the contribution of mortality disparities in different ages to overall disparities in life expectancy at birth. By presenting differences across several dimensions using a consistent set of data and methods, our paper provides the most comprehensive picture of social group differences in mortality in India to date. Fourth, our approach makes an important estimation advance. We demonstrate how survey data on recent household deaths and birth histories can be used to reliably estimate age-specific mortality rates, both overall and across social groups. Finally, complementary to Vyas, Gupta, and Hathi (2021), we estimate accurate standard errors using a cluster-bootstrap approach. This approach accounts for the complex survey design of the NFHS survey and the clustering of observations within primary sampling units (villages or urban blocks) in the NFHS. Thus, by presenting differences across several dimensions using a consistent set of reliable data and methods, our paper provides the most comprehensive picture of social differences in mortality in India to date.

Unfortunately, our numerical results are difficult to directly compare to existing studies because of these data and methodological differences and because some studies estimate mortality differences using measures other than life expectancy (which is the standard in the mortality literature). Despite the differences in data and methods, our findings align with the extant literature that generally finds evidence of large and important social differences in mortality.

## Materials and methods

### Data

Our data are from the second (1998–1999) and fourth rounds (2015–2016) of the Indian NFHS, India's Demographic and Health Survey. The NFHS is a nationally representative survey of Indian households that collects extensive information on the health, fertility, and socioeconomic characteristics of household members. We were not able to use the first round of the NFHS since it did not distinguish between all the caste and tribe groups and the third round because it did not contain a question on recent deaths of household members.

Both the NFHS-2 and NFHS-4 employed a multistage stratified sampling design. For the NFHS-2, strata were defined by districts and additional potential geographic and demographic characteristics (International Institute for Population Sciences and ORC Macro 2000, 2). Within rural areas of each stratum, villages were randomly selected from the 1991 census list of villages. Survey staff then attempted a complete household mapping in each selected village and subsequently randomly sampled households from this mapping. In urban areas within each stratum, a random sample of wards was selected based on listings from the 1991 census list of wards, followed by a random sampling of census enumeration areas within wards. Survey staff then conducted a household listing within selected census enumeration areas and randomly selected households from this listing. The sampling procedure was similar in the NFHS 4, with the main difference that the 2011 census was used to list villages in rural areas and census enumeration blocks in urban areas. The NFHS-4 also directly sampled census enumeration blocks in urban areas and did not use the information on wards.

These surveys involved multiple interviews for each household, including a household questionnaire and a separate woman's questionnaire administered to an ever-married woman in the household between the age of 15–49. The household questionnaire asked the respondent to provide an entire listing of household members with basic demographic information on each member, including their age, sex, and relationship to the household head. Within the household interview, the respondent was also asked about household members who had recently died. The woman's

questionnaire asked several health- and fertility-related questions, including a full birth history, where women of reproductive ages report details about the children they have had and the survival of the children

### Measuring social groups

We classified all individuals into one of five mutually exclusive social groups based on the respondent-reported caste and religion of their household head: SCs, STs, Muslims, OBCs, and high castes. The classification is based on two questions asked in the NFHS surveys—one on caste or tribe group and another on religion. We classified individuals as SC and ST regardless of their religion. Although Indian official classifications allow only Sikhs, Hindus, and Buddhists to claim benefits reserved for SCs (Fazal 2017), many SC individuals are in fact members of other religions (Kumar et al. 2020; Louis 2007). The Muslim social group consists of those who reported Islam as their religion but who were not SC or ST. Given the small number of respondents who reported being Muslim and SC or ST (0.62 percent of the sample in NFHS-4), this makes little difference to our estimates. High castes and OBCs are classified as such only if they are Hindu. Appendix Table A1 in the Supporting Information shows that these five groups account for 97 percent of deaths and person-years. The remaining sample, about 3 percent of respondents, for whom we are unable to estimate life expectancy, consists of members of minority religions (Sikhs, Jains, Buddhists, Christians, Parsis, etc.) who did not identify as SC or ST. The approach we follow here is consistent with that of the India Human Development Survey (Desai et al. 2010).

### Measuring mortality

The NFHS-2 and NFHS-4 contain information on mortality in the birth-history module of the woman's questionnaire and the recent household deaths module of the household questionnaire. We take advantage of both sources of information. We use the birth-history module to estimate under-5 mortality and information on recent household deaths for mortality at all other ages. For both child and adult mortality, we only examine mortality within the two years prior to the date of the household interview to minimize potential recall biases. Since the NFHS-2 and NFHS-4 were conducted over an approximately two-year period, our mortality estimates therefore correspond to approximately two four-year periods (1997–2000 and 2013–2016).

The approach of estimating under-5 mortality from the pregnancy module of the DHS surveys is widely applied by governments and the United Nations and is thought to produce reliable estimates of under-5 mortality in the absence of comprehensive vital registration systems (Moultrie

et al. 2013). Within the pregnancy-history module, women were asked how many pregnancies they had in their lifetime and whether these pregnancies resulted in a live birth. For each live birth, women were additionally asked information on the date of birth and sex of the child and if the child was still alive at the time of the interview. For children who were reported to have died, women were asked to provide their age at death. Using this information, we created individual life-lines for each live birth, starting at their date of birth and ending at the date of interview for those children who were still alive and the date of death for those children who died. This allows us to identify exactly how many deaths and person-years lived there were for children under the age of 5 in the two years prior to the interview.

We estimate mortality for individuals ages 5 and above from information on household-reported recent deaths. Specifically, the survey respondent was asked if any regular member of the household had died since January 1996 for NFHS-2 and January 2012 for NFHS-4. For each deceased individual, respondents were asked to provide the sex, date of death, and age at death of the deceased. Using this information, we created lifelines for each deceased individual starting from their age two years prior to the interview to their age at death. Next, we created lifelines for surviving individuals using information on the age and sex of household members enumerated in the household roster. For each household member, we first calculated their age two years prior to the interview and then created life-lines that ended at their age at the time of the interview. Similar to under-5 mortality, we were then able to use these lifelines to estimate exactly how many deaths and person-years lived there were for each five-year age group between 5 and 85.

### Statistical methods

We first directly estimate age-specific mortality rates for age groups 0–1, 1–4, five-year age groups between 5 and 85, and the open-ended age interval 85+ by dividing the number of deaths in each age group by the person-years lived in that age group. We do this separately by social group. We then convert these mortality rates into life tables using standard period life table techniques (Preston, Heuveline, and Guillot 2000). Based on the estimated life tables, we examine three life-expectancy measures: life expectancy at birth ( $e_0$ ), age 15 ( $e_{15}$ ), and age 60 ( $e_{60}$ ). We estimate life expectancy at three different ages to determine whether social differences in mortality are isolated to specific ages or are present across the life course:  $e_0$  is strongly influenced by mortality in the younger ages,  $e_{15}$  captures both midlife and old-age mortality, and  $e_{60}$  captures just old-age mortality. The complete set of life tables is provided in the Supporting Information.

The three life-expectancy estimates reveal whether mortality differences are present at multiple points of the life course. A second, related, way



of assessing the importance of mortality differences across the life course is by decomposing the difference in  $e_0$  across social groups into the contribution of mortality differences at multiple ages. To do this, we apply Arriaga's decomposition (Arriaga 1984) and estimate the contribution of social groups differences in mortality between ages 0–5, 5–15, 15–30, 30–45, 45–60, and 60+ to the overall difference in  $e_0$  between social groups. Intuitively, Arriaga's decomposition determines the importance of each age group to the overall difference in  $e_0$  by seeing how much social-group differences in  $e_0$  change when there are no longer mortality differences in that age group across social groups.

Lastly, we investigate whether the size of life-expectancy differences across social groups varies geographically by estimating these differences separately by broad regions of India. For this analysis, we only focus on the most recent data from the NFHS-4 since this was the only survey that was designed with a large enough sample size to facilitate regional comparison within India.

All our estimates are weighted to be nationally representative. We estimated standard errors and 95 percent confidence intervals (CIs) using a cluster-bootstrap approach (Cai et al. 2010; Solé-Auró, Beltrán-Sánchez, and Crimmins 2015; Fishman 2015; Vyas, Gupta, and Hathi 2021) that accounts for the fact that the NFHS surveys are multistage surveys in which households are selected within randomly selected clusters.

### Reliability of mortality estimates

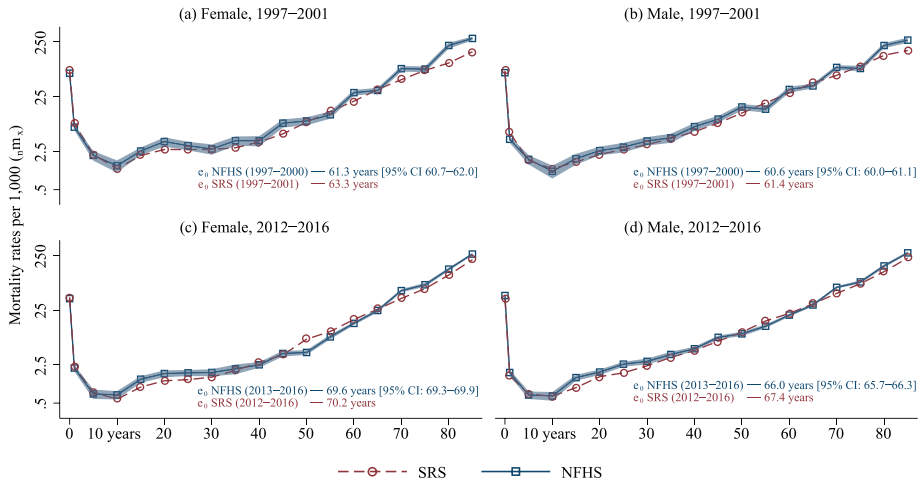
The use of birth-history modules to estimate child mortality is widely accepted (Moultrie et al. 2013). However, demographers have been concerned about underreporting of mortality from household-reported prior-deaths questions (Preston, Heuveline, and Guillot 2000), particularly for children (Hill 1991). We attempted to reduce the potential for these biases by using the birth history for mortality under age 5 and using the household-reported prior deaths for the remaining ages. To reduce recall bias, we limited the period for which age-specific mortality rates are estimated to just the two years prior to the survey.

Empirically, we assessed whether our estimation approach produces accurate estimates of mortality by comparing our results for men and women to the Indian SRS. We conducted this comparison separately by sex but not also by the social group since the SRS does not publish mortality information by caste and tribe. We judged the accuracy of the NFHS-2 and NFHS-4 by first comparing our estimates of age-specific mortality rates and life expectancy at birth to those in the closest published SRS life table.

We found close agreement in the age-specific mortality rates estimated from our approach to the SRS (Figure 1). Interestingly, while close, the life expectancies at birth estimated from the NFHS were about 1.3 years less



**FIGURE 1** Comparison of estimated age-specific mortality rates from NFHS and reported age-specific mortality rates from SRS



than life expectancies in the SRS.<sup>1</sup> This means that the NFHS estimates of age-specific mortality are higher—rather than lower, which is the typical concern when using household-reported deaths—than the SRS. This could be because the SRS underestimates true mortality, or because of differences in reference periods

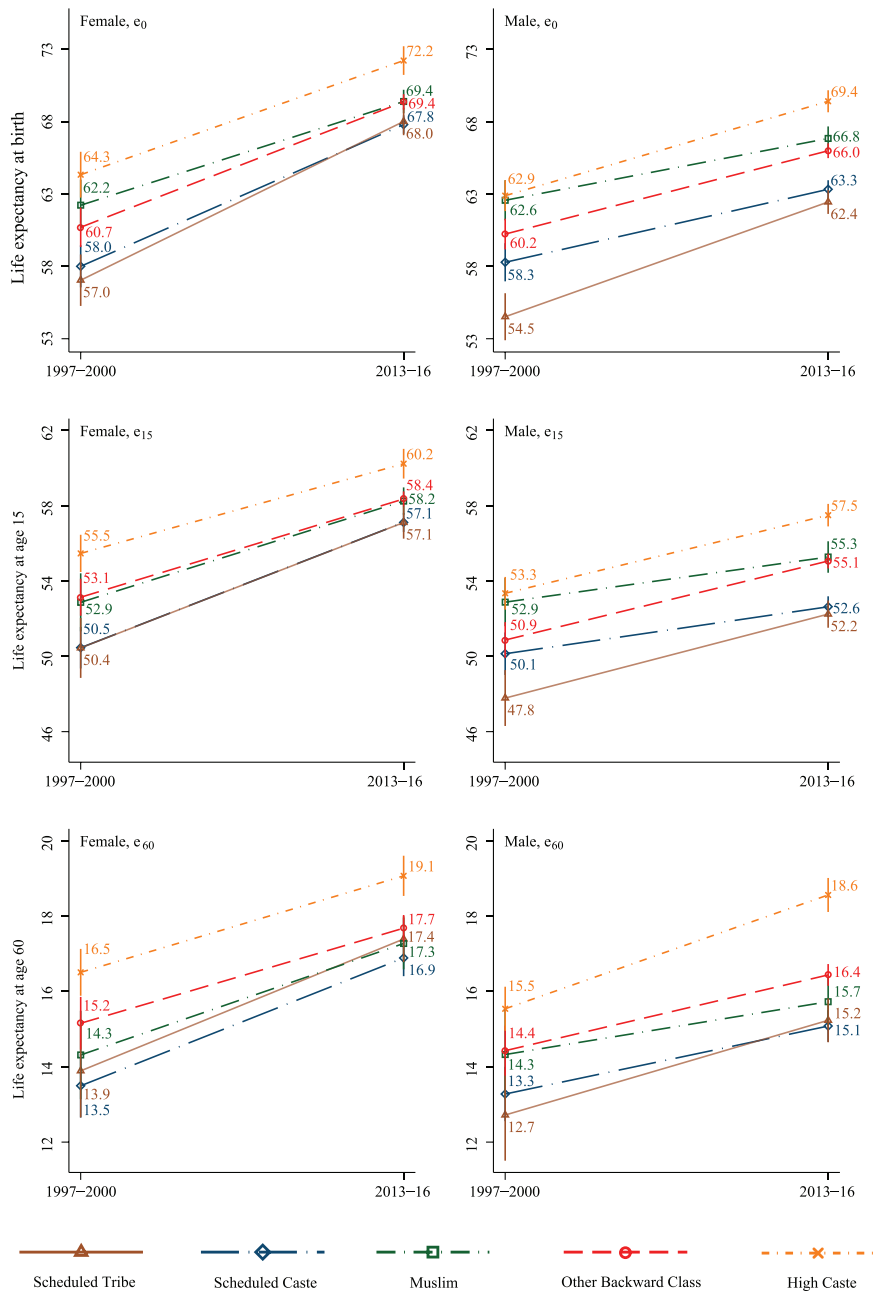
The empirical mortality rates we estimate align closely with those derived from modeling approaches, such as the Log-Quad model. This can be seen in Appendix Figure A5 and Table A7 in the Supporting Information. In Appendix Table A8 in the Supporting Information, we confirm that our estimates for overall infant and child mortality are consistent with other estimates, such as those provided by the United Nations Inter-agency Group for Child Mortality Estimation (UN-IGME 2021) and India’s SRS.

### Results

#### Size and trends of life-expectancy disparities across Indian social groups

Figure 2 reports estimates of life expectancy at birth, age 15, and age 60 for men and women from SC, ST, OBC, high caste, and Muslim backgrounds, for the years 1997–2000 and 2013–2016.<sup>2</sup> The figure reveals four major findings. First, there were very large absolute caste and tribe differences in life expectancy at birth for both men and women in 1997–2000. For women, high-caste life expectancy was 64.4 compared to just 57.0 among the STs (a difference of 7.2 years). Similarly, for men, high-caste life expectancy was 62.9 compared to 54.6 among the STs (a difference of 8.2 years). Differences between high castes and the SCs were also very large,

FIGURE 2 Disparities in life expectancy at birth, 15 years, and 60 years



NOTE: 95% CIs calculated using a cluster-bootstrap approach. The number of bootstrap samples drawn was 100.

with a difference of 6.2 years for women and 4.5 years for men. For both men and women, OBC individuals had life expectancies at birth between the SCs/STs and high castes (OBC life expectancy at birth for women was 61.0 and 60.5 for men).

Second, the large caste and tribe differences in life expectancy at birth were not just driven by differences in child mortality. We find evidence of large differences across social groups in life expectancy at age 15 and even 60. For example, the difference in life expectancy between high caste and SC individuals in 1997–2000 was 5.0 years for women and 3.2 years for men at age 15; and 3 years for women and 2.2 years for men at age 60. Similarly, the difference in life expectancy between high caste and ST individuals in 1997 was 5.1 years for women and 5.5 years for men at age 15; and 2.6 years for women and 2.8 years for men at age 60. As with life expectancy at birth, OBC life expectancy at ages 15 and 60 fell between the high caste and ST and SC life expectancies. The Supporting Information present age-specific mortality rates and survival curves by social group. Taken together, the results in Figure 2 and the Supporting Information confirm that large differences in mortality persist across the life course and underscore the need to examine differences beyond the childhood ages.

Third, we find that differences in life expectancy did not close between 1997–2000 and 2013–2016. Although absolute levels of life expectancy at birth, age 15, and age 60 improved for all groups, the differences between castes persisted. For example, in 2013–2016, compared to the high castes, life expectancy at birth was still 4.4 years lower for women and 6.1 years lower for men from the SCs, and 4.2 years lower for women and 7.0 years lower for men from the STs. Most worryingly, absolute differences between SC men and high caste men increased in this period. These patterns contrast with those in the United States, where Black–white differences have narrowed, and are smaller in both absolute and relative terms. Differences in life expectancy between Black and white Americans were 7.0 years in 2000 and 3.4 years in 2015 (National Center for Health Statistics 2017), while overall life expectancy was higher than in India.

Fourth, we observed a distinct but still important pattern of disparities between Muslims and high caste Hindus. In 1997–2000, disadvantages in life expectancy at birth compared to high castes were smallest for Muslims, with a difference of 2.1 years among women and 0.3 years for men. However, this relatively small difference was mostly driven by a Muslim advantage at the younger ages. When looking at life expectancy at age 15 and 60, the disparities between Muslims and high caste Hindus increased substantially to a difference of 2.6 years for women and 0.4 years for men at age 15; and 2.3 years for women and 1.2 years for men at age 60. By 2013–2016, however, the Muslim disadvantage in life expectancy at birth had increased considerably: Muslim female life expectancy was 69.4 years, 2.8 years less than high caste female life expectancy; and

Muslim male life expectancy was 66.8 years, 2.6 years less than high caste male life expectancy. The already important Muslim disadvantage at age 15 and 60 also increased further to a gap relative to high-caste Hindus at age 15 of 2.0 years for women and 2.2 years for men, and age 60 of 1.8 years for women and 2.9 years for men.

### **Contribution of mortality differences across age to disparities in life expectancy at birth**

Building on the findings that disparities in life expectancy are present at age 15 and 60 as well, we estimate the exact contribution of mortality differences at different age groups to the overall difference in life expectancy at birth using Arriaga's decomposition (Arriaga 1984). Figure 3 shows the contributions of six broad age groups to overall disparities.

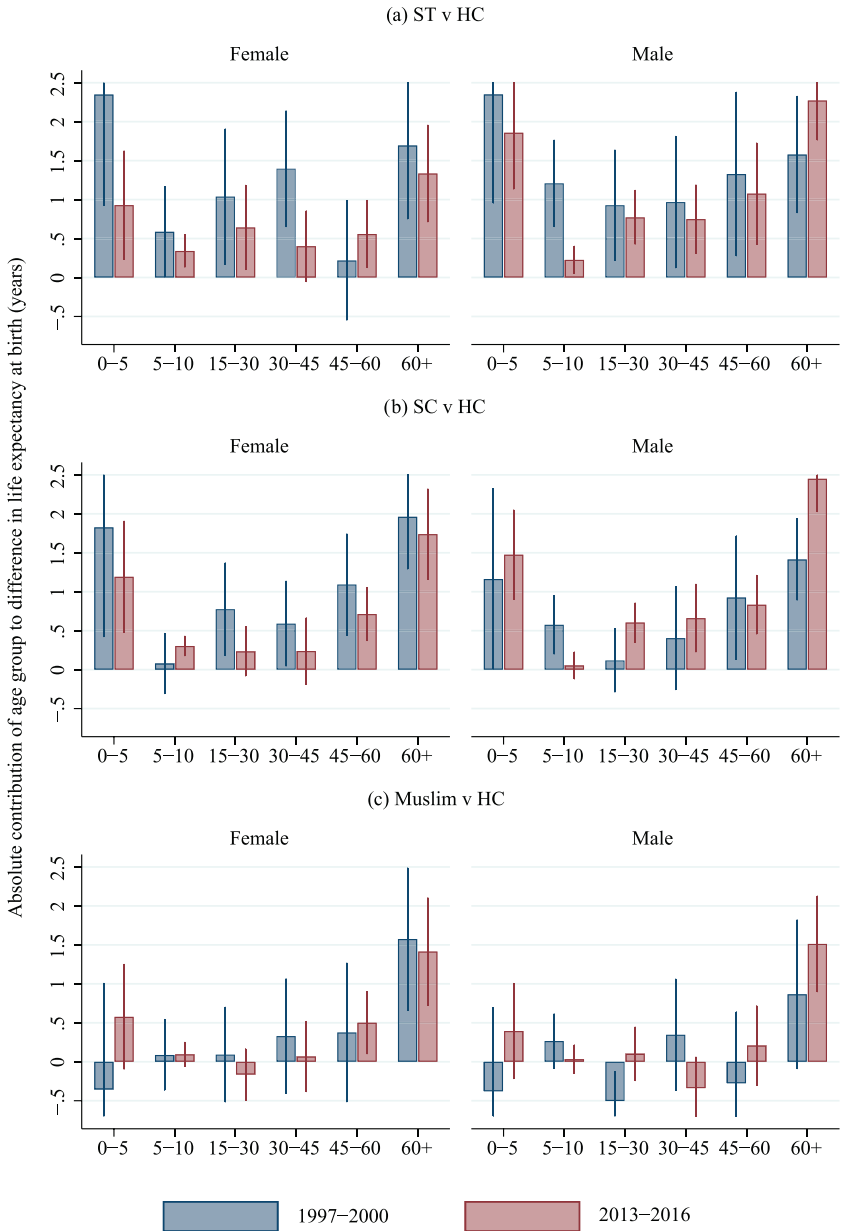
Our decomposition results numerically confirm the insights from our previous figures: life expectancy at birth disparities between SC/ST groups and high castes are not just the result of differences in infant or child mortality but also of large mortality disparities in the older adult ages. For example, in 1997–2000, 1.82 years of life expectancy deficits between SC and high caste women came from ages 0–5 and 1.96 years from ages 60+. We observe a similar pattern between ST and high castes, where 2.35 years of deficit for both men and women came from ages 0–5 while 1.69 years for women and 1.58 years for men were from ages 60+.

The relative contributions of mortality differences in the adult ages further increased between 1997–2000 and 2013–2016. For example, by 2013–2016, 1.73 years of life expectancy deficits for SC women and 2.45 years for SC men came from ages 60+, compared to just 1.45 years for women and 1.19 years for men from ages 0–5. This broad pattern is similar for differences between STs and high castes. These trends reveal a decline in the importance of disparities at the younger ages and the growing importance of disparities at older, adult, ages.

We observed a distinctly different set of age contributions for disparities between Muslims and high caste Hindus. In 1997–2000, infant mortality was higher for high caste Hindus than for Muslims, leading to a negative contribution (life expectancy advantage) to overall life-expectancy-at-birth disparities between Muslims and higher caste Hindus. This finding is consistent with a vast literature documenting the "Muslim mortality paradox," where despite facing social disadvantage Muslims have lower rates of infant mortality (Bhalotra, Valente, and Van Soest 2010; Geruso and Spears 2018; Guillot and Allendorf 2010).

We also find smaller or negative contributions of mortality in ages 5–60. Although a full investigation of the underlying processes that contribute to these patterns is constrained by data availability, potential explanations include lower accidental mortality and liver disease among Muslim men

**FIGURE 3** Absolute contributions of mortality differences in different age groups to overall disparities in life expectancy at birth



NOTE: 95% CIs calculated using a cluster-bootstrap approach. The number of bootstrap samples drawn was 100. Some CIs may extend beyond y-axis limits.

because of lower alcohol consumption; the lower prevalence of cervical cancers among women because of male circumcision; later-life effects of a better early-life disease environment; and lower suicide mortality. The patterns documented here are consistent with those observed by Vyas, Gupta, and Hathi (2021) in nine poor Indian states. Even in 1997–2000, however, this "paradoxical" mortality advantage does not extend to the older ages: deficits of 1.58 years of life expectancy at birth for Muslim women and 0.87 years for Muslim men come from their higher levels of mortality above age 60.

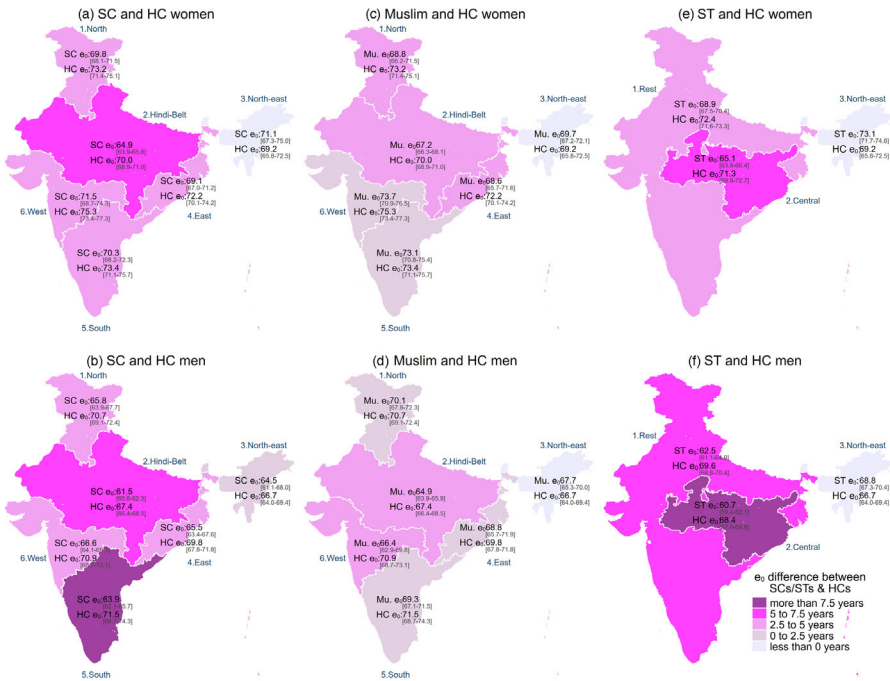
By 2013–2016, we no longer find evidence of an infant mortality advantage for Muslims relative to high caste Hindus. Deficits of 0.58 years for women and 0.39 years for men and of life expectancy at birth relative to high caste Hindus were due to higher child mortality among Muslims. This is a significant departure from the "mortality paradox" and reveals that like other marginalized populations, Muslims now also face an infant mortality disadvantage relative to high caste Hindus. At the same time, consistent with the trends for SC and ST populations, we see evidence of a growing importance of older-age mortality for men and a consistently high contribution of older-age mortality for women.

### Disparities by region and urban–rural residence

India is strikingly diverse and heterogeneous geographically (Dyson and Moore 1983). Patterns of social inequality, mobilization, and efforts made to improve the condition of the marginalized social groups also vary substantially across states and regions of India (Xaxa 2008; Ambedkar 1989a). We next investigate regional patterns of disparities in life expectancies at birth in 2013–2016. We are unable to investigate regional disparities in the earlier 1997–2000 period because of the much smaller sample sizes, and consequently large confidence intervals at regional levels in NFHS-2. In the left panel of Figure 4, we show differences in life expectancy between SCs and high castes for six regions in India: North India, the Hindi belt (the largest region), West, South, East, and North-East.<sup>3</sup> The middle panel shows differences between Muslims and high castes for the same regions. For differences between STs and high castes, we show three regions (right panel): North-East, where most of the population identifies as ST, Central Indian states with a large ST population, and the rest of India. These regions correspond to broad differences in indigenous identity within India (Guha 2006). On the maps, darker shades of purple represent larger absolute differences in life expectancy at birth.

We find that geographic differences in the size of SC–high castes disparities in life expectancy vary for men and women. For women, there is substantial geographical heterogeneity, with the largest disparity in the Hindi belt (6.1 years). These differences seem to be driven primarily by the

FIGURE 4 Regional patterns of life-expectancy disparities, 2013–2016



NOTE: 95% CIs calculated using a cluster-bootstrap approach. The number of bootstrap samples drawn was 100.

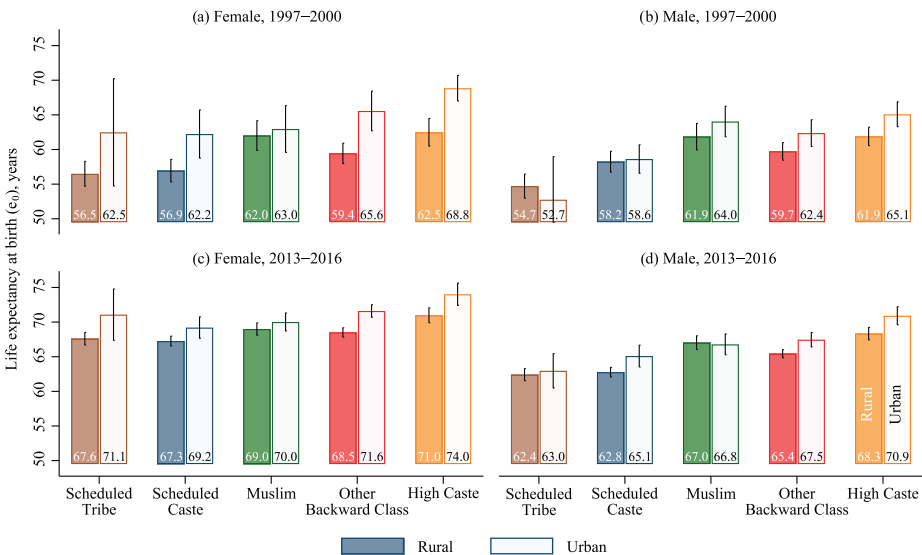
absolute level of life expectancy for SC women: SC women have the lowest life expectancy in the Hindi belt. For men, there is lesser geographic variation in the size of SC–high castes disparities in life expectancy at birth, although the disparity is higher in the South (7.6 years) compared to the rest of the country. In terms of absolute levels, patterns of life expectancy for SC men were similar to SC women, with the highest life expectancy in the western states and lowest in the Hindi Belt.

Muslims also face mortality disadvantages in all regions of India except the North-East. As with SCs, their life expectancy is lowest in the Hindi belt region. Absolute differences between Muslims and high caste women are highest in North India, and for men, they are highest in the western region.

In the North-East, although the 95 percent CIs overlap, STs had the highest life expectancies. In these states, STs have higher social status than other social groups, which these life expectancy patterns likely reflect (Kikon 2017). On the other hand, in states of central India, where STs face greater marginalization (Xaxa 2008), as well as in the rest of India, STs had lower life expectancies than high castes. Disparities were highest in the central states, with life expectancies of STs lower by as many as 7.7 years.



FIGURE 5 Social group disparities by urban and rural residence



NOTE: Urban estimates are shown by lightly colored bars and black text. Rural estimates are solid bars and white text. 95% CIs calculated using a cluster-bootstrap approach. The number of bootstrap samples drawn was 100. Some CIs may extend beyond y-axis limits.

Broadly, these patterns show that although Central India and the Hindi belt are regions where marginalized groups have the lowest life expectancies, disparities can be high even in regions with comparatively higher levels of overall human development.

In Figure 5, we consider disparities by rural and urban residence. Three patterns are worth noting. First, urban life expectancy is higher for almost all social groups compared to their rural counterparts. However, differences in life expectancy between rural and urban areas are lowest for Muslims, a pattern consistent with high sanitation use among rural Muslims (Geruso and Spears 2018). Second, disparities have reduced between the two rounds, particularly for rural women. Third, for most marginalized groups, life expectancy is lower than that of higher caste Hindus in both rural and urban areas. However, the magnitude of disparities is not uniformly higher in rural or urban areas. Estimates for STs in urban areas have large confidence intervals. Given that more than 90 percent of STs are residents of rural areas, sample sizes for STs in urban areas are smaller, particularly for urban STs in 1997-2000. Finally, comparing marginalized social groups in rural areas and high caste Hindus in urban areas reveals the extent of disparities within India. In 2013-2016, urban high caste women have life expectancies that are six years higher than life expectancies of rural SC women. Among men, this difference is more than eight years, an exceptionally large disparity in terms of life expectancy.

## Discussion

More than 60 years ago, Dr. B.R. Ambedkar argued that “the health of the Untouchable is the care of nobody. Indeed, the death of an Untouchable is regarded as a good riddance” (Ambedkar 1989b). Our findings reveal that Dr. Ambedkar’s concerns about the health of marginalized social groups in India are still relevant in contemporary India. We find that SCs and STs have substantially lower life expectancies than high castes and that these large disparities have persisted over a nearly 20-year period between 1997 and 2016. Importantly, we also find that mortality disparities in India are not just a childhood phenomenon and are increasingly becoming an issue of disparities among older individuals.

Disparities between Muslims and higher caste Hindus were comparatively small in 1997, largely because of a Muslim mortality advantage in the younger ages. Our results however reveal a worrying trend: between 1997 and 2016, there was a significant reduction in the Muslim mortality advantage at the younger age. This reduction ultimately led Muslims to lose their parity with high caste Hindus in terms of life expectancy at birth, with evidence in 2016 of large mortality disparities.

Social differences in longevity in India are exceptionally large in the context of global health disparities. In comparison to race in the United States (Arias and Xu 2019), we find that caste differences in life expectancy in India are larger in an absolute sense and even more pronounced when considered as a percent difference since the overall levels of life expectancy in India are lower. Mortality disparities in India are comparable to disparities in other severely stratified contexts, such as between Arabs and Jews in Israel (Saabneh 2015); between indigenous and white residents in New Zealand, Australia, or Canada (Anderson et al. 2016; Phillips et al. 2017; Tjepkema, Bushnik, and Bougie 2019); and by race in Brazil (Chiavegatto Filho, Beltrán-Sánchez, and Kawachi 2014). The salience of the mortality disparities we document is heightened when considering that the combined population size of any two of these three marginalized social groups is as large as the population of the United States. Our results contrast with the emerging literature on adult mortality in low- and middle-income countries, which has found modest disparities in education (Sudharsanan et al. 2020). This contrast suggests that social group and caste might be more important axes of stratification in contexts like India.

Our study has three important limitations. First, data limitations prevent us from examining mortality rates for India’s other religious minorities. Second, because our estimates rely on household-reported prior mortality, there is the possibility that households do not report all prior deaths because of recall errors. While we are not aware of studies that empirically provide evidence of such biases in the Indian context, recall biases would likely be greater among more disadvantaged groups. Under that scenario, however,

our results would be conservative and our main conclusions about the size and importance of caste and tribe differences in mortality would remain unchanged. The magnitude of this bias may also vary over time and affect our estimates of the time trends in mortality by caste or tribe. Unfortunately, it is ambiguous how such a bias would affect the estimates. Third, mortality estimates may be influenced by age misreporting, especially for older adults. Similar to the prior limitation, bias from age-misreporting makes our results conservative since studies have shown that it biases mortality estimates downward (Preston, Elo, and Stewart 1999) and is likely more common among more disadvantaged individuals. Modeled estimates show that these biases are modest compared to the extent of the disparities between advantaged and disadvantaged groups.

Despite these limitations, our study benefits from large nationally representative data and demonstrates how such data sources can be used to monitor the inequalities in life expectancy in contexts without comprehensive vital registration systems linked to social indicators. This approach is helpful in understanding other axes of stratification, such as education or class. An important future area of research will be to identify which causes of death and mortality risk factors contribute to the large and persistent life expectancy differences we observe. Detailed cause-of-death data in India are currently highly incomplete. Developing the capacity for collecting such information will be key for helping to identify why these social differences in mortality exist and what policy solutions might be able to reduce them.

Ultimately, our findings have two important implications for research to reduce inequalities in human development in India and globally. First, they suggest that far more attention must be paid to marginalized populations in India who continue to face mortality disadvantages despite rapid economic growth. Second, our results underscore that development efforts need to move beyond the historic focus on child health to better understand the sources and ways to reduce disparities among adults globally.

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## Notes

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1 Although the SRS is also a survey, 95 percent CIs are not available for the SRS estimates as the SRS does not release them.

2 Overall deaths and person-years exposed are provided in Table A1. Life

expectancy at birth estimates and 95 percent CIs are also provided in Table A2 in the Supporting Information. Abridged life tables for these four social groups are available in Tables A3–A6 in the Supporting Information.

3 The Hindi belt is the region below North India in the maps on the left panel which compares SCs and HCs. It is also the largest region in the maps in the left panel. The regions are also labeled on the maps.

## References

- Aggarwal, Ankita, Jean Drèze, and Aashish Gupta. 2015. "Caste and the Power Elite in Allahabad." *Economic and Political Weekly* 50(6): 45–51.
- Alkire, Sabina. 2002. "Dimensions of Human Development." *World Development* 30(2): 181–205.
- Allendorf, Keera, and Roshan K. Pandian. 2016. "The Decline of Arranged Marriage? Marital Change and Continuity in India." *Population and Development Review* 42(3): 435–464.
- Ambedkar, Bhimrao Ramji. 1936. *Annihilation of Caste: With a Reply to Mahatama Gandhi*. Accessed April 14, 2021. Available at [http://cnmtl.columbia.edu/projects/mmt/ambedkar/web/readings/aoc\\_print\\_2004.pdf](http://cnmtl.columbia.edu/projects/mmt/ambedkar/web/readings/aoc_print_2004.pdf).
- . 1989a. "Thoughts on Linguistic States, 1955." *Writings and Speeches* 1: 143–144.
- . 1989b. "Untouchables or the Children of India's Ghetto." In: *Dr. Babasaheb Ambedkar Writings and Speeches, Compiled by Vasant Moon..* Mumbai, India: Government of Maharashtra.
- Anderson, Ian, Bridget Robson, Michele Connolly, Fadwa Al-Yaman, Espen Bjertness, Alexandra King, Michael Tynan, Richard Madden, Abhay Bang, and Carlos EA Coimbra Jr. 2016. "Indigenous and Tribal Peoples' Health (The Lancet–Lowitja Institute Global Collaboration): A Population Study." *The Lancet* 388(10040): 131–57.
- Arias, Elizabeth, and Jiaquan Xu. 2019. "United States Life Tables: 2017." Accessed April 14, 2021. [https://www.cdc.gov/nchs/data/nvsr/nvsr68/nvsr68\\_07-508.pdf](https://www.cdc.gov/nchs/data/nvsr/nvsr68/nvsr68_07-508.pdf)
- Arriaga, Eduardo E. 1984. "Measuring and Explaining the Change in Life Expectancies." *Demography* 21(1): 83–96. <https://doi.org/10.2307/2061029>.
- Azam, Mehtabul, and Vipul Bhatt. 2015. "Like Father, Like Son? Intergenerational Educational Mobility in India." *Demography* 52(6): 1929–1959.
- Barik, Debasis, Sonalde Desai, and Reeve Vanneman. 2018. "Economic Status and Adult Mortality in India: Is the Relationship Sensitive to Choice of Indicators?" *World Development* 103: 176–187.
- Bhalotra, Sonia, Christine Valente, and Arthur Van Soest. 2010. "The Puzzle of Muslim Advantage in Child Survival in India." *Journal of Health Economics* 29(2): 191–204.
- Bora, Jayanta Kumar, Rajesh Raushan, and Wolfgang Lutz. 2019. "The Persistent Influence of Caste on Under-Five Mortality: Factors That Explain the Caste-Based Gap in High Focus Indian States." *PloS One* 14(8): e0211086.
- Borooh, Vani Kant, Nidhi S. Sabharwal, Dilip G. Diwakar, Vinod Kumar Mishra, and Ajaya Kumar Naik. 2015. *Caste, Discrimination, and Exclusion in Modern India*. New Delhi, India: SAGE.
- Cai, Liming, Mark D. Hayward, Yasuhiko Saito, James Lubitz, Aaron Hagedorn, and Eileen Crimmins. 2010. "Estimation of Multi-State Life Table Functions and Their Variability from Complex Survey Data Using the SPACE Program." *Demographic Research* 22(6): 129.
- Chiavegatto Filho, Alexandre Dias Porto, Hiram Beltrán-Sánchez, and Ichiro Kawachi. 2014. "Racial Disparities in Life Expectancy in Brazil: Challenges from a Multiracial Society." *American Journal of Public Health* 104(11): 2156–62.
- Desai, Sonalde B., Amaresh Dubey, Brij Lal Joshi, Mitali Sen, Abusaleh Shariff, and Reeve Vanneman. 2010. *Human Development in India*. New York: Oxford University Press.
- Desai, Sonalde, and Amaresh Dubey. 2012. "Caste in 21st Century India: Competing Narratives." *Economic and Political Weekly* 46(11): 40–49.
- Dommaraju, Premchand, Victor Agadjanian, and Scott Yabiku. 2008. "The Pervasive and Persistent Influence of Caste on Child Mortality in India." *Population Research and Policy Review* 27(4): 477–95.

- Dyson, Tim, and Mick Moore. 1983. "On Kinship Structure, Female Autonomy, and Demographic Behavior in India." *Population and Development Review* 9(1): 35–60. <https://doi.org/10.2307/1972894>.
- Fazal, Tanweer. 2017. "Scheduled Castes, Reservations and Religion: Revisiting a Juridical Debate." *Contributions to Indian Sociology* 51(1): 1–24. <https://doi.org/10.1177/0069966716680429>.
- Fishman, Ezra. 2015. "Variance Estimation for a Complex Life Table Quantity: Disease-Free Life Expectancy." PSC Working Paper Series, WPS 15-2.
- Geruso, Michael, and Dean Spears. 2018. "Neighborhood Sanitation and Infant Mortality." *American Economic Journal: Applied Economics* 10(2): 125–162.
- Government of India. 2006. *Report of the Prime Minister's High Level Committee (Headed by Justice Rajindar Sachar) on Social, Economic and Educational Status of the Muslim Community of India*. New Delhi, India: Government of India, Cabinet Secretariat.
- . 2013. "Census of India 2011: Primary Census Abstract." New Delhi, India: Office of the Registrar General and Census Commissioner of India. <http://censusindia.gov.in/pca/pcadata/pca.html>.
- Guha, Sumit. 2006. *Environment and Ethnicity in India, 1200-1991*. Vol. 4. New York: Cambridge University Press.
- Guillot, Michel, and Keera Allendorf. 2010. "Hindu-Muslim Differentials in Child Mortality in India." *Genus* 66(2): 43–68.
- Hill, Kenneth. 1991. "Approaches to the Measurement of Childhood Mortality: A Comparative Review." *Population Index* 57(3): 368. <https://doi.org/10.2307/3643873>.
- International Institute for Population Sciences and ORC Macro. 2000. "National Family Health Survey (NFHS-2), 1998–99: India." Mumbai: IIPS.
- Jaffrelot, Christophe. 2021. *Modi's India: Hindu Nationalism and the Rise of Ethnic Democracy*. Princeton, NJ: Princeton University Press.
- Kikon, Dolly. 2017. "Jackfruit Seeds from Jharkhand: Being Adivasi in Assam." *Contributions to Indian Sociology* 51(3): 313–37.
- Kumar, Surinder, Fahimuddin Prashan, Kumar Trivedi, and Srinivas Goli. 2020. *Backward and Dalit Muslims: Education, Employment and Poverty*. Jaipur, India: Rawat Publications.
- Kumari, Meena, and Sanjay K. Mohanty. 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.
- Louis, Prakash. 2007. "Dalit Christians: Betrayed by State and Church." *Economic and Political Weekly* 42(16): 1410–1414.
- Maity, Bipasha. 2017. "Comparing Health Outcomes Across Scheduled Tribes and Castes in India." *World Development* 96(August): 163–181. <https://doi.org/10.1016/j.worlddev.2017.03.005>.
- Mandal, Bhindeshwari Prasad. 1980. *Mandal Commission: Report of the Backward Classes Commission 1980 (Part I And II)*. New Delhi, India: Government of India.
- Mohanty, S. K., and F. Ram. 2010. *Life Expectancy at Birth among Social and Economic Groups in India*. Mumbai, India: International Institute for Population Science, Accessed April 14, 2021. Available at: <http://14.143.90.243/iips/sites/default/files/RB-13-file-for-uploading.pdf>.
- Moultrie, Tom A., R. E. Dorington, A. G. Hill, Kenneth Hill, I. M. Timæus, and Basia Zaba. 2013. *Tools for Demographic Estimation*. Liège, Belgium: International Union for the Scientific Study of Population.
- National Center for Health Statistics. 2017. *Health, United States, 2016, with Chartbook on Long-Term Trends in Health*. Washington, DC: Government Printing Office.
- Phillips, Bronwen, John Daniels, Alistair Woodward, Tony Blakely, Richard Taylor, and Stephen Morrell. 2017. "Mortality Trends in Australian Aboriginal Peoples and New Zealand Māori." *Population Health Metrics* 15(1): 1–12.
- Preston, Samuel H., Irma T. Elo, and Quincy Stewart. 1999. "Effects of Age Misreporting on Mortality Estimates at Older Ages." *Population Studies* 53(2): 165–177.
- Preston, Samuel, Patrick Heuveline, and Michel Guillot. 2000. *Demography: Measuring and Modeling Population Processes*. New York: Wiley.
- Ramaiah, Avatthi. 2015. "Health Status of Dalits in India." *Economic and Political Weekly* 50(43): 70–74.

- Rao, Chalapati, Aashish Gupta, Mamta Gupta, and Ajit Kumar Yadav. 2021. "Premature Adult Mortality in India: What Is the Size of the Matter?" *BMJ Global Health* 6(6): e004451.
- Registrar General of India. 2011. *Sample Registration System Statistical Report 2010*. New Delhi, India: Government of India.
- Saabneh, Ameer M. 2015. "Arab-Jewish Gap in Life Expectancy in Israel." *The European Journal of Public Health* 26(3): 433–438.
- Saikia, Nandita, Jayanta Kumar Bora, and Marc Luy. 2019. "Socioeconomic Disparity in Adult Mortality in India: Estimations Using the Orphanhood Method." *Genus* 75(1): 7.
- Solé-Auró, Aida, Hiram Beltrán-Sánchez, and Eileen M. Crimmins. 2015. "Are Differences in Disability-Free Life Expectancy by Gender, Race, and Education Widening at Older Ages?" *Population Research and Policy Review* 34(1): 1–18.
- Subramanian, S. V., Shailen Nandy, Michelle Irving, Dave Gordon, Helen Lambert, and George Davey Smith. 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.
- Sudharsanan, Nikkil. 2019. "The Association between Socioeconomic Status and Adult Mortality in a Developing Country: Evidence from a Nationally Representative Longitudinal Survey of Indonesian Adults." *The Journals of Gerontology: Series B* 74(3): 484–495.
- Sudharsanan, Nikkil, Yuan Zhang, Collin F. Payne, William Dow, and Eileen Crimmins. 2020. "Education and Adult Mortality in Middle-Income Countries: Surprising Gradients in Six Nationally-Representative Longitudinal Surveys." *SSM-Population Health* 12: 100649.
- Thorat, Amit, Reeve Vanneman, Sonalde Desai, and Amaresh Dubey. 2017. "Escaping and Falling into Poverty in India Today." *World Development* 93(May): 413–426. <https://doi.org/10.1016/j.worlddev.2017.01.004>.
- Tjepkema, Michael, Tracey Bushnik, and Evelyne Bougie. 2019. "Life Expectancy of First Nations, Métis and Inuit Household Populations in Canada." *Health Reports* 30(12): 3–10.
- UN-IGME. 2021. *Levels and Trends in Child Mortality Report 2020*. New York: United Nations.
- Vaid, Divya. 2014. "Caste in Contemporary India: Flexibility and Persistence." *Annual Review of Sociology* 40: 391–410.
- Vyas, Sangita, Gupta, Aashish, and Hathi, Payal. 2021. "Social Disadvantage, Economic Inequality, and Life Expectancy in Nine Indian States." working paper.
- Xaxa Committee. 2014. "Report of the High Level Committee on Socio-Economic, Health and Educational Status of Tribal Communities of India." *Government of India, New Delhi: Ministry of Tribal Affairs*.
- Xaxa, Virginius. 2008. *State, Society, and Tribes: Issues in Post-Colonial India*. New Delhi: Pearson Education India.
- Zahran, Sammy, Jeffrey G. Snodgrass, David G. Maranon, Chakrapani Upadhyay, Douglas A. Granger, and Susan M. Bailey. 2015. "Stress and Telomere Shortening among Central Indian Conservation Refugees." *Proceedings of the National Academy of Sciences* 112(9): E928–E936. <https://doi.org/10.1073/pnas.1411902112>.