

Title: Educational Gradient in Life Expectancy at Birth in India: Combining Estimations from Survey Data for Childhood and Adult Mortality

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Abstract

Educational gradients in longevity have been thoroughly studied in high-income countries. Most studies provide education-specific life expectancy estimates for adult ages and do not account for mortality among children. Applying this approach for countries with high child mortality leads to underestimation of differentials. Our study aims to address this issue by combining education-specific mortality estimates from a) retrospective estimates based on parental education for ages 0-19 years from the NFHS-IV survey (2015-2016) and b) education for ages 20 years and above based on mortality follow-up from the IHDS survey (2004-2005). Using this new approach, we derive education- and age-specific death rates and life tables for India for the period 2004-2012. We found substantial life expectancy gaps between the secondary education group and the no education group, ranging from 6.8 years for men to 7.7 years for women. The higher gap among women is attributable to differences in child mortality.

Keywords: life expectancy, education, low-middle income countries, India

Background

Improvements in the health status of the population are closely related to socio-economic development. Numerous studies relying on data from high income countries have drawn the link between education attainment, occupational status, income, wealth on the one hand and health outcomes on the other (Bollen et al., 2001; Liberatos et al., 1988). Educational attainment recognised as key social determinants health and mortality (Balaj, 2021; Lutz, 2018). The most of literature available on educational differences in mortality focused either on children or adults, usually without providing education-specific life expectancy at birth. It is a plausible approach for low mortality countries, but restricting analyses for adult ages for countries with high children mortality may lead to substantial underestimation of longevity differentials.

The ample of literature highlighted the effect of education on their children survival status. Almost universally, children born to high educated mother experience lower mortality than their counterpart born to lower educated mothers (Dhakad and KC, 2023). Jack Caldwell in 1979 advocated for the importance of better mothers' educational attainment as a means of reducing under-five mortality. Latter a number of studies have confirmed Caldwell's hypothesis, and found maternal education as one of the most influential factors in reducing under-five mortality (U5MR) across the countries (Balaj, 2021; Lutz, 2018; Wu, 2022, Desai and Alva, 1998; Hobcraft, 1993).

Research have documented a strong and negative correlation between education and adult mortality controlling for other measures of socio-economic status, such as income and race (Grossman & Kaestner, 1997). Using a series of U.S. school reforms, Lleras-Muney (2005) finds that in 1960 an additional year of schooling has been causally linked to an increase in life expectancy at age 35 of 1.7 years (Lleras-Muney, 2005). In addition, Montez et al. (2012) show that the reduction in the mortality risk due to education has not been levelling off with education among American adults (Montez et al., 2012). Rather, due to technological progress that increased the demand for highly skilled labor, the negative association between educational attainment and adult mortality in the U.S. may have increased over time (Hayward et al., 2014). A related study by Montez and Hayward (2014) confirms that educational attainment has been essential in explaining health and mortality differentials among elderly U.S.-Americans in the latter parts of the 20th century after controlling for early life conditions, such as childhood socioeconomic disadvantages and childhood health problems (Montez & Hayward, 2014). KC and Lentzner (2010) also found that among all countries at different levels of socio-economic development less educated segment of the adult ages for men and women have higher morbidity and mortality than those who are better educated (KC & Lentzner, 2010). An in-depth meta-analysis by Baker et al (2011) showed that less education has been associated consistently with a higher likelihood of premature death. The pooled education effect implies that people with below secondary education had a 46 percent higher probability of dying than people with high school or higher education (Baker et al., 2011).

Educational attainment can affect adult mortality both directly and indirectly. Education affects human health directly by increasing knowledge of potential health threats and by enhancing cognitive skills that affect health-seeking behavior (Brinch & Galloway, 2011; Cutler & Lleras-Muney, 2010; Glymour et al., 2008). Indirectly, education can affect human health through its poverty-reducing effect, better access to valuable information and healthy lifestyles (House, 2002; Lutz, W. & Skirbekk, 2013; Marmot & Wilkinson, 2001; Rogers et al., 2013). Moreover, education affects people's social networks and the mobility and portability of important social connections, which have been shown to have positive health effects (Berkman et al., 2000; House et al., 1988). Quite frequently, though, education affects mortality by enhancing job opportunities. Higher incomes and reduced likelihood of unemployment explain large parts of the effects of economic status on life expectancy. According to Kandel (2007), education changes our cognition, including our perception of the environment, our view of the future, the degree of rationality in our decisions, and ultimately behavior resulting from these mental processes (Kandel, 2007). Some empirical studies show that more educated individuals tend to have a longer investment horizon, are more risk-averse and suffer from mental health problems to a lesser degree (Lachman et al., 2010; Meijer et al., 2009; van der Pol, 2011). Education also affects psychosocial factors in health, such as sense of control, anxiety, depression, social isolation, and stress (Matthews et al., 2010).

India exhibits substantial socioeconomic and regional inequalities in health and mortality (Gupta and Sudharsanan, 2022; Dhakad, and Saikia, 2023; Barik et al., 2018; Bora et al., 2019; Das et al., 2010; Dommaraju et al., 2008; Nguyen et al., 2013; Subramanian et al., 2006). Under-five mortality is considerably higher among children of women with low educational attainment, those belonging to socially disadvantaged groups, households with poor economic status, and families residing in the northern regions of the country (Dhakad and KC, 2023; Bora et al., 2019). Individuals from lower social groups, such as Scheduled Castes and Scheduled Tribes, have a lower life expectancy compared to those from higher caste groups. Similarly, individuals in the poorest wealth quintile have, on average, a 7.6-year shorter life expectancy than those in the richest households (Asaria et al., 2019). Despite these well-documented disparities, only a few studies have attempted to estimate socioeconomic inequalities in adult mortality in India (Dhakad & Saikia, 2023; Saikia et al., 2019; Barik et al., 2018; Saikia and Ram, 2010). Saikia et al. (2019) indirectly estimated adult life expectancy and found that parents of higher-educated children experience a survival advantage in adulthood compared to those whose children have lower educational attainment. However, to date, no study has provided estimates of educational differences in life expectancy at birth for India.

Estimating education-specific life expectancy at birth requires age-specific deaths and population exposure disaggregated by educational attainment. In many low- and middle-income countries (LMICs), weak civil registration and vital statistics systems result in incomplete death registration and limited mortality data. Consequently, countries often rely on household surveys, which capture early-life mortality primarily through women's birth

histories but provide sparse information for older ages. As a result, much of the LMIC literature focuses on under-five mortality, while adult mortality remains under-studied.

Although some countries collect mortality through household or sample registration systems, survey instruments rarely record the educational attainment of the deceased, producing a dearth of education-specific mortality estimates in LMICs. In contrast, several high-income countries maintain linked data that enable analyses of adult mortality by education. For LMICs, however, education-specific analyses have largely been restricted to child mortality. Robust estimation of life expectancy at birth by education requires mortality information across the full age range, which is typically unavailable. To our knowledge, no prior study has constructed education-specific life expectancy at birth for LMICs using age-specific mortality disaggregated by education.

Aims:

Our study aims to fill this knowledge gap by combining education-specific mortality estimates from a) retrospective estimates based on parental education for ages 0-19 years from the NFHS-IV survey (2015-2016) and b) education for ages 20 years and above based on mortality follow-up from the India Human Development Survey (2004-2005). Using this new approach we derive education- and age specific death rates and life tables for the period 2004-2012.

Data and Methods:

This study used two national representative data for India. First, we used Demographic Health Survey called National Family Health Survey (NFHS)-IV in India collected in 2015-2016. Using NFHS we calculated age-specific mortality rates (ASMRs) based on 942635 children up to age 19 years by parental education (mothers education) between 2004-2012. Second we used two round of the India Human Development Survey (IHDS) longitudinal data conducted in 2004-2005 and followed their survival status until 2011-2012. We estimated age-specific mortality from 20 years based on individuals' own education levels using data from IHDS.

Person-years of exposure were calculated using episode-splitting methods. We will derive standard errors via nonparametric bootstrap. Based on the estimated mortality schedules, we constructed abridged life tables by sex for 2004–2012 using Chiang's (1984) approach. Because the number of deaths was small in some age groups, leading to irregular ASMRs, we applied standard demographic smoothing procedures based on cubic splines. All analyses incorporated the survey sampling weights.

Results and conclusion

Figure 1 provides estimated figures of life expectancy at birth (LE_0) showing 68.8 years for females and 65.2 years for males. These estimates are close to the official statistics of India based on the Sample Registration System (2007-2011) (female=68.2 years, male=64.9 years).

Figure 2 shows that life expectancy at birth rises with education for both sexes, and women show higher longevity men at each educational level. Among women, LE_0 increases from 66.33 years with no education to 70.71 with primary education and to 74.00 years with secondary education —the maximal gap of 7.67 years. Among men, LE_0 rises from 61.94 (no education) to 64.15 (primary education) and to 68.69 (secondary education), showing the maximal gap of 6.75 years. These patterns indicate a strong educational gradient in longevity for both sexes and a persistent female advantage across the educational distribution. The educational gap in life expectancy at birth is larger for women than for men, suggesting the higher importance of education for survival of women. Taking into account that life expectancy gap at age 20 is larger for men, the overall larger gap among women seems to be attributable from mortality disparities in childhood and adolescence.

Our further analyses will be directed towards: a) testing more advanced smoothed techniques for education- and age-specific death rates and applying modelling approaches for old-age mortality b) conducting more thorough sensitivity analyses, and c) performing age-decomposition of life expectancy differences.

Figure 1: Life expectancy at birth by sex estimated using the NFHS-IV and IHDS-1 & 2

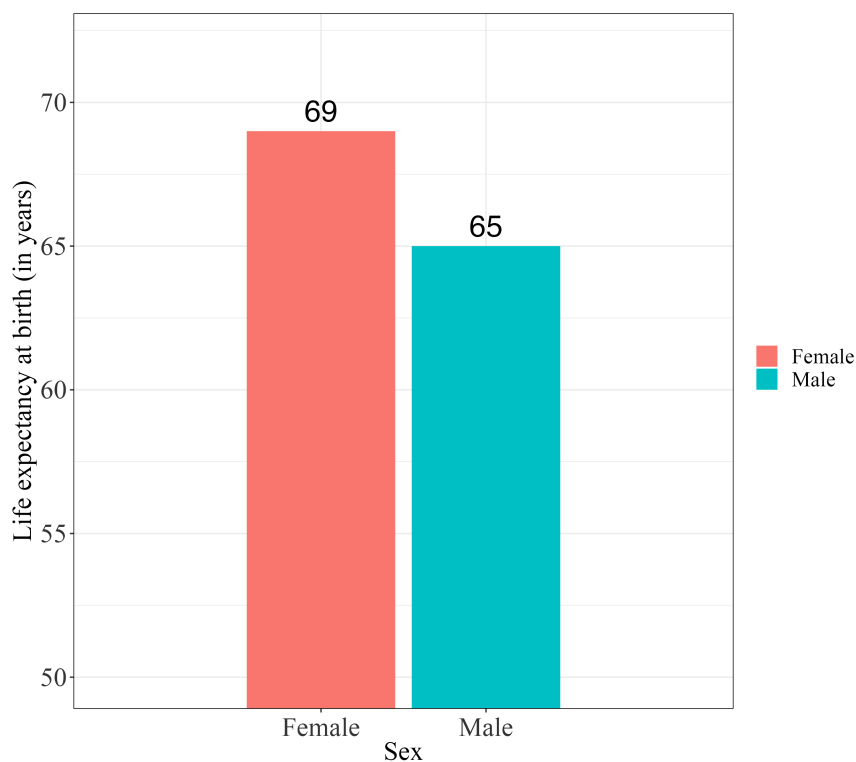


Figure 2: Life expectancy at birth by educational attainment for males and females

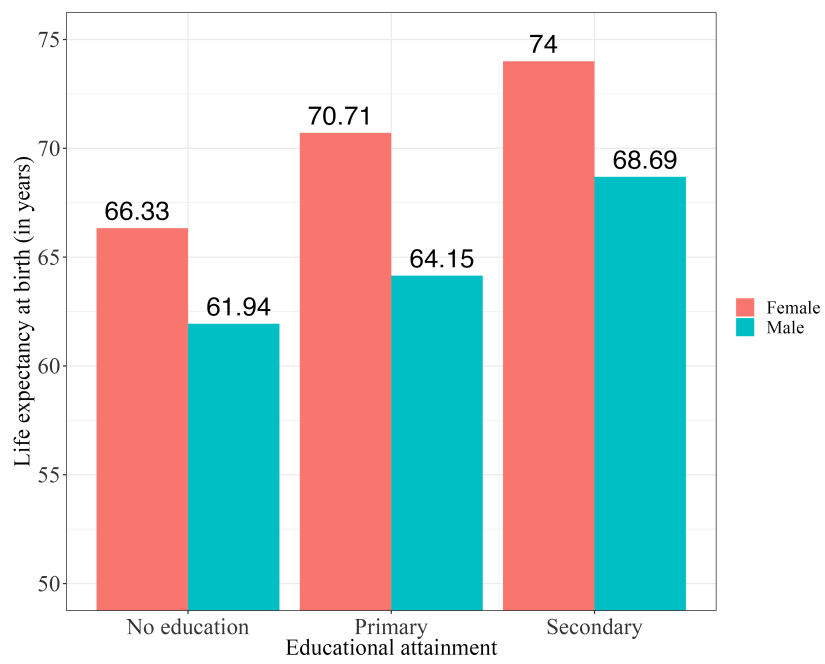


Figure 3: Age specific mortality rates by males and females

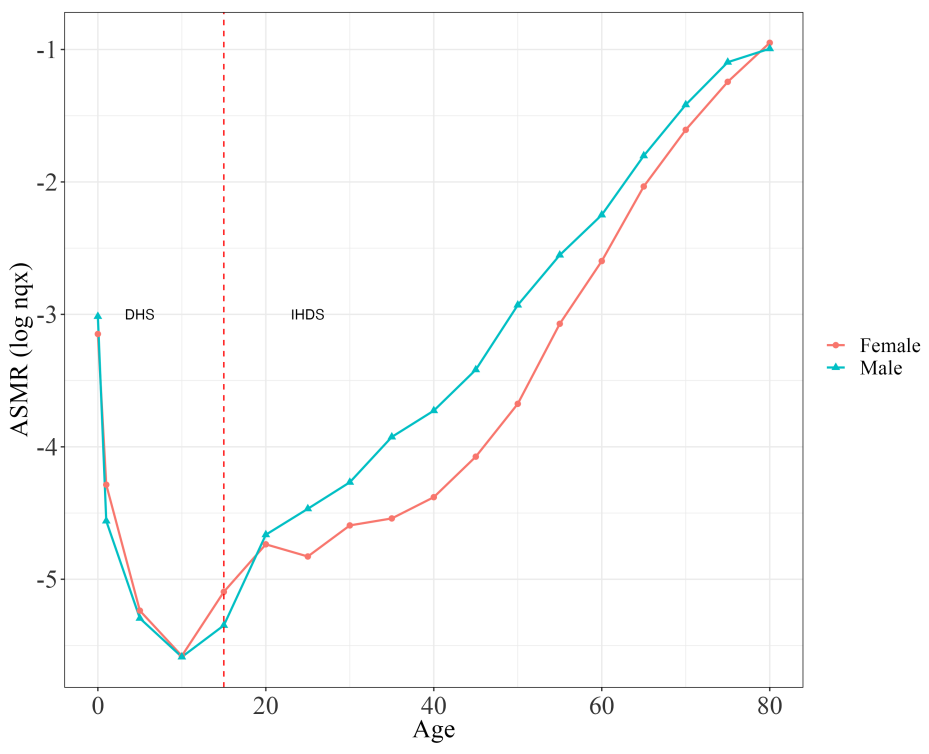
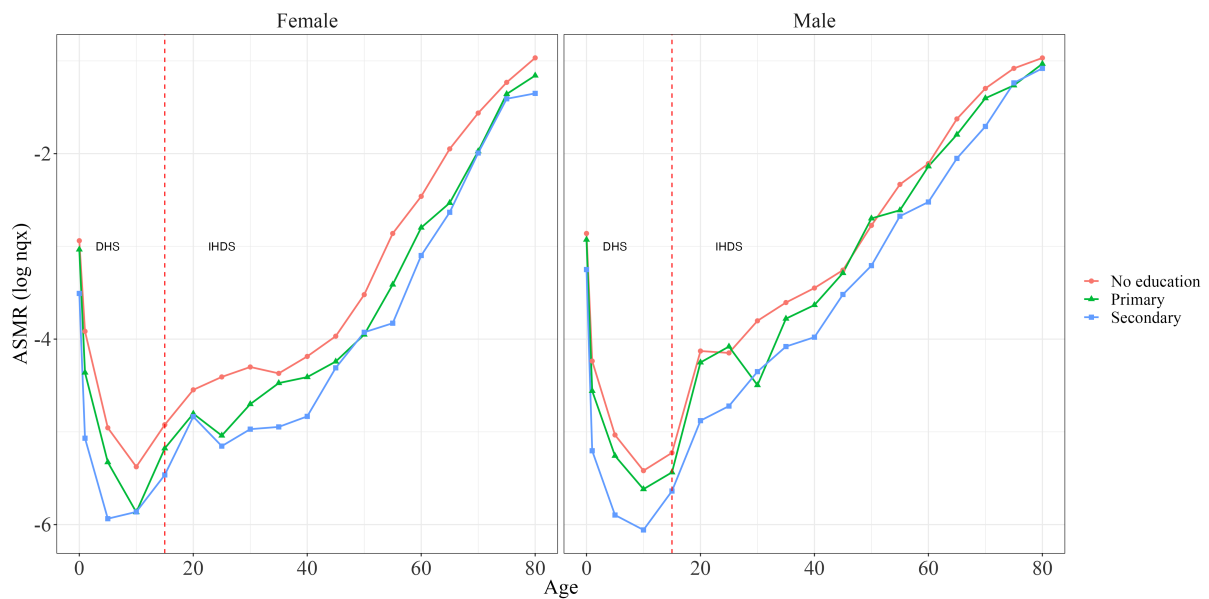


Figure 4: Age specific mortality rates by educational attainment for males and females



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