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# Offspring schooling associated with increased parental survival in rural KwaZulu-Natal, South Africa

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ABSTRACT

*Background:* Investing in offspring's human capital has been suggested as an effective strategy for parents to improve their living conditions at older ages. A few studies have assessed the role of children's schooling in parental survival in high-income countries, but none have considered lower-resource settings with limited public wealth transfers and high adult mortality.

*Methods:* We followed 17,789 parents between January 2003 and August 2015 in a large population-based open cohort in rural KwaZulu-Natal, South Africa. We used Cox proportional hazards models to investigate the association between offspring's schooling and time to parental death. We assessed the association separately by parental sex and for four cause of death groups.

*Results:* A one year increase in offspring's schooling attainment was associated with a 5% decline in the hazard of maternal death (adjusted Hazard Ratio [aHR]: 0.95, 95%CI: 0.94–0.97) and a 6% decline in the hazard of paternal death (aHR: 0.94, 95%CI: 0.92–0.96), adjusting for a wide range of demographic and socio-economic variables of the parent and their children. Among mothers, the association was strongest for communicable, maternal, perinatal and nutritional conditions (aHR: 0.87, 95%CI: 0.82–0.92) and AIDS and tuberculosis (aHR: 0.92, 95%CI: 0.89–0.96), and weakest for injuries. Among fathers, the association was strongest for injuries (aHR: 0.87, 95%CI: 0.79–0.95) and AIDS and tuberculosis (aHR: 0.92, 95%CI: 0.89–0.96), and weakest for non-communicable diseases.

*Conclusion:* Higher levels of schooling in offspring are associated with increased parental survival in rural South Africa, particularly for mothers at risk of communicable disease mortality and fathers at risk of injury mortality. Offspring's human capital may be an important factor for health disparities, particularly in lower-resource settings.



## 1. Introduction

Several recent studies from Asia (Cai et al., 2006; Frankenberg et al., 2002; Giles et al., 2011; Knodel et al., 2000), Latin America (Bravo, 2006; Saad, 2005), and sub-Saharan Africa (Adamchak et al., 1991; Kohler et al., 2012) suggest that a majority of individuals of ages 60 and older in low- and middle-income countries depend on the financial support provided by their children. Given the strong empirical relationship between schooling and socioeconomic status, investing in their children's human capital may thus be one of the most effective strategies for parents to improve their living conditions at older ages. This may be particularly the case in settings where public wealth transfers are limited and children play a more prominent role in supporting older generations.

The effect of children's human capital on the health of their parents is likely to be mostly protective for several reasons. First, children may function as a substitute for market institutions (e.g., employer-provided pensions and health insurance) or tax supported institutions (e.g., social security and health insurance) (Barouni and Broecke, 2014; Psacharopoulos, 1994; Schultz, 2004). For example, children could recompense their parents for human capital investments received in childhood ('parental repayment'), based on their increased financial means arising from their schooling (Clay and Vander Haar, 1993; Frankenberg et al., 2002). Additionally, more highly educated children may be better able to communicate health knowledge and skills acquired at or after

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school to parents, positively affecting their health behavior (Berkman et al., 2000; Cutler and Lleras-Muney, 2010; Field and de la Roca, 2005; Rowa-Dewar et al., 2014). More educated children may facilitate the use of medical information among their parents (e.g., understanding doctors' prescriptions) or may help their parents navigate the complex web of health insurance bureaucracies (Grossman, 1972). Offspring with additional schooling may also be generally more familiar with modern society (Glewwe, 1999), which may make them more receptive to modern medicine (Aslam and Kingdon, 2012; Frost et al., 2005), or the 'hidden curriculum' values of discipline and obedience of authority learned in school (Basu and Stephenson, 2005). Finally, formal schooling may open access to careers in the health sector (e.g., as a nurse practitioner or community health worker), allowing offspring to directly provide care to their parents (Bauman et al., 2006; Evans and Becker, 2009; McGarry, 1998).

While all of these pathways suggest that differential investment in children's human capital may be a key driver of social and health inequalities at older ages (Berkman and Kawachi, 2000; Kaufman and Cooper, 1999; Krieger, 2001; Marmot, 2003), surprisingly little evidence is available on the empirical relationship between children's human capital investment and parental survival. In the United States, one longitudinal study estimated a difference in life expectancy between parents of children with a college degree and parents of children with less than a high school diploma of about two years (age of death 71 vs 69) (Friedman and Mare, 2014). Interestingly, this relationship persisted after controlling for parents' own socio-economic resources, and was more pronounced for deaths that were linked to behavioral factors (most notably, chronic lower respiratory disease and lung cancer). In Sweden, a study compared parental siblings and found that parents whose children had tertiary schooling had a 21% lower hazard of dying compared to their siblings whose children completed only nine years of compulsory schooling (Torssander, 2013). A quasi-experimental study in Sweden, exploiting changes in schooling law as a 'natural experiment', found *no evidence* of a causal effect of schooling in children on parental longevity (Lundborg and Majlesi, 2015). Large effects of children's schooling on parental survival might, however, seem unlikely in Sweden – where a comprehensive welfare system generously provides for the elderly, and upward intergenerational wealth transfers are uncommon (Fritzell and Lennartsson, 2005; Lennartsson et al., 2009; Torssander, 2013). Even though children may still provide informal care in this setting (Bolin et al., 2008; Lennartsson et al., 2009), the marginal impact of this additional support in the Swedish setting is likely to be much smaller than the impact in a low-resource setting.

Two relevant panel studies have been conducted in middle-income countries. In a Chinese study, the adjusted hazard of parental death for those living with offspring with 10 or more years of schooling was 17% lower than that for offspring with 6 years of schooling or less (Yang et al., 2016). The study suggests that children's and spousal schooling were similarly important for the health of the elderly in this setting. Another longitudinal study, using data from Mexico, assessed the impact of children's schooling on their parents' functional limitations. In adjusted analysis, parents whose children had completed high school were less likely to report functional limitations than those whose children had not (Yahirun et al., 2016). To our knowledge, no studies have been conducted in sub-Saharan Africa.

### 1.1. South Africa education system

The public education system in South Africa is divided into three phases of basic education (Republic of South Africa, 2013). The 'foundation' phase runs from grade R (pre-primary) to grade 3; the 'intermediate' phase from grades 4 to 9; and the 'senior' phase from grades 10 to 12. Primary school would typically be considered grades 1 to 7, with the *de jure* primary school-age population being 7–13 years old. Lower secondary school would typically be considered grades 8 to 9; upper-secondary school would be considered grades 10 to 12. Students between the ages of 14 and 18 years old are officially being regarded as of secondary school-going age. Schooling is mandatory for children aged 7–15 years (i.e., those in the foundation and intermediate phases). Gross primary school enrollment (both sexes) was 99.7% in 2014 (UNESCO Institute for Statistics, 2016). Gross lower-secondary school enrollment (both sexes) was 94.9% and gross upper-secondary school enrolment (both sexes) was 94.5%. The National Senior Certificate, commonly known as 'matric', is a three year qualification that signifies the end of twelve years of schooling. In principle, public schooling is free for those who cannot afford to pay school fees. Tertiary schooling in South Africa offers a wide range of options, including three-year bachelor's degrees and an honors degree, an optional fourth-year qualification, in addition to advanced masters and doctorate degrees.

The relationship between schooling attainment and health outcomes has garnered increasing attention from government, donors, and health system researchers and planners in South Africa. In particular, recent research and policy efforts have increased their focus on improving access and retention in schools as a potential HIV prevention strategy among young women. Two recent RCTs, including in rural KwaZulu Natal (KZN) and Mpumalanga provinces, have assessed the role of schooling conditional cash transfers to reduce HIV infection risk among secondary school students (Karim et al., 2015; Pettifor et al., 2016). Moreover, increased access to, and retention in, school is a key part of the United States President's Emergency Plan for AIDS Relief DREAMS initiative, which is being piloted in several South African sites (PEPFAR, 2016). The current study thus has important implications for research and policy, in determining whether these efforts to increase school attainment in South Africa may have additional health benefits in terms of increased survival for older generations, over and above those arising more directly from offspring's reduced HIV risk.

We therefore used longitudinal data to test the hypothesis that offspring's schooling decreases the hazard of parental death in an African setting with very high adult mortality (Coovadia et al., 2009). We used one of Africa's largest cohorts, located in rural KZN, South Africa, to follow up 17,789 parents and observe their survival over the period January 2003 to August 2015. The availability of a range of demographic and socio-economic variables in our dataset allowed us to control for important determinants of adult mortality and to assess the role of offspring's schooling on the most prevalent causes of death among their parents in South Africa.

## 2. Methods

### 2.1. Study area

Since 2000, the Africa Centre for Population Health has collected longitudinal demographic, social, and economic data on over 100,000 people living in a 432 $km^2$ demographic surveillance area (DSA) in uMkhanyakude District, in northern KZN. The DSA includes both rural areas that were a designated Zulu 'homeland' area during Apartheid and urban areas that formerly constituted a black-only township. uMkhanyakude is the poorest of the 11 districts in KZN and the second most deprived district in South Africa (Government of South Africa, 2015). Adult HIV prevalence in this community is very high. Prior to the roll-out of public-sector antiretroviral therapy (ART), adult life expectancy in the DSA was 49.2 (Bor et al., 2013) with over half of the population deaths attributed to HIV (Herbst et al., 2011). Since the roll-out of ART in 2004, however, the