



# Trends and group differences in the association between educational attainment and U.S. adult mortality: Implications for understanding education's causal influence<sup>☆</sup>



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## ABSTRACT

Has the shape of the association between educational attainment and U.S. adult mortality changed in recent decades? If so, is it changing consistently across demographic groups? What can changes in the shape of the association tell us about the possible mechanisms in play for improving health and lowering mortality risk over the adult life course? This paper develops the argument that societal technological change may have had profound effects on the importance of educational attainment – particularly advanced education – in the U.S. adult population for garnering health advantages and that these changes should be reflected in changes in the functional form of the association between educational attainment and mortality. We review the historical evidence on the changing functional form of the association, drawing on studies based in the United States, to assess whether these changes are consistent with our argument about the role of technological change. We also provide an updated analysis of these functional form patterns and trends, contrasting data from the early 21st Century with data from the late 20th Century. This updated evidence suggests that the shape of the association between educational attainment and U.S. adult mortality appears to be reflecting lower and lower adult mortality for very highly educated Americans compared to their low-educated counterparts in the 21st Century. We draw on this review and updated evidence to reflect on the question whether education's association with adult mortality has become increasingly causal in recent decades, why, and the potential research, policy, and global implications of these changes.

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Has the shape of the association between educational attainment and U.S. adult mortality changed in recent decades? If so, how is it changing? Is it changing consistently across demographic groups? The answers to these questions are critical in understanding the kinds of mechanisms by which educational attainment operates or whether changes in the shape of the association are being driven by unobserved factors such as intelligence or child health. In addition, answers to these questions may point to whether the association is becoming more causal for particular

subgroups of the population and help identify what societal level conditions may be contributing to these changes.

This paper offers a conceptual framework for understanding how macro societal changes may be influencing changes in the functional form of the association between educational attainment and adult mortality. We focus specifically on the possible implications of rapid technological change for changes in the shape of the association between individuals' educational attainment and adult mortality risk. We then turn to a review of the evidence on the changing functional form of the association between educational attainment and adult mortality, drawing on studies based in the United States, to assess whether the empirical evidence thus far is consistent with our argument regarding the role of technological change in influencing the functional form. Particular attention is given to how widespread the changes are across race and gender subgroups of the population. We further provide an updated

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analysis of these functional form patterns and trends, contrasting data from the late 20th Century with data from the early 21st Century. We draw on this review and our updated evidence to reflect on the question whether education's association with adult mortality has become increasingly causal in recent decades, among whom, why, and the potential research, policy, and global implications of these changes.

### 1. The conceptual links between educational attainment and adult mortality

It is not news that high educational attainment is strongly associated with lower U.S. adult mortality (Feldman et al., 1989; Hummer and Lariscy, 2011; Kitagawa and Hauser, 1973; Preston and Taubman, 1994). Very often, the interpretation of this association is rooted in the idea that education fosters the creation of individuals' "health capital" throughout the adult life course (Cutler and Lleras-Muney, 2010; Hummer and Hernandez, 2013). This interpretation is portrayed heuristically in Fig. 1. On average, individuals' higher levels of education improve access to better jobs and associated extrinsic and intrinsic rewards and psychosocial resources – factors that have long been shown to be associated with lower mortality and better health (House, 2002; Marmot and Wilkinson, 2001; Marmot et al., 1997; Moore and Hayward, 1990; Ross and Wu, 1996). Educational attainment also provides individuals with the means to acquire valuable information about, and support for, healthy lifestyles and health care that also reduce mortality (Lantz et al., 1998; Rogers et al., 2013; Ross and Wu, 1996; Schoeni et al., 2010). Education influences persons' access to valuable networks and social relationships and the mobilization of those relationships (Hout, 2012; Lin, 1999), which have been shown to benefit health (Berkman et al., 2000; House et al., 1988). And, education also fosters the development of general cognitive skills in individuals, and a greater sense of control and human agency that are critical in garnering health advantages (Baker et al., 2011). In terms of general cognitive skills, education teaches people how to learn, communicate more effectively, be proactive in figuring things out, be analytical in problem solving and so on – factors that are

critical in producing health and managing health problems. With greater human agency and feelings of control that accrue from education comes the ability to make health-related choices that maximize health advantages (Mirowsky and Ross, 2003). Framed in these terms, persons with advanced education are presumed to have a bounty of resources that can be used to garner health advantages compared to less educated persons (Hout, 2012; Link and Phelan, 1995; Mirowsky and Ross, 2003). This is the basis for the idea that a significant part of the association between educational attainment and adult mortality is causal.

Life course research on achievement processes points to the possibility that the education-mortality association also reflects other early life conditions such as the childhood socioeconomic and health environment, shown in Fig. 1. Childhood socioeconomic advantages are associated with a lower risk of adult mortality and health problems (Hayward and Gorman, 2004; Luo and Waite, 2005; Montez and Hayward, 2011). Similarly, childhood health problems also have been linked to higher mortality risks and health problems in adulthood (Blackwell et al., 2001; Haas, 2007). Some researchers have also suggested that IQ may be an "elusive fundamental cause" of health that may account for the associations between socioeconomic factors such as education and adult health (Gottfredson and Deary, 2004). With respect to effects of childhood socioeconomic disadvantages, much of these effects have been shown to operate through adult conditions such as educational attainment and income (Hayward and Gorman, 2004). Moreover, Hayward's and Gorman's (2004) results suggested that the effects of adult socioeconomic factors on mortality are highly robust to controls for early life conditions, and that the association between educational attainment and adult mortality is potentially *underestimated* when childhood conditions are not controlled. Link et al. (2008) similarly observed in analyses of the Wisconsin Longitudinal Study and the Health and Retirement Study data sets that the associations between educational attainment, income, and adult mortality changed very little when intelligence was controlled and that there was no direct effect of intelligence. In addition, a very recent study by Montez and Hayward (2014) documented, using the Health and Retirement Study, that educational attainment's

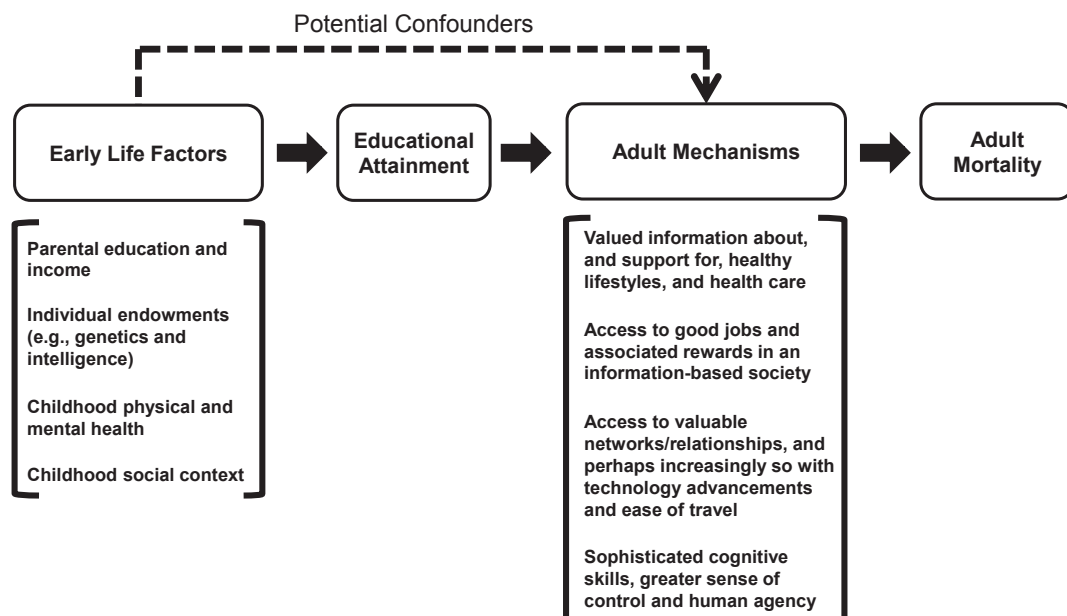


Fig. 1. Conceptual model depicting the relationship between educational attainment and adult mortality.

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