Article

The health benefits of secondary education in adolescents and young adults: An international analysis in 186 low-, middle- and high-income countries from 1990 to 2013

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ABSTRACT

Background: The health benefits of secondary education have been little studied. We undertook country-level longitudinal analyses of the impact of lengthening secondary education on health outcomes amongst 15-24 year olds.

Methods: Exposures: average length of secondary and primary education from 1980 to 2013.

Data/Outcomes: Country level adolescent fertility rate (AFR), HIV prevalence and mortality rate from 1989/90 to 2013 across 186 low-, middle- and high-income countries.

Analysis: Longitudinal mixed effects models, entering secondary and primary education together, adjusted for time varying GDP and country income status. Longitudinal structural marginal models using inverse probability weighting (IPW) to take account of time varying confounding by primary education and GDP. Counterfactual scenarios of no change in secondary education since 1980/1990 were estimated from model coefficients for each outcome.

Findings: Each additional year of secondary education decreased AFR by 8.4% in mixed effects models and 14.6% in IPW models independent of primary education and GDP. Counterfactual analyses showed the proportion of the reduction in adolescent fertility rate over the study period independently attributable to secondary education was 28% in low income countries. Each additional year of secondary education reduced mortality by 16.9% for 15-19 year and 14.8% for 20-24 year old young women and 11.4% for 15-19 year and 8.8% for 20-24 year old young men. Counterfactual scenarios suggested 12% and 23% of the mortality reduction for 15-19 and 20-24 year old young men was attributable to secondary education in low income countries. Each additional year of secondary education was associated with a 24.5% and 43.1% reduction in HIV prevalence amongst young men and women.

Interpretation: The health benefits associated with secondary education were greater than those of primary education and were greatest amongst young women and those from low income countries. Secondary education has the potential to be a social vaccine across many outcomes in low and middle income countries.

1. Introduction

Education is suggested to be one of the strongest determinants of health and human capital (Commission on Social Determinants of Health, 2008), with the association of better education with greater health and wellbeing seen across the life-course and across very different socioeconomic, cultural and political contexts and one that has persisted over time (Montez & Friedman, 2015). The more educated live longer lives with less disability and ill-health in both rich and poor countries, and there is evidence that the association between education and health is strengthening over time in high income countries (Strand, Groholt, Steingrimsdottir, Blakely, Graff-Iversen & Naess, 2010). Education appears to also have inter-generational benefits; improved education for women may account for up to half the global improvement in child mortality since 1970 (Gakidou, Cowling, Lozano, & Murray, 2010). For this reason uni-

versal primary education was one of the key UN Millennium Development Goals (MDG Goal 2).

There is a growing consensus that education has some causal effects on health, (Baker, Leon, Smith Greenaway, Collins, & Movit, 2011; Behrman, 2015; Miyamoto & Chevalier, 2010; Montez & Friedman, 2015) although there are also likely pathways from health to education and confounding by genetic (Liu et al., 2015) or personality factors (Fuchs, 1982) contributing to both improved health and higher educational attainment. Education may improve health through multiple mechanisms, including stimulation of greater cognitive development and self-regulation, knowledge acquisition and literacy, promotion of more healthy behaviours and avoidance of health risks, greater access to protective societal resources (e.g. the built environment or medical care), avoidance of early marriage as well as greater exposure to prosocial peers and enhancement of social support networks (Baker et al., 2011; Jukes, Simmons, & Bundy, 2008; Liu et al., 2015; Miyamoto & Chevalier, 2010). Through these or alternative mechanisms, education may modify genetic risks for certain diseases (Liu et al., 2015). Education may also be most powerful when substituting or compensating for deprived backgrounds (Ross & Mirowsky, 2011). The existence and strength of such mechanisms are almost certainly dependent on broader social and economic contexts, and are likely to vary by national development level and income (Montez & Friedman, 2015; Smith-Greenaway, 2015).

Many of the suggested mechanisms by which education may influence health can be argued to be most strongly operative during secondary schooling, given dramatic cognitive development during adolescence and the emergence of key health issues such as substance use, depression, sexually transmitted infections and teenage pregnancy emerge during this time (Patton et al., 2016). Yet health gains from secondary education have been little studied, in contrast to primary education. This is despite a dramatic global expansion in length of education in the past 30 years, with most gains in the late primary and early secondary years (Institute for Health Metrics and Evaluation (IHME), 2015). Data from the Institute of Health Metrics (IHME) suggests that globally in 2015, young women aged 15-24 years had on average 9.5 years of education and young men had 9.9 years. Less than 7 average years of education, equivalent to primary education, was the norm for young men in 22% of countries and for young women in 26% of countries. Achieving 8-10 years of education, equivalent to lower secondary, was the norm for 34% of countries for young men and 18% for young women, with upper secondary or beyond (11 plus years of education) being the norm in 44% of countries for young men and 56% for young women (Institute for Health Metrics and Evaluation (IHME), 2015). Amongst adults in high income countries (HIC) upper secondary education is the education level most strongly associated with better health and mental health, (Miyamoto & Chevalier, 2010) although tertiary education confers additional benefits in US studies (Case & Deaton, 2015). Secondary education is known to promote better pregnancy and child health outcomes amongst adult women internationally, (Grepin & Bharadwaj, 2015; UNESCO, 2010) and a small literature from Sub-Saharan African countries suggests that the effect of secondary schooling on teenage fertility may be stronger and more consistent than for primary education (Mahy & Gupta, 2002). However the effects of education on health may differ across cultures and nations, (Snopkowski, Towner, Shenk, & Colleran, 2016) and may be greater in resource poor groups and settings (Ross & Mirowsky, 2011).

Estimates that poor education attainment is a relatively large contributor to overall health, e.g. directly contributing to 9% of US deaths in a recent study, (Galea, Tracy, Hoggatt, Dimaggio, & Karpati, 2011) have driven interest in education policy as a potential tool to improve population health (Miyamoto & Chevalier, 2010; Montez & Friedman, 2015). The United Nations Sustainable Development Goals (SDG) include a target for countries to provide every child with access to free primary and secondary education by 2030 (Target 4),

(Sustainable Development Knowledge Platform, 2014) driven by the well-evidenced benefits of education for economic development (Barro, 2013). Concerns about the ability of low income countries to meet this target led to the formation of the International Commission on Financing Global Education in 2015 (Brown, 2015).

Here we undertake the first systematic international exploration of the effect of participation in secondary education on health outcomes in adolescence and young adulthood. We used country-level analyses to examine longitudinal associations over the past 23 years of average length of secondary compared with primary education per country with key SDG priority outcomes, adolescent fertility rate, HIV prevalence and all-cause mortality, amongst 15-24 year olds. We undertook separate analyses by gender given differences in length of education for women, (Institute for Health Metrics and Evaluation (IHME), 2015) differences in causes of mortality between sexes in adolescence, (Viner et al., 2011) and previously reported differences in education and health associations (Ross, Masters, & Hummer, 2012). We undertook longitudinal analyses and examined trends by world region and by country income status as associations between health and education may shift with economic development (Snopkowski et al., 2016). We hypothesized that greater length of participation in secondary education in a country was associated with better health outcomes for a country over and above benefits from primary education and after accounting for economic development. We tested these hypotheses in a range of models for each health outcome studied, and used data from the models to compute counterfactual estimates for each health outcome, identifying the likely contribution of increases in secondary education to progress in each health outcome by world region and by country income group.

2. Methods

We used longitudinal models to examine associations between secondary education and health outcomes globally.

2.1. Education data

Recent and reliable national education data on a wide range of countries were available from two sources:

I. Secondary education: Barro and Lee (BL) (Barro & Lee, 2010) data on national average completed years in primary, secondary and tertiary education for 146 countries at 5 year intervals from 1950 to 2010. We interpolated education outcomes for intervening years to provide estimates for each country-year for 15-24 year olds (see Appendix).

II. Overall education: Estimates of the national average completed years of education for people over the age of 15 in 10 year age-bands from 1970 to 2015 were recently published by the Institute of Health Metrics and Evaluation (IHME) for 188 countries by sex (Institute for Health Metrics and Evaluation (IHME), 2015). For these analyses we used 15-24 year olds (Appendix).

Our primary analyses in this paper related to the secondary education data from the BL dataset, however we also included analyses using overall years of education (IHME) as most variation between countries in overall years of education now lies in the secondary education domain.

2.2. Health outcomes

Adolescent fertility rate (AFR), defined as annual births per 1000 women aged 15-19 years were obtained from the United Nations Department of Economic and Social Affairs Population Division for 1990 to 2012 (United Nations, 2014). AFR data were available for 137 countries for secondary education analyses.