Rethinking mass education and population health: Vertical, horizontal, and integrative educational expansion and child mortality in a cross-national panel

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Abstract

The expansion of formal education is one of the signature achievements of modern society. And while the implications of mass education has been central to demographic research on population health, the majority of work has focused on the extent of average educational attainment. In this paper, we suggest that there are three types of mass education. The "vertical" involves the extent of average educational attainment in a population and has been the most common object of study. But this exists along side a "horizontal" dimension involving participation and an "integrative" dimension involving variation in educational disparities. Importantly, these dimensions operate at the primary, secondary, and tertiary levels and should have differing implications for population health. We investigate the effects of the different types of mass education using data from a cross-national panel of 145 countries spanning 1990 to 2015 using fixed effects longitudinal regression with suitable controls for time-varying confounders. Results are four-fold. First, the various dimensions are empirically distinct with small associations between them. Second, the vertical dimension has associations that are not particularly large and vary in statistical significance. Third, gender parity in mass education has large, robust associations with child mortality that are independent of vertical and horizontal mass education. Finally, the most substantial mortality gains are seen for the expansion of mass education at the primary level with smaller and uneven gains with expansion at higher levels. Implications for theory, research, and policy are discussed.

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1 Introduction

The expansion of formal education is one of the signature achievements of modern society. Data from a variety of sources show that more and more people have some schooling, more and more people are in school longer, and differences in educational experience and attainment both within- and across-countries are becoming smaller and smaller (UNESCO 2010). Given that education is widely viewed as a personal and social good, the extension of mass education features prominently in macro-social policy statements such as the UNs Sustainable Development Goals (Griggs et al. 2013) and has become a central institutional feature of the modern nation state (Meyer & Hannan 1979; Meyer & Rowan 1977). Equally important, social science has focused considerable attention on the implications of expanding education for social and economic development (Autor, Katz, & Krueger 1998; Goldin & Katz 2018; Rubinson & Fuller 1992).

One area of particular significance is the relationship between education and population health with specific attention to the association between education and mortality. Although the roots of interest in educational differences in mortality can be traced back to pioneering work on suicide in the late 1800s, the mid to late 1970s saw fundamental work on educational gradients in mortality in both developing (Caldwell 1979) and advanced economies (Kitagawa & Hauser 1973). Such work has spawned a large and impressive body of work that shows pervasive educational differences in health among adults, mothers, and children (Baker et al. 2011) and suggests that educational attainment is both a fundamental cause of health Link and Phelan (1995); Mackenbach et al. (2015); Masters, Link, and Phelan (2015) and an important policy lever to both improve health and reduce disparities (Foundation, Kaplan, House, Schoeni, & Pollack 2008).

The phenomenon of mass education is however more complicated than contemporary demography and epidemiology recognize. In particular, the empirical reality of mass education is that it has unfolded rather unevenly across countries and is comprised of a number of inter-related dimensions. On the former point, John Meyer and numerous colleagues (Boli, Ramirez, & Meyer 1985; Meyer, Ramirez, & Soysal 1992; Schofer & Meyer 2005) have documented the expansion of educational institutions that

are typically only loosely coupled to the different socioeconomic landscapes that characterize modern society. Fairly uniform models of educational are articulated, codified and adopted, yet yield highly heterogeneous practices across countries at any given point in time. On the latter point, mass education involves vertical, horizontal, and integrative dimensions that operate simultaneously. The "vertical" component is perhaps the most common conceptualization with measures of mean or median educational attainment or school life expectancy frequently used. The "horizontal component" involves increases in the number or percentage of a population that is involved in educational institutions at a given point in time. Here, gross enrollment is a useful metric. The "integrative" dimensions involve equity or uniformity of involvement in educational institutions with typical reference to more marginalized groups within a population. Here, attention focuses on parity in enrollment across groups. Importantly, these dimensions can characterize different stages of educational systems, specifically primary, secondary, and tertiary education. To date, mortality research has focused most, if not sole, attention on the first dimension without systematic attention to different stages and thus the broader implications of mass education are less understood.

In this paper, we try and disentangle the different types of mass education and examine their associations with mortality. Our analyses focus on 145 countries contributing over 1700 country-years spanning 1990 to 2015 and involve two dimensions. First, we document the associations between different indicators to highlight heterogeneity in associations that showcase the variable institutionalization of formal education across countries. Second, we systematically examine associations with key measures of mortality. Here, our goal is to identify the independent and cumulative effects of different forms of mass education to parse out what types of education matters for population health.

2 Methods

2.1 Data

The cross-national dataset used for the research covers 145 countries, spanning from 1990 to 2016. The total number of countries varies by model due to small variation in missingness across items. On average however, the countries contribute an average of

12 country-years. The only countries excluded from the dataset were those with missing information about either the education or health measures on the entire time period considered. A full list of countries in the analytic sample is shown in Appendix A.

2.2 Measures

All health and education measures were taken from the World Bank (2016) database. The former originate from the Health Nutrition and Population Statistics dataset, while the latter come from the Education Statistics dataset which is original from the UNESCO Institute for Statistics.

Population Health Our research focuses on child mortality. This indicator has a number of advantages in that it is clearly defined and permits direct comparison of the health status of a population over time or across countries and different cultures (Baker et al. 2011). The child mortality does not simply measure a small part of the population; it reflects instead an important indicator of the whole population health. In facts, structural factors affecting the health of entire populations have an impact on the mortality rate of children, making the latter a representative measure of the overall population health (Reidpath & Allotey 2003). The child mortality rate is defined as the number of children dying before the 5 years of age per 1,000 live births in a given year, if subject to the age-specific mortality rate of the specified year.

Mass Education As we noted earlier, comparing mass education across countries worldwide is a complex matter because of different educational structures, standards and measurement systems. Given this, a comprehensive assessment would include multiple dimensions. To capture the vertical dimension, we use school-life expectancy. This indicates the total number of years a child of school entrance age can expect to spend in schooling, assuming that the probability of enrolment at any particular age is equal to the current age specific enrolment ratio (UNESCO Institute for Statistics 2009). Such a measure proxies the concept of educational attainment in that it measures how far children will be expected to go in schooling given the typical life table assumptions associated with synthetic cohorts. It should be noted that being an average based on participation in different levels of education, the expected number of years of schooling may be pulled down by the number of children who never go to school.

Gross enrolment ratios captures the horizontal dimensions of mass education. Gross

enrolment ratios of a specific level of education account for all children enrolled at the given level (e.g., primary), regardless of their age. The ratios are expressed as a percentage of the school-age population that officially corresponds to that level of education. For this reason gross enrolment rates can and often do exceed 100%, due to the possible inclusion of under-aged and over-aged students (UNESCO 2010)

With respect to the integrative dimension, the most widely available indicator focuses on gender differences in enrollment. Here, the gender parity index in enrolment is calculated by dividing the female value for the indicator by the male value for the indicator. A gender parity index equal to 1 indicated parity between sexes enrolment rates. Values less than 1 indicates disparity in favor of males, while values greater than 1 indicate disparity in favor of females (UNESCO 2010). As with gross enrolment, gender parity indicators can be calculated for each educational stage, as well as aggregate enrolment level.

With the combination of indicators such as school life expectancy for vertical expansion, gross enrolment rates as measures of horizontal expansion, and gender parity indices to capture the equality of education, it is possible to evaluate the overall education level of a country.

Control Variables Across a number of disciplines, studies of the effects of education on health have fostered speculation that education is mostly a proxy for other aspects of socioeconomic status at the individual level or of economic development at the aggregate level. Baker and colleagues (2011) provide a comprehensive discussion and note that mass education has been conceptually and empirically associated with both modernity as a historical phenomenon and development as socioeconomic processes (see also Ramirez & Meyer 1980). Given this, it is important to control for other demographic, economic, and social dynamics that correlate with educational expansion. We do so by including a number of key covariates.

To account for the national economic development, our models include by including logged gross domestic product per capita (hereafter GDP). GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. To capture variation in population

risks for mortality, we include a measure of the crude birth rate. This is the number of live births occurring during the year, per 1,000 population estimated at midyear. As a measure of state capacity for education and health interventions, we include the country-year dependency ratio. The latter is the ratio of dependents–people younger than 15 or older than 64–to the working-age population–those ages 15-64. Data are shown as the proportion of dependents per 100 working-age population. To capture dimensions of womens status that could influence mortality among children and mothers, we include the proportion of legislators that are female (i.e., political empowerment) and female labour force participation (i.e., economic empowerment). We also capture the extent of urbanization given a typical pattern of elevated mortality and reduced access to education in more rural contexts. Social conflict can both exacerbate mortality and undermine social institutions. We control for this with a measure of total exposure of a country-population to intra- and inter-state violent conflict. The latter measure comes from the Centre for Systemic Peaces global surveillance project. Finally, we include country-fixed effects to account for all time-stable attributes that could bias coefficients, as well as year-fixed effects to control for temporal trends in both mass education and mortality. The latter is particularly significant in moving us towards better causal inference given long-standing concerns that educational expansion simply proxies broader patterns of social and economic development (Basu 1994; Hobcraft 1993).

This analytic strategy yields the following longitudinal regression:

$$\begin{aligned} MR_{it} = \alpha + \beta_1 SLE_{it} + \beta_2 GE_{it} + \beta_3 GP_{it} + \beta_4 LNGDP_{it} + \beta_5 CBR_{it} + \beta_6 DEP_{it} \\ + \beta_7 FPR_{it} + \beta_8 FLFP + \beta_9 URB_{it} + \beta_{10} WAR_{it} + c_i + t_t + \epsilon \end{aligned} \tag{1}$$

where MR refers to the mortality rate for country i at time t, SLE is school life expectancy, GE is gross enrollment at some educational stage (e.g., gross secondary enrollment), GP is gender parity at some educational stage (e.g., gender parity in primary enrolment), LNGDP is logged GDP per capita, CBR is the crude birth rate, DEP is the dependency ratio, FPR is female political representation, FLFP is female labour force participation, URB is the proportion of a population living in urban areas, WAR is exposure to social conflict, c is country fixed effects, t is the year fixed effects, and ϵ

is the idiosyncratic error term.

All models are estimated with the XT protocol in Stata 15.1 with controls for autocorrelation and with cluster-corrected standard errors. For ease of interpretation and to facilitate comparison of effects whose underlying variables have widely different metrics, we estimate marginal effects that are predicted mortality rates with corresponding 95% confidence intervals. Summary statistics for all measures are shown in Table 1.

Table 1: Summary statistics.

	Observations	Mea	SD	Min	Max
Child mortality rate	2,114	42.454	50.083	2,1	328,2
Maternal mortality ratio	2,114	185.846	293.734	3	2700
School life expectancy	2,114	12.300	3.507	2.069	23.282
Gross primary enrolment	2,114	100.814	16.015	25.481	152.252
Gender parity in primary enrolment	2,114	0.958	0.085	0.435	1.256
Gross secondary enrolment	2,066	76.384	32.022	5.132	164.812
Gender parity in secondary enrolment	1.963	0.961	0.104	0.406	1.295
Gross tertiary enrolment	2,069	33.795	26.007	0	119.779
Gender parity in tertiary enrolment	1,888	1.002	0.332	0.065	1.3
Logged GDP per capita	2,114	8.223	1.658	4.714	11.634
Crude birth rate	2,114	21.197	11.564	7.6	55.122
Dependency ratio	2,114	61.316	18.452	17.031	111.855
Female political representation	2,114	0.153	0.111	0	0.6375
Female labour force participation	2,114	50.623	15,82393	9.244	90.788
Percent in urban areas	2,114	57.727	22.443	5,416	99.244
Exposure to war	2,114	0.498	1.382	0	9

3 Results: Associations among indicators of mass education

Our analyses begin by describing the associations between the different dimensions of mass education. Figure 1 shows the bivariate associations between school life expectancy, gross primary enrolment, and gender parity in primary enrolment. There are clear, positive associations as would be expected given broad understandings of isomorphism and the centrality of educational institutions in models of modern nation states Meyer, Boli, Thomas, and Ramirez (1997); Meyer et al. (1992). At the same time, the association is far from uniform. In the case of gross primary enrolment and school life expectancy, there is a (very) strong linear association at low levels of both variables, large variation at mid range, and essentially a null association when school life

expectancy is high. The fixed effects partial correlation, one that controls for time-stable attributes of countries and temporal trends, is only 0.23. For the association between school life expectancy and gender parity in primary enrolment, the relationship is very heterogeneous and really only clusters when parity is 1 and school expectancy exceeds thirteen. Given this, the partial correlation is even smaller at 0.12. The association is somewhat stronger between gross primary enrolment and gender parity in primary enrolment, but still is far from uniform (r = 0.59).

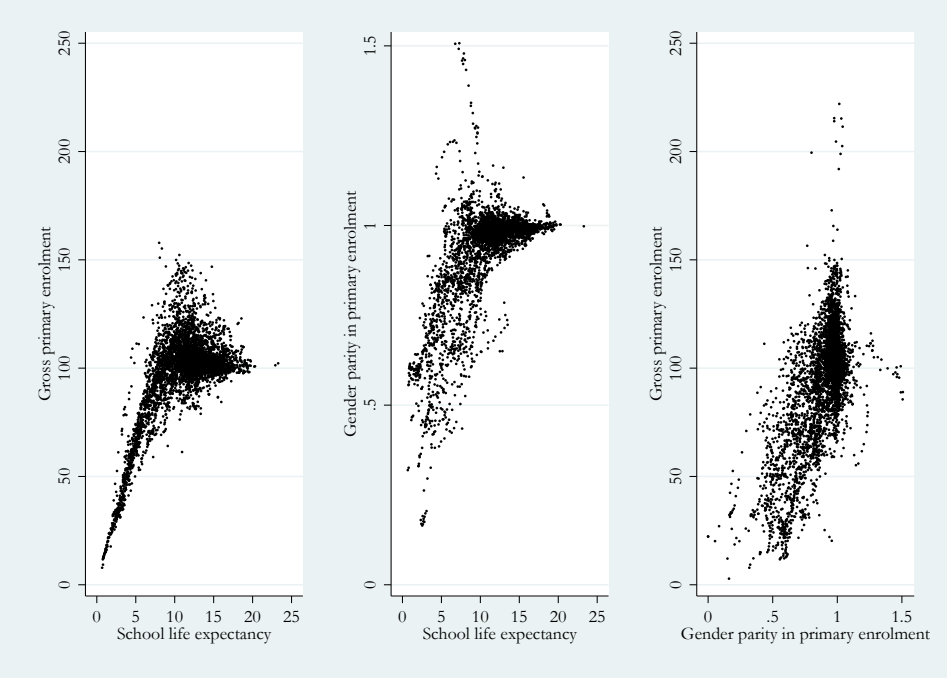

Figure 1: Observed prevalence of non-cohabiting marriage by country.

Table 2 summarizes these associations with the full set of partial correlations. There are three conclusions. First, the overall pattern of associations is highly variable. The partial correlations range from 0.820 (Gender parity in primary enrolment and gender parity in secondary enrolment) to -0.419 (Gross primary enrolment and gross tertiary enrolment). Second, many of the associations are quite small: 11 of the 21 partial correlations are smaller than 0.15. Theoretically, this echoes arguments about the loose coupling of educational institutions (Meyer and Rowan 1977). Empirically, this suggests the value in thinking about the different measures as distinct measures of mass education that may have differentiated effects on population mortality. Third, there is a particularly loose association between dimensions of tertiary education and primary and

secondary education. This might be anticipated given prior work on the uniqueness and complexities of tertiary expansion (Schofer & Meyer 2005), but the empirical associations are clear. All associations between measures of primary and secondary education are positively correlated with one another and in some cases the association are reasonably strong ($r > .50$). In contrast, the ten partial correlations between tertiary education and primary or secondary education include four correlations that are negative and a further five that are less than 0.10. Again, this suggests reasonably independent dynamics that may have variable consequences for population mortality.

Table 2: Partial correlation coefficients with fixed effects for country and year.

	School life expectancy	Gross primary enrolment	Gender parity in primary enrolment	Gross secondary enrolment	Gender parity in secondary enrolment	Gross teritary enrolment
School life expectancy	.—	.—	.—	.—	.—	.—
Gross primary enrolment	.234	.—	.—	.—	.—	.—
Gender parity in primary enrolment	.124	.588	.—	.—	.—	.—
Gross secondary enrolment	.500	.152	.036	.—	.—	.—
Gender parity in secondary enrolment	.141	.651	.820	.067	.—	.—
Gross tertiary enrolment	.185	-.483	-.419	.084	-.390	.—
Gender parity in tertiary enrolment	.045	-.015	.045	.070	.103	.035

4 Results: Implications for population mortality

The second dimension of our research examines the associations between the various measures of mass education and mortality. The relevant coefficients are shown in Table 3 with marginal effects (i.e., estimates mortality) shown in Figures 2 through 4.

Beginning with the table of coefficients (see Table 3), it is worth noting that the overall pattern of coefficients for the control variables is consistent with expectations. All three coefficients for logged GDP per capita are negative and two are statistically significant. Crude birth rate is positively and significantly associated with child mortality. All coefficients for dependency ratio are negative, although none are statistically significant. The situation is similar for female political representation. For percentage living in urban areas, all coefficients are negative and one of the three is statistically significant. In contrast, coefficients for exposure to war are positive and statistically significant in two of three cases. The only anomalous and unanticipated effects are those of

female labour force participation. In all three models, the coefficients are positive and statistically significant. In general however, effects are consistent with prior work and theoretical expectations.

Table 3: Regression coefficients: Child mortality regressed on indicators of mass education with select controls.

	Child mortality (per 1,000)		
School life expectancy	0.284 (0.798)	-3.328*** (1.150)	-7.414*** (1.080)
Gross primary enrolment	-0.536*** (0.096)	.—	.—
Gender parity in primary enrolment	-113.078*** (20.992)	.—	.—
Gross secondary enrolment	.—	0.090 (0.100)	.—
Gender parity in secondary enrolment	.—	-133.521*** (24.816)	.—
Gross tertiary enrolment	.—	.—	0.699*** (0.114)
Gender parity in tertiary enrolment	.—	.—	-14.582** (4.869)
Controls			
Logged GDP per capita	-6.833*** (1.788)	-3.321 (2.053)	-3.526* (1.826)
Crude birth rate	1.862*** (0.359)	1.865*** (0.378)	2.493*** (0.400)
Dependency ratio	-0.103 (0.203)	-0.169 (0.250)	-0.306 (0.235)
Female political representation	-17.843 (15.328)	-17.846 (20.402)	-9.477 (13.663)
Female labour force participation	0.362*** (0.136)	0.343** (0.165)	0.298** (0.145)
Percent in urban areas	-0.194 (0.154)	-0.116 (0.158)	-0.235* (0.137)
Exposure to war	1.369** (0.561)	1.654*** (0.577)	0.845 (0.533)
Constant	220.732*** (35.221)	192.472*** (41.707)	116.903*** (27.097)
Country fixed-effects	Yes	Yes	Yes
Year fixed-effects	Yes	Yes	Yes
Observations	2,114	1,964	1,890
Countries	149	148	146

Robust standard errors in
in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Turning to mass education, model one shows effects for school life expectancy and primary enrolment on child mortality. Interestingly, school life expectancy, the measure that proxies educational attainment which has been the standard metric for most prior research, is not statistically significant and in fact is estimated quite close to zero (b = .284, ns). In contrast, there are robust effects for both gross primary enrolment (b = -.536, $p < 0.001$) and gender parity in primary enrolment (b = -113.078, $p < 0.001$).

Figure 2 shows the magnitude of the change in child mortality given the variances of the three indicators. As would be expected, the estimates for school life expectancy are change little across the range of the measure and all confidence intervals overlap. Estimated mortality is approximately the sample mean (40 per 1,000). In contrast, there is a fairly steep gradient for gross primary enrolment. Here, estimated mortality is 81 per 1,000 when gross primary enrolment is very low (30 percent) and this decreases to 27 per 1,000 when enrolment is very high 130 percent.[1] The gradient is even steeper with respect to gender parity in primary enrolment. Here, estimated child mortality is 106 per 1,000 when gender parity is low (0.4), yet only 16 per 1,000 when parity favors women (1.2).

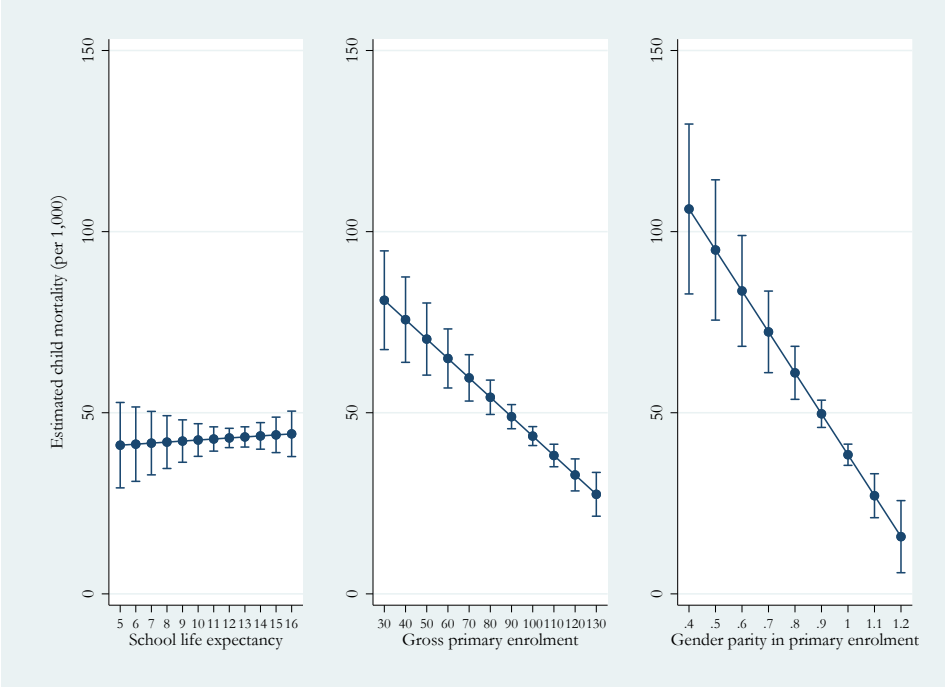

Figure 2: Estimated child mortality bvy extent of mass primary education.

The effects of mass education on child mortality are somewhat different for secondary education. Here, model two shows statistically significant effects for school life expectancy (b = -3.328, $p < 0.01$) and gender parity in secondary enrolment (b = -133.521, $p < 0.001$). In contrast, the coefficient for gross secondary enrolment is almost zero (b = 0.09, ns). Figure 3 shows the variation in estimated child mortality at different levels of mass education for the three indicators. For school life expectancy, estimated

[1] One interpretation of values greater than 100 percent is that mass education is divorced from eligible cohorts which actually speaks to a greater level of institutionalization.

mortality is 61 per 1,000 when expectancy is very low (5). This decreases to 46 per 1,000 when expectancy is average (10) and 29 per 1,000 when expectancy is high (16). In contrast, there is little variation across levels of gross secondary enrolment with all estimates around 40 per 1,000 and confidence intervals overlapping. The education gradient is largest and substantively very large with respect to gender parity in secondary enrolment. When gender parity is low (< 0.5), estimated mortality is 120 per 1,000. This decreases to 7 per 1,000 when parity high (1.2).

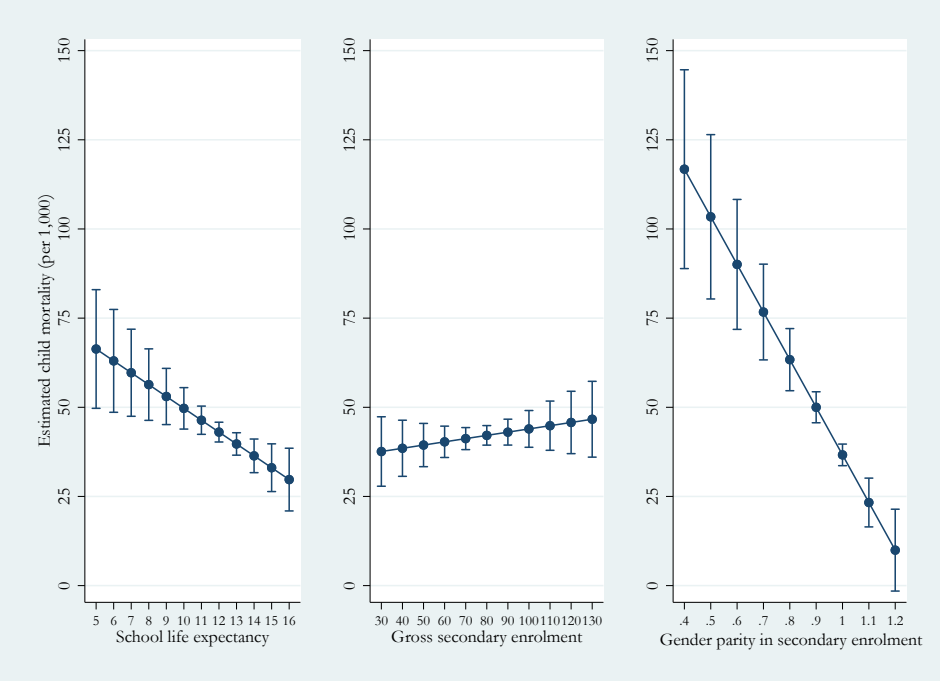

Figure 3: Estimated child mortality by extent of mass secondary education.

Effects of mass education are most complicated with respect to tertiary education. Here, the effect of school life expectancy is negative and statistically significant. Each year increase reduces the child mortality rate by over seven and a half ($b = -7.682$, $p < 0.001$). In contrast, gross tertiary enrolment is associated with a small but significant increase in child mortality ($b = 0.705$, $p < 0.001$). Gender parity in tertiary enrolment again in contrast is associated with a significant decrease in child mortality ($b = -3.900$, $p < 0.05$). Figure 4 shows variation in estimated child mortality by the different indicators of mass education. As before, school life expectancy shows significant variation. At low levels of expectancy (5), estimated mortality is 98 per 1,000. This decreases to 13 per 1,000 when expectancy is very high (16). In contrast, there is a substantial positive

gradient for gross tertiary enrolment. When enrolment is very low (10), estimated mortality is 24 per 1,000. This increases to 100 per 1,000 when gross enrolment is very high (120). Finally, there is a weaker but still significant gradient with respect to gender parity in tertiary enrolment. At low levels of parity, estimated mortality is 51 per 1,000. This decreases to 30 per 1,000 when parity favors women (1.3).

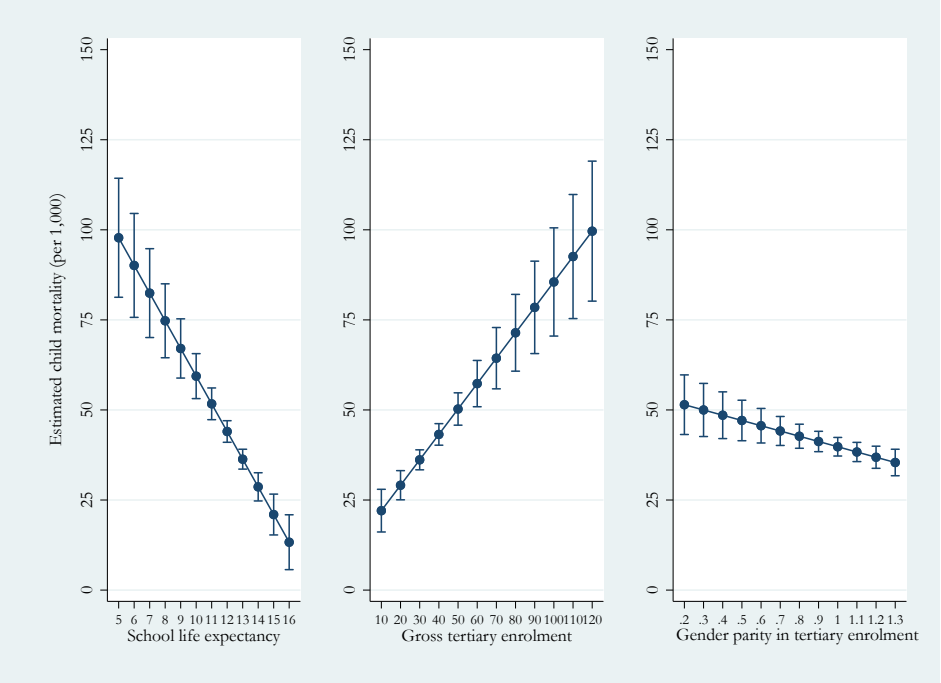

Figure 4: Estimated child mortality by extent of mass tertiary education.

5 Conclusion

The expansion of mass education is one of the core social dynamics of the modern era and social scientists have devoted considerable attention to understanding the broad implications of mass education for social and economic development (Autor et al. 1998; Goldin & Katz 2018; Rubinson & Fuller 1992). In demography, research has focused particular attention on implications for population health with recent work stressing education attainment as a key aspect of socioeconomic status that many view as a fundamental cause of health and health disparities Link and Phelan (1995).

In this paper, we argue for a broader conceptualization of mass education. To date, the majority of research has focused on the vertical dimension of education that

involves variation in average educational attainment for a population. At the same time, mass education involves a horizontal dimension that captures the extent of educational participation and an integrative dimension that is measured in our work as gender parity in enrolments. Equally important, these three dimensions exist simultaneously and in different combinations at the primary, secondary, and tertiary levels. Our research operationalizes these dimensions and investigates their relationship with child mortality in a diverse cross-national panel.

Although there are a number of important findings, three are particularly salient. First, the traditional focus of social science research, the vertical dimension, has small and variable effects. This raises important questions as to why, particularly given its hegemonic status in social epidemiological research. One explanation is the global conceptualization of education as related to human capital (Becker et al. 1994). From this perspective, education produces variation in the amount of human capital, personally and socially, and hence measurement of the institutional processes and attainments that produce more education is the common operationalization. Sociologists, in contrast, recognize the social and cultural capital dimensions of education (Bourdieu 2013; Coleman 1988), as well as the social value that comes with particular credentials (Collins 1979). The latter view calls into question a generic more equals better perspective that is reflected in a human capital perspective.

There is also the issue that school life expectancy has an empirical association with other dimensions of education and hence analyses that only include a vertical dimension may overestimate effects. Results not shown indicate that the coefficient for school life expectancy is almost twice as large when aspects of enrolment and parity are not included. Add to this the fact that different levels of school life expectancy reflect different extents of primary, secondary, and tertiary enrolments. If mass education varies depending upon the extent of institutionalization of different levels, then omnibus measures will again misrepresent associations. Our analyses indicate the value of a broader conceptualization of mass education and suggest that prior work may highlight aspects that are ultimately not particularly significant.

Second, easily the strongest and most robust associations are seen for gender parity in enrolment. Although there is variation in the magnitude of effects, greater parity produces large reductions in child mortality. At the primary level, increasing parity

moves child mortality from very high to very low levels, from 113 to 15 per 1,000. This is a very large effect. If one uses logged GDP as a benchmark, the change in mortality from low to high economic development, 54 to 27 per 1,000, is considerably smaller.

The gender parity effects highlight the double-edged sword of mass education. Although the institutionalization of mass education is not in dispute and in fact is remarkably pervasive across societies of vastly different cultures and economies (Boli et al. 1985; Meyer et al. 1992; Schofer & Meyer 2005), mass education intersects with a variety of social structures that give it unique shape and meaning in particular social contexts. In particular, mass education occurs against a backdrop of socioeconomic inequalities that typically predate expansion and have long and pervasive historieas. One implication of this is the long-standing concern that mass education both reflects and reproduces existing inequalities in societies unless there exist norms, policies, and practices that make education more available to historically marginalized groups in society (Lipman 2004). Although our work is limited to examination of gender differences in access to education, the results still highlight the critical importance of equity in educational access for population health. Although it will likely require reduction in scope, further study of racial, ethnic, and socioeconomic parities would seem a fruitful avenue of inquiry.

Finally, a broad assessment of the coefficients highlights important differences between the different stages of education and suggests that the strongest health gains are seen for mass education at the primary level. If one thinks about joint effects given the quasi-independence of the measures, the variation based on increases in horizontal and integrative mass education are striking. When gross primary enrolment and gender parity are low (30 and 0.6, respectively), estimated child mortality is very high 125 per 1,000. And this is not a rare situation. In our data, 24 countries contributing over 200 country-periods have low primary enrolments and high gender disparities (e.g., Afghanistan, Djibouti, Ethiopia, Gambia, Mali, and Niger). By comparison, estimated mortality is 12 per 1,000, when both gross primary enrolment and gender parity are high (greater than 100 and greater than 1). Although reports of successes and on-going challenges of the UN's Sustainable Development Goals indicate substantial improvement in access to primary education and increased enrolments of girls, recent reports still show a significant number of countries and concomitantly tens, if not hundreds, of millions of children, where intake is weak and women remain excluded (United Nations

2017). If our research is a useful reference point, the mortality differential is ten-fold when mass education is both horizontal ***and*** integrative at the primary level. Education that absorbs populations early and does so in a way that incorporates women is uniquely beneficial in reducing mortality. Ultimately, such strategies may be vital to development strategies for world society.

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