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**Do Schooling Reforms Also Improve Long-Run Health?**

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# Do Schooling Reforms Also Improve Long-Run Health?

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**Abstract:** An association between health and education has been well-established empirically. It is not clear however whether this represents a causal effect and, if so, in which direction. Recent research has attempted to unravel this by using educational reforms, such as compulsory schooling laws, as exogenous sources of variation in education and examining their long-run effects on a variety of health outcomes. When proper account is taken of age, cohort, and state specific effects, it is difficult to establish a credible causal link from educational reforms which affect the quantity of education to health. Thus the balance of research so far suggests that it would be imprudent to assign a causal effect from educational reforms to long-run health

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# Do Schooling Reforms Also Improve Long-Run Health?<sup>1</sup>

## Introduction and Motivation

There is considerable evidence linking education (whether measured by years of schooling, or highest level of education attained) with a variety of health outcomes [1]. However, such evidence is consistent with (a) greater education causing better health (b) better health causing greater education or (c) a third unknown factor which simultaneously affects both health and education. In order to isolate a causal link from education to health, researchers have attempted to identify truly exogenous changes in education and then examined their effect upon health. One set of such exogenous changes is the educational reforms enacted in the 20<sup>th</sup> century, most of which involved increases in compulsory education.

The identification of a causal link between education and health has important policy implications. As well as providing benefits in terms of improved educational outcomes, there would be a double-dividend with improved health outcomes. In the limit, it could prove to be the case that educational reforms might be the most cost-effective method of improving health outcomes. Thus it is important to assess carefully the evidence concerning such a link.

## Discussion of Pros and Cons

The existence of a correlation between health outcomes and education has been known since at least the early 1970s [2], when differences in mortality by educational categories in the US were observed for both genders. This finding has been echoed in many other studies for other countries and time periods [1]. Theoretical support for this empirical regularity was also provided by the influential contribution of Grossman, who developed a model whereby health and education were both dimensions of human capital and which predicted a correlation between the two [3]. In this model health was regarded as both a consumption and a capital good. It was a consumption good in that good health (or the absence of bad health) is valued in its own right and it was a capital good in that good health enhanced productivity in the labour market.

The observed correlation between health and education, however, is consistent with a number of potential pathways. Causality can run from education to health if more educated people are more efficient at using existing health inputs, or if they choose a more efficient set of health inputs. Higher educated people will also, on average, have higher incomes and so may be able to purchase more, and better-quality, health inputs, such as diet and gym membership. However a case can also be made for causality from health to education, particularly health in childhood and adolescence. Since important educational decisions are typically made at these ages, poor health may lead to lower investment in education. If poor health in

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<sup>1</sup> This is the first draft of a paper submitted to IZA World of Labor Series.

childhood is correlated with poor health in adulthood, then a correlation between health and education will be observed.

It is also possible that there is no direct link between health and education, but instead a third, perhaps unobserved, factor is simultaneously influencing them both. Perhaps the most common suggested third factor is time-preference, or patience, the willingness to incur costs now (e.g. investing in education and health) in order to receive benefits in the future. In turn, time-preference itself may be influenced by education and/or health. More educated people can expect higher incomes later in life and so may be inclined to weight the future more heavily. Similarly, healthier people, who can anticipate living longer, may place a higher weight upon the future than those whose life-expectancy is lower.

Thus we have a complex pattern of relationships between health, education and other factors, with causality potentially running in a number of different directions. One way of disentangling this pattern is to identify a clearly exogenous source of change in education or health. This challenge has also arisen in research into the pecuniary returns to education, and one approach which has been applied in this area is to exploit the changes in compulsory schooling laws which have been implemented in a number of countries, many of them during the expansion of the welfare state in the aftermath of the second world war. These changes often involved the raising of the earliest age at which a child could leave school and since the changes were compulsory, they cannot be regarded as having been chosen by the individuals concerned, or their families. Research in this area of financial returns to education indicated that this approach performed a good job in terms of isolating an exogenous change in education. Applying the approach to the question addressed here, the extra year's schooling obtained following these reforms should not be correlated with other decisions which might also affect health. In addition since these changes were imposed by the government and were compulsory, it seems reasonable that compliance would have been high.

#### *Early Studies Exploiting Compulsory Schooling Laws*

An early and influential study which exploited compulsory schooling laws as a source of exogenous variation in schooling analysed the effects of a sequence of compulsory schooling laws which were passed in various US states between 1915 and 1939 [4]. Over that period, in excess of 30 states changed their compulsory schooling and child labour laws leading to children taking more schooling than if they had chosen themselves. As these law changes were not all implemented at the same time, different people would have experienced different levels of education for reasons that are arguably unrelated to other determinants of health. Results from cell-level data suggested that an additional year of schooling could lower mortality rates over a ten year period by up to 60 per cent. However the results do not appear to be robust to the inclusion of state specific time trends and arguably more accurate timing of the introduction of compulsory laws. Analysis using individual level data suggest that compulsory schooling laws may have improved overall general health status though significant results are not obtained for specific conditions [5].

### *Subsequent Studies*

Subsequent studies in a variety of countries which have exploited changes in compulsory schooling laws have produced mixed results. While all exploiting such law changes, there have still been differences between the studies on a number of dimensions. The date of introduction of the reform has ranged from the 1920s (Netherlands) up to the 1970s (Denmark and the UK). Thus reforms introduced later on, in the 1970s, have only been able to test for mortality effects up to around age 55. Studies have also differed in terms of the dimensions of health which have been analysed, with some studies focussing on mortality, while other studies have looked at specific conditions or health behaviours. The majority of studies have used individual level data, but in some cases cell level data has been used. Finally, the research design employed to detect the health effect has differed, with some approaches relying upon stronger statistical assumptions than others, and hence not being quite so robust.

Is there any discernible pattern which can be detected from this variety of results? There do appear to be some factors which appear to be associated with whether or not a causal effect is obtained. First of all, earlier reforms appear to have been more effective. One of the most comprehensive studies looks at the Dutch schooling reform introduced in 1928 [6]. This study has the advantage of a large sample size, though owing to data issues it is only possible to detect mortality effects after age 80. However, it seems arguable that the results obtained act as a lower bound, since at worst, no effects would be found for ages below 80. It finds that for men surviving to age 81, an additional year of schooling reduces the probability of dying before 89 by nearly three percentage points, compared to a baseline probability of 50 per cent. These are significant effects, although data limitations imply that effects can only be detected for those who survive up to age 80. However, the authors point out that greater effects might be found with a younger sample, and this study is one of the more convincing ones which finds a causal effect from a compulsory schooling reform to health.

Another study which examined one of the earlier reforms found that a 1936 reform in Sweden, which was introduced over a twelve year period led to discernible reductions in mortality before the age of 30, and the effect grew in magnitude up to age 60 [7]. These effects are arguably implausibly large, however this study did not use individual level data, a point to which we return below.

Many of the reforms in compulsory schooling happened in the years immediately following the Second World War, and in general these studies find little or no causal effect. It is possible that no effect is found as people affected by these reforms would have been aged in their 60s around the time the studies were carried out and it is possible that health benefits of extra education do not appear until older ages. One counter-example to this is a study of changes in German compulsory schooling laws applied between 1949 and 1969 and which finds a significant causal effect of schooling on long-term illness and disability for men [8].

A study for France looked at two different educational reforms, one implemented in the 1930s and the other in the 1960s, the latter reform increasing school leaving age by two years

[9]. This study employs a credible research design, yet fails to find any influence of the educational reforms on mortality. For the first of these reforms mortality up to age 80 is analysed, while for the second reform it is mortality up to age 50.

A second factor which appears to exert some influence upon results is the unit of observation i.e. whether the data is at individual or cell level. Results for cell level data generally show more of an effect ([1], [7]) but these are ecological inferences i.e. inferences about individual behaviour drawn from data on aggregates albeit that there may be quite a high degree of disaggregation. Such studies can, however, be susceptible to an ecological fallacy, whereby if an effect is observed for a group it is assumed it also holds for the individual.

Research design may also exert an influence on results. Perhaps the ideal research design would be a randomised controlled trial, where some children (chosen at random) were exposed to an extra years schooling and others were not. It seems clear that it is neither practical nor ethically acceptable to carry out such a trial and hence researchers are faced with the challenge of isolating a form of randomisation via what is sometimes called a “natural experiment”.

The intuition behind the approach of using compulsory schooling to identify a causal effect is that such schooling (or the extra schooling which the reform entails) is not a choice consciously made by an individual, but rather it is exogenously imposed upon them. Many studies approach this by examining the correlation between health and a measure of schooling where instead of using actual years of schooling, they use predicted schooling, taking account of the extra schooling imposed by the reform. This measure of schooling (known as the instrumental variable, IV) is designed to produce a measure of schooling which is truly exogenous and outside the choice of the individual, and hence a correlation between a health outcome and this schooling measure can be viewed as causal.

An alternative approach to using compulsory schooling laws to identify a causal effect is where there is a clear discontinuity (e.g. by year or preferably month of birth) in schooling laws. Presuming there is a large enough sample, then in looking at health outcomes for individuals either side of this discontinuity, it is reasonable to assume that all other factors which might affect health (apart from schooling) are equal between the two groups. This is known as a regression discontinuity (RD) approach and it is generally considered to be one of the most robust approaches to identifying causal effects, in the absence of a randomised trial. In particular, it imposes fewer assumptions than the IV approach.

A study which examined the UK schooling reforms of 1947 and 1972 employed a very strong RD approach [10]. The first of these reforms raised the school leaving age from 14 to 15 and came into effect on April 1<sup>st</sup>, 1947. Since the authors had information on month of birth, this offered a very sharp discontinuity between those affected (the treatment group) and not affected (the control group) by the reform. Thus treatment and control groups are born only one month apart, and so would almost certainly have been subjected to the same set of contemporaneous factors affecting health. Using a combination of individual and cell level data, the authors find no effect of the reforms on mortality. The authors also use an

instrumental variable approach to examine the effect on other health measures and find no effect.

Of the studies which appear to have the strongest research design, we thus find that two studies find no effect [9, 10], while another finds quite a strong effect, though only for older men [6] and within this category, the study with the tightest RD design finds no effect [10]. It is also noteworthy that the influential US study which found large mortality effects using cell level data and an IV strategy, failed to find effects using individual level data and the more robust RD approach [1].

Finally, for those studies which do find a causal effect, it appears that the effects may not be homogenous across gender and socioeconomic status. For example, the Dutch and German studies referred to above find effects for men only ([6], [8]), while there is evidence for Sweden that effects are greater for lower socioeconomic groups [11]. This reflects a more general point which we return to below, which is that different compulsory schooling laws may have affected different groups at different times. Thus even if convincing evidence could be found that a specific reform did produce health benefits, that is no guarantee that such a result could be replicated elsewhere.

The evidence so far seems to indicate conflicting evidence regarding the presence of a causal effect from education to health, though there do seem to be some common factors associated with those studies where effects are found. Is it possible to come to a coherent conclusion in the face of these seemingly contradictory results? First of all, each of these schooling reforms, and their effect upon health, must be seen as context dependent i.e. evaluated in terms of the specific local circumstances which applied at the time. This may explain why earlier reforms appear to find effects and why such effects are found more often for men. Earlier reforms typically had high compliance and in some cases the reforms increased schooling by more than a year.

Earlier reforms may also have been effective owing to an “incarceration effect” Thus the earlier reforms in countries such as the Netherlands had the effect of keeping young males in school for longer, and away from the alternative, which was often tough physical labour, the more so for males of lower socio-economic background. This can be viewed as a (benign) form of incarceration and may also explain why the UK reforms of 1947 and 1972 show less of an effect, since the alternative of not being in school may have had less severe health consequences. The phenomenon of an incarceration effect is also consistent with the fact that for some school reforms, there was little or no change in the curriculum [7], reducing the possibility that extra education led to increased knowledge, which in turn might have had health benefits. This is also supported by the relative lack of an effect of compulsory schooling reforms on health behaviours (such as smoking).

However, if the effects which have been discovered so far are due to an incarceration effect and the removal of young men from physically demanding labour, the policy implication is that health benefits of further compulsory schooling laws are unlikely to be seen for advanced industrialised countries, where heavy physical labour in areas such as agriculture has all but

vanished. For developing countries however, compulsory schooling may yet bring health benefits.

Thus while some studies show effects, it seems fairest to say that the case so far is unproven. However, the evidence reviewed in this article has referred to the possible causal effect of a fairly specific educational reform i.e. the effect of one or two extra years of compulsory education in early to mid-teens. The absence of clear evidence for a health benefit of such a reform does not imply that extra education at other stages of the life-cycle does not have positive health benefits. For example, it is quite plausible that increased third level education may lead to greater efficiency in both the choice and use of health inputs. It may also enhance qualities such as patience, which in turn may lead to greater health investments.

Unfortunately, there are no analogues to compulsory schooling laws when analysing third level education and its impact upon health. Other research designs which have used the Vietnam draft in the US to generate random variation in education have found some effects of college education on health behaviours [12], but in general the research design has not been as robust as the RD studies referenced earlier.

Compulsory schooling laws clearly have an impact upon the quantity of education, but might the quality of education also be important in terms of health benefits? Note that if the incarceration effect is the principal pathway whereby education affects health, then there may be comparatively low health returns from higher quality education, since the incarceration effect presumably operates irrespective of the quality of education. Educational quality is inherently more difficult to measure than quantity, and different factors may contribute to quality according to the stage of education (e.g. class size in primary and secondary education and quality of faculty in third level education).

Studies have examined the convergence in school quality between blacks and whites in the US in the 20<sup>th</sup> century to investigate how much this contributed to convergence in health outcomes [13]. School quality is measured as a combination of pupil-teacher ratio, length of school year and teachers' wages. Statistically significant results are found for disability status, but not for self-related health, obesity or smoking behaviour. However, as before, these results, which show only modest effects in a limited measure of health, may be highly context specific and it is not clear that they would generalise to more conventional settings where policy makers may attempt to improve school quality.

## **Limitations and Gaps**

The results reviewed above show that it is still not entirely clear-cut as to whether there is a causal effect from education reforms to health. Even in those cases where an effect has been observed, there is still some ambiguity as to the precise mechanism underlying the effect. In most reforms observed there is relatively little change in the curriculum covered, hence it seems unlikely that an effect is observed arising from a broader curriculum. Hence it may be the case that simply by staying in school, individuals have reduced exposure to adverse health

shocks and conditions. It may also be the case that the extra years of education enable the existing curriculum to be covered in greater depth or detail, but lack of the precise mechanism at work constitutes a clear gap in our knowledge.

An implication of this gap in knowledge is that the general applicability of these policies is reduced. Confusion over why reforms may (or may not) provide health benefits increases the risk associated with implementing such a policy, though of course there may well be non-health benefits associated with the policy and indeed these may be the principal reason for introducing the policy in the first place.

The nature of reforms which address the quantity of schooling also limit their general applicability. Unlike more conventional policies which may be changed on a year by year basis, changes in compulsory schooling laws are typically only introduced at long and infrequent intervals. Most countries in Western Europe introduced one, or at most two, such reforms in the last 100 years. Thus these reforms are not part of the conventional toolkit which policy makers have at their disposal.

## **Summary and Policy Advice**

Overall, the results from using compulsory schooling reforms as a means of identifying a causal effect from education to health are ambiguous. Effects are found in some cases, but not in others. Trying to adjust for the quality of data and research design, on balance the evidence seems to be tentatively against such a causal effect. There are some factors alluded to above which appear to be correlated with the presence of health benefits, but overall results do appear to be time, country and context specific.

The fact that results appear to be so context specific poses problems for policy-makers. If they hope to bring about an improvement in health via an educational reform which increases schooling years, then they need to be very careful as regards the setting in which this reform will be implemented. In some cases for simple historical reasons it may not be possible to replicate those conditions from earlier times which appear to give the best chance of educational reforms also providing health benefits. It may be that for many countries the low-hanging fruit in this area has already been picked and further compulsory schooling reforms would not provide health benefits. This is less likely to be the case for low income countries where current educational attainments are more modest and it seems there is a greater chance of a health dividend from educational reforms.

For other countries, it seems safest to suggest that policy-makers would be unwise to expect that health benefits will automatically accrue from educational reforms, certainly from compulsory reforms which increase the quantity of schooling. If such reforms are to be introduced, it appears to be best that they be introduced on account of their educational, as opposed to their health, merits.

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