

## Helpdesk Report: Child Health and Parents' Education

Date: 18<sup>th</sup> November 2011

**Query:** What is the evidence about the associations between child health outcomes and mothers' (or parents') education? Does education have an impact on child survival and where are published papers about this? How much education delivers what kind of impact? What is the nature of the difference (for example, better preventive management of children in the home, improved income, strengthened decision-making about seeking care, adherence to treatment etc.)?

**Enquirer:** DFID UK

### Content

1. Overview
2. Key Papers
3. Impact of Parental Education on Child Health and Child Survival
4. Level of Education Needed
5. What is the Nature of the Difference?
6. Evidence Disputing the Relationship
7. Additional References
8. Additional Information

### 1. Overview

This review shows that there is evidence of an association between child health outcomes and parents' education. This relationship is particularly pronounced when considering the impact of maternal education. Section 2 presents some key papers showing this relationship, including one recent paper arguing that of the 8.2 million fewer deaths in children under 5 between 1970 and 2009, 51.2% could be attributed to increased educational attainment in women of reproductive age.

Section 3 includes further published papers evidencing this association. Many indicate that maternal education is closely related to child health measured either by nutritional status, child height, weight for age or by infant and child mortality. The effect of father's education on infant and child mortality appears to be smaller, and some papers claim the effect is about one half that of mother's education.

The level of education a mother needs to have an impact on their child's health is shown in Section 4. It has been shown that even one to three years of maternal schooling is associated

with a large reduction in the risks of childhood death and this modest exposure to primary schooling is rarely sufficient to impart lasting reading and writing skills. However, even a few years at school may improve oral literacy, namely the understanding of decontextualised language (i.e. formal distanced language in which meaning resides in the words and syntax alone rather than in shared contextual understandings). The relationship between length of mothers' schooling and child survival is essentially linear and has no threshold; on average a rise of one year of maternal schooling is associated with a 6-9% decline in under-five mortality.

Research showing the ways that education makes a difference is presented in Section 5. This includes the ability to acquire and understand information on the prevention and cure of childhood diseases, greater decision making power for women and improved hygiene. Additionally more highly educated people are more likely to use curative and preventive services, for example immunisation.

Section 6 includes other papers which have argued that the association is considerably less than what is expected and state that when family characteristics and mother's prior health status are taken into account the relationship may not longer be statistically significant. Additionally urban-rural differences, community education and harsh economic conditions may have more impact. However, there is more published evidence showing a strong association between parents' education and child health and mortality than papers arguing against this relationship.

Additionally, Section 7 includes a list of further recommended references and Section 8 contains comments about this issue from specialists in this area.

## 2. Key Papers

### **The benefits of educating women**

John Cleland, *The Lancet*, Volume 376, Issue 9745, Pages 933 - 934, 18 September 2010  
[http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(10\)61417-1/fulltext#bib20](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(10)61417-1/fulltext#bib20)

This paper gives an overview of the research on the association between parents' education and child health. It argues that the paper by Gakidou and colleagues (which is the next article) makes an important contribution to a topic with a long research pedigree. Caldwell's pioneering study, showing that mothers' education acted as a greater influence on child survival in Nigeria than more economic characteristics of the household, opened the floodgates to a deluge of studies on the link between parental education and child health and survival. At the individual level, key features of the statistical relationship have been firmly established. The influence of mothers' schooling is a more decisive influence than that of fathers'.

The relationship between length of mothers' schooling and child survival is essentially linear and has no threshold; even a few years of primary schooling, insufficient to impart functional literacy, conveys an advantage in terms of child survival. The link persists across countries with widely diverse schooling systems, suggesting that the quality of education is not an important causal element. It is stronger for the survival of children between ages 1 and 5 than in infancy, implying that mothering skills, rather than factors such as maternal nutrition and fetal growth, are implicated. Maternal education is also associated with child stunting and weight for age in a broadly parallel manner to its association with mortality.

Finally, the contextual effect of education is important. The children of poorly educated mothers are less likely to die in a setting where average educational levels are high than where they are low. For instance, the child mortality gradient by mothers' schooling is similar in the southern Indian state of Kerala, where educational levels are high to the gradient in the northern state of Uttar Pradesh where average education is much lower; but, at each specific level of maternal schooling, mortality is much lower in Kerala than in Uttar Pradesh; for example, the under-five mortality rate for the children of mothers with 1-10 years of schooling is 28 in Kerala and 91 in Uttar Pradesh.

**Increased educational attainment and its effect on child mortality in 175 countries between 1970 and 2009: a systematic analysis**

Dr Emmanuela Gakidou, Krycia Cowling, Prof Rafael Lozano, Prof Christopher JL Murray, *The Lancet*, Volume 376, Issue 9745, Pages 959 - 974, 18 September 2010

[http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(10\)61257-3/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(10)61257-3/fulltext)

**Of 8.2 million fewer deaths in children younger than 5 years between 1970 and 2009, the authors estimated that 4.2 million (51.2%) could be attributed to increased educational attainment in women of reproductive age.**

In this study, 915 censuses and nationally representative surveys were compiled to estimate the mean number of years of education by age and sex. By use of a first-differences model, they investigated the association between child mortality and women's educational attainment, controlling for income per person and HIV seroprevalence. They then computed counterfactual estimates of child mortality for every country year between 1970 and 2009.

The global mean number of years of education increased from 4.7 years (95% uncertainty interval 4.4—5.1) to 8.3 years (8.0—8.6) for men (aged  $\geq 25$  years) and from 3.5 years (3.2—3.9) to 7.1 years (6.7—7.5) for women (aged  $\geq 25$  years). For women of reproductive age (15—44 years) in developing countries, the years of schooling increased from 2.2 years (2.0—2.4) to 7.2 years (6.8—7.6). By 2009, in 87 countries, women (aged 25—34 years) had higher educational attainment than had men (aged 25—34 years).

Substantial progress has been made in education in the past 40 years, especially in developing countries, where the mean number of years of education has increased substantially in men and women aged 15 years and older between 1970 and 2009. For women of reproductive age (15—44 years) in developing countries, the increase was much greater. The rapid progress in educational attainment in women has resulted in significant reductions in the gender gap in education. The effect of educational expansion on child health has been enormous. 4.2 million deaths averted can be attributed to the increase in women's education. The authors' estimate of the effect of women's education on child mortality is very similar to that reported in 1988 by Cleland and van Ginneken. In sub-Saharan Africa, if women's education had not increased, the number of child deaths would have increased during the period of the MDGs as a result of the HIV epidemic.

In developing countries, since women aged 15—24 years have higher educational attainment than do those aged 25—34 years and 35—44 years, educational attainment for women of reproductive age as a group will continue to steadily rise. The expansion of women's education will have serious implications for global health in the next few decades. Increases in educational attainment will probably lead to more rapid reductions in the total fertility rate, even in sub-Saharan Africa. Research suggests that education is associated with a reduction in the demand for children and thus increased demand for family planning services. The authors' findings

might be important to individuals advocating increased investment in the provision of family planning services in sub-Saharan Africa. Since more educated women are more likely to use health services, and specifically preventive interventions, the steadily rising women's educational attainment in all areas of sub-Saharan Africa, except for the Sahel, will probably result in greater uptake of new maternal, newborn, and child interventions.

By contrast with the substantial effect of increased education, economic growth has contributed to a reduction of 586,388 child deaths (7.2%) since 1970, partly because economic growth has been slow in regions such as sub-Saharan Africa, where 48.9% of child deaths occur. Analysis of the past four decades has shown that trends in educational attainment and income per person are not always closely correlated—the correlation of yearly rates of change was 0.27. In countries with less than 1% growth per year in GDP from 1990 to 2009, educational attainment in adults older than 25 years has increased by a mean of 1.9 years (40%) during the same period. The rise in educational attainment in regions without economic growth is probably attributable to a combination of increased domestic financing of education and enhanced development assistance for education. This effect is an important demonstration of how global, regional, and national policies emphasising the expansion of primary education have led to changes that are disconnected from general economic growth, even if in the long term these policy changes will encourage rapid growth.

### The effect of Educational Attainment on Survival and Health

John G. Cleland and Jeroen K. van Ginneken, International Encyclopedia of Public Health, Pages 295-303, 2008

<http://www.sciencedirect.com/science/article/pii/B9780123739605005542>

Maternal education has a strong impact on infant and child mortality; on average a rise of one year of maternal schooling is associated with a 6-9% decline in under-five mortality. Evidence from developed countries is provided on the influence of education on adult mortality. In many countries, male adult mortality in the lowest educational group is about twice as high as in the highest educational group; for women the impact is less. In both parts much attention is paid to the various mechanisms or intervening factors that explain how education influences health.

Figure 1: Relative risks of death by mother's years of schooling: average results from 24 national surveys

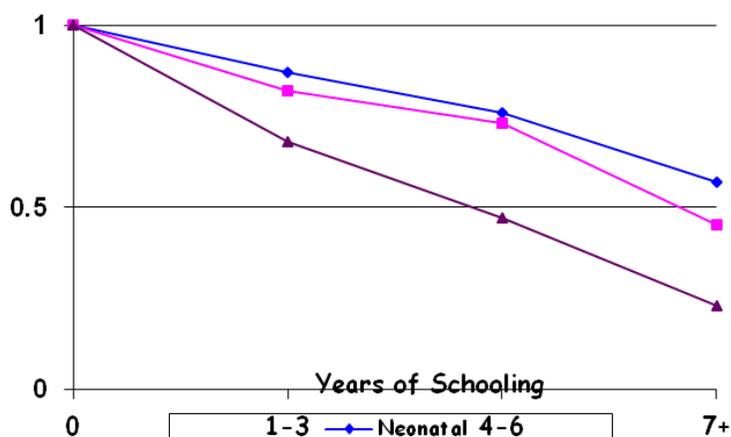
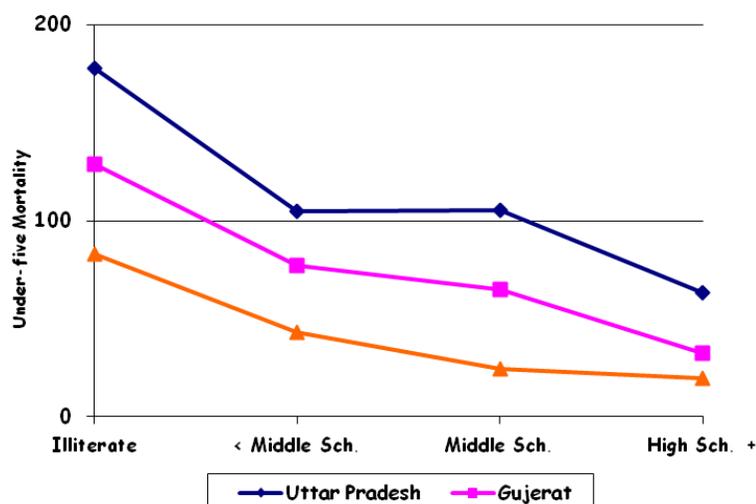


Figure 2 Child Mortality by Mother's Schooling: Selected Indian States circa 1990



There is nothing new about the belief that the spread of education with its impact on knowledge and outlook is a central force underlying mortality decline and fertility decline. However, in most early studies, education was regarded as an indicator of broad socio-economic status and thus the common finding of a strong universe relationship between length and schooling and mortality was accorded an economic interpretation. In recent decades, more attempts have been made to isolate the effect of education from its economic and other correlates and to identify the causal pathways.

The link is strong and essentially linear, with no threshold. A rise of one year of maternal schooling is typically associated with a 6-9% drop in under-five mortality and this relationship is apparent even at one, two or three years of schooling. Second, the link is considerably stronger in childhood (years one to five) than in infancy. Third, crude associations between fathers' schooling and child survival are similar in magnitude to those for mothers' education but multivariate analyses have shown that mothers' education generally has a more decisive influence, thus justifying the focus on maternal influences.

A compilation of data from 19 low income countries demonstrated that maternal education is associated with stunting and weight-for-age in a broadly parallel manner to its association with mortality. The median estimates of the percentage stunted among children aged 3-35 months were 35.6%, 28.9% and 16.4% for children of mothers with no schooling, primary schooling and secondary or higher schooling, respectively.

There is evidence to show that the relative advantage of maternal education is just as strong in low mortality areas as in high mortality areas. They observed a strong impact of education on adult mortality in Western industrialised countries and in Eastern Europe. In many nations, male adult mortality of the lowest educational group is 1.6 to 2.2 times higher than in the highest educational group. For adult women, the impact is less.

### 3. Impact of Parental Education on Child Health and Child Survival

#### **Adult Education and Child Mortality in India: The Influence of Caste, Household Wealth, and Urbanisation**

Archana Singh-Manoux, Aline Dugravot, George Davey Smith, Malavika Subramanyam, and S. V. Subramania, *Epidemiology*, 2008;19: 294–301

[http://www.hsph.harvard.edu/faculty/sv-subramanian/files/epi2008\\_19\\_2\\_294\\_301.pdf](http://www.hsph.harvard.edu/faculty/sv-subramanian/files/epi2008_19_2_294_301.pdf)

Compared with those who had no education, 9 or more years of education for the head of household and for the spouse were associated with lower child mortality (odds ratio [OR] \_ 0.54; 95% confidence interval [CI] \_ 0.48–0.62 and OR \_ 0.44; 95% CI \_ 0.36–0.54, respectively) in analyses adjusted for age, sex, and state of residence. Further adjustments for caste and urbanisation attenuated these associations slightly; when adjustments were made for household wealth the associations were attenuated more substantially. Nevertheless, in fully adjusted models, 9 or more years of education for the head of household (OR \_ 0.81; 95% CI \_ 0.70–0.93) and the spouse (OR \_ 0.75; 95% CI \_ 0.60–0.94) remained associated with lower child mortality. There was no effect modification of this association by caste, household wealth and urbanisation.

**TABLE 1.** Characteristics of the Study Population in Relation to Indicators of Socioeconomic Position

	Included in the Analysis (n = 66,367)		Missing Data (n = 9044)	
	No. (%)	% Dead	No. (%)	% Dead
Education of the head of household				
No schooling	24,237 (36.5)	4.3	844 (9.3)	3.8
1–8 yrs	24,674 (37.2)	3.7	472 (5.2)	2.5
9 yrs or more	17,456 (26.3)	2.1	254 (2.8)	2.8
Missing data			7474 (82.6)	3.5
Education of spouse				
No schooling	43,328 (65.3)	4.2	204 (2.3)	2.0
1–8 yr	15,697 (23.7)	2.6	74 (0.8)	2.7
9 yr or more	7342 (11.1)	1.5	24 (0.3)	0
Missing data			8742 (96.7)	3.5
Caste				
Scheduled caste	12,048 (18.2)	4.0	1512 (16.7)	4.0
Scheduled tribe	9830 (14.8)	4.7	1120 (12.4)	4.9
Other backward caste	18,836 (28.4)	3.5	2470 (27.3)	3.6
No caste	3539 (5.3)	3.7	540 (6.0)	2.2
Other caste	22,114 (33.3)	2.7	3402 (37.6)	2.9
Household wealth				
Poorest quintile	14,391 (21.7)	5.2	1723 (20.8)	5.1
Second quintile	13,692 (20.6)	4.5	1607 (20.8)	4.8
Third quintile	12,300 (18.5)	3.6	1657 (20.6)	3.3
Fourth quintile	13,134 (19.8)	2.5	1936 (21.2)	3.2
Top quintile	12,850 (19.4)	1.4	2121 (16.7)	1.5
Urbanization				
Village	49,385 (74.4)	4.0	6557 (72.5)	3.6
Town	7783 (11.7)	2.4	1030 (11.4)	3.5
Small city	3427 (5.2)	1.9	545 (6.0)	2.4
Large city	5772 (8.7)	1.5	912 (10.1)	3.2

### Like Father, like Son; Like Mother, like Daughter: Parental Resources and Child Height

Duncan Thomas, *The Journal of Human Resources*, Vol. 29, No. 4, Special Issue: The Family and Intergenerational Relations. (Autumn, 1994), pp. 950-988.

[http://www.dial.prd.fr/articles/master\\_ape/CRI6/Duncan\\_thomas\\_Child\\_height.pdf](http://www.dial.prd.fr/articles/master_ape/CRI6/Duncan_thomas_Child_height.pdf)

Using household survey data from the United States, Brazil and Ghana, this paper examines the relationship between parental education and child height, an indicator of health and nutritional status. In all three countries, the education of the mother has a bigger effect on her daughter's height; paternal education, in contrast, has a bigger impact on his son's height. There are, apparently, differences in the allocation of household resources depending on the gender of the child and these differences vary with the gender of the parent. These results are quite robust and persist even after including controls for unobserved household effects.

In Ghana, relative to other women, the education of a woman who is better educated than her husband has a bigger impact on the height of her daughter than her son. In Brazil, women's non-labour income has a positive impact on the health of her daughter but not on her son's health. If relative education of parents and non-labour income are indicators of power in

household allocation decisions, then these results, along with difference-in-difference of estimated income effects, suggest that gender differences in resource allocations reject both technological differences in child rearing and differences in the preferences of parents.

In Ghana, if a woman is better educated than her husband, then her daughter benefits more and her son benefits less from her education than if the husband is better educated than his wife. If non-labour income, opportunities outside the home, and relative educational status are indicative of power in household allocation decisions, then these results suggest that more powerful women are able to assert their own preferences in the allocation of household resources.

The evidence indicates that mothers and fathers invest different amounts of resources in the human capital of their children. Mothers allocate more resources to their daughters and fathers channel resources towards their sons. This is true in the United States, Brazil and Ghana. This reflects, at least in part, the technology of child rearing which Durkheim (1933) called the sexual division of labour. A good deal of research over the last two decades by psychologists indicates that fathers play a bigger role in the development of their sons than their daughters. Fathers spend more time with their sons and sons show preference for their fathers at an early age (at least from the second year of life) (Lamb 1976; Morgan, Lye, and Condran 1988). Mothers, on the other hand, tend to spend more time with their daughters.

In sum, in a variety of economic, social and cultural settings, maternal education has a bigger impact on the height of her daughter than son whereas sons benefit more than daughters as paternal education increases. Taken together, all the evidence suggests that this does not only reflect technological differences in child rearing but, rather, it suggests that mothers prefer to allocate resources towards daughters and fathers treat their sons preferentially.

#### **Parental education and child health: intracountry evidence**

Cochrane SH, Leslie J, O'Hara DJ. *Health Policy and Education*, 1982 Mar;2(3-4):213-50  
<http://www.ncbi.nlm.nih.gov/pubmed/10298649>

This paper examines a wide range of evidence on the relationship between parental education and child health. The data reviewed here indicates that maternal education is closely related to child health measured either by nutritional status or by infant and child mortality. The effect of fathers' education on infant and child mortality appears to be about one half that of mothers' education. The exact mechanisms through which education acts to affect child health are unclear. Better nutrition among the children of the more educated has been well-documented here, but it is unclear to what extent these effects result from improved knowledge and to what extent from higher income. The analysis does suggest that income differences cannot explain all the effect or perhaps even as much as half.

#### **Empirical findings on the association between education and child health status: discussion**

Behm H, *Health Policy and Education*, 1982 Mar; 2(3-4):269-73  
<http://www.ncbi.nlm.nih.gov/pubmed/10256649>

The association between education and child mortality is found in a variety of conditions, and mother's education appears to have a stronger effect than fathers' education. The point that must be emphasised is that both the changes in mortality and education are occurring in developing countries within a historic transition from pre-capitalistic modes of production to relatively advanced, dependent, capitalistic development. Examples are included which show

the importance of considering the contextual, historical conditions which, to a certain extent, are determining both parents' education and child mortality as well as the association between them. Another point to be considered is that both the magnitude of mortality and the low educational levels are shocking in several underdeveloped countries with avoidable deaths running to the order of several million each year. The final point concerns informal education. Recently, the idea of extending health services through primary health care has received important consideration. Those programmes emphasise health education and certain community participation in health programs, but these facts are not reflected in the usual years of schooling index. In sum, the study of the association of parents' education and child mortality must be understood in the historic perspective of the different and complex social changes that are taking place in the societies of developing countries.

### **Maternal education and child survival in developing countries: The search for pathways of influence**

John G. Cleland, Jerome K. van Ginneken, *Social Science & Medicine*, Volume 27, Issue 12, 1988, Pages 1357-1368

<http://www.sciencedirect.com/science/article/pii/0277953688902018>

During the past two decades a considerable amount of information has become available from developing countries showing that maternal education has a strong impact on infant and child mortality. On average, each one-year increment in mothers' education corresponds with a 7–9% decline in under-5s' mortality. Education exercises a stronger influence in early and later childhood than in infancy. The central theme of this paper is to assess the various mechanisms or intervening factors which could explain how mother's education influences the health and survivorship of her children.

Two of the possible intervening variables, namely reproductive health patterns and more equitable treatment of sons and daughters, play a relatively minor role in the explanation of the relationship. Economic advantages associated with education (i.e. income, water and latrine facilities, housing quality, etc.) account for about one-half of the overall education-mortality relationship. The influence of use of preventive and curative health services as a group of intervening variables is complex and variable. There are countries whose primary health services are so weak that they have no effect on the health of mothers and children; there are also other countries whose health services may tend to accentuate educational disparities because of differential access. Little is known about the intervening role of health beliefs and domestic practices, but it is hypothesised that they are important in the explanation of the education-mortality relationship. Finally, suggestions for specific studies on mechanisms or intervening factors are made and the relevance of such studies for formulation of health and educational policies is stressed.

### **Childhood morbidity and treatment patterns**

Ryland S and Raggars H., *Demographic and Health Surveys Comparative Studies No 27*. Calverton MA: Macro International Inc. 1998

<http://www.measuredhs.com/pubs/pdf/CR8/CR8.pdf>

Children of mothers with more years of formal education are less likely to have had diarrhoea recently than children of less educated mothers. While this association is demonstrated for both urban and rural children, it is somewhat stronger for urban children. Perhaps, in rural areas, the greater lack of hygienic water supplies and adequate sanitary facilities preclude a significant influence of mother's education on diarrhoea.

In most countries, mothers' educational attainment is also negatively associated with the prevalence of fever. Generally, in both urban and rural areas, there is a consistent increase in the percentage of children with symptoms of Acute Lower Respiratory Infection (ALRI) and/or fever taken to a health care provider by mother's increasing educational attainment.

Overall, urban residence, higher household wealth, higher maternal education, and older maternal age are associated with a lower diarrhoea prevalence, as are better child nutritional status and full breastfeeding (among infants). A household's lack of adequate sanitary facilities and finished floors in the home, and the provision of plain water or a bottle with a nipple to younger infants (under age 6 months) are associated with a higher diarrhoea prevalence. Vaccination against measles is associated with a lower diarrhoea prevalence throughout the second and third years of life.

In rural areas, the largest regional mean difference in diarrhoea prevalence by mothers' education is seen in Latin America/Caribbean (six percentage points), because of the large positive differentials found in Brazil and Colombia (16 and 14 percentage points, respectively). A positive differential in prevalence among rural children whose mothers have the least versus the most education exceeds ten percentage points in just two other countries: Niger and Mozambique. Rural Jordan is a notable exception, with a negative differential of 12 percentage points

The regional average prevalence of use of oral rehydration solutions with urban sick children increases consistently with increasing maternal education in West/Middle Africa, South/East Africa, and South/Southeast Asia. This pattern of use is repeated in all regions, apart from Central Asia, with rural sick children. In urban areas, sick children of mothers with no formal education are less likely than sick children of mothers with a secondary or higher education to receive oral rehydration solutions by more than 20 percentage points in five countries (Ghana, Nigeria, Rwanda, Uganda and Cambodia). In only one country, Guatemala, is an equally large positive differential observed. In rural areas, a large negative differential of 20 or more percentage points is observed in nine countries (Cameroon, Nigeria, Rwanda, Zambia, Zimbabwe, Turkey, Cambodia, Nepal and Haiti).

**The report includes many tables. Two examples are included here:**

Table 3.11

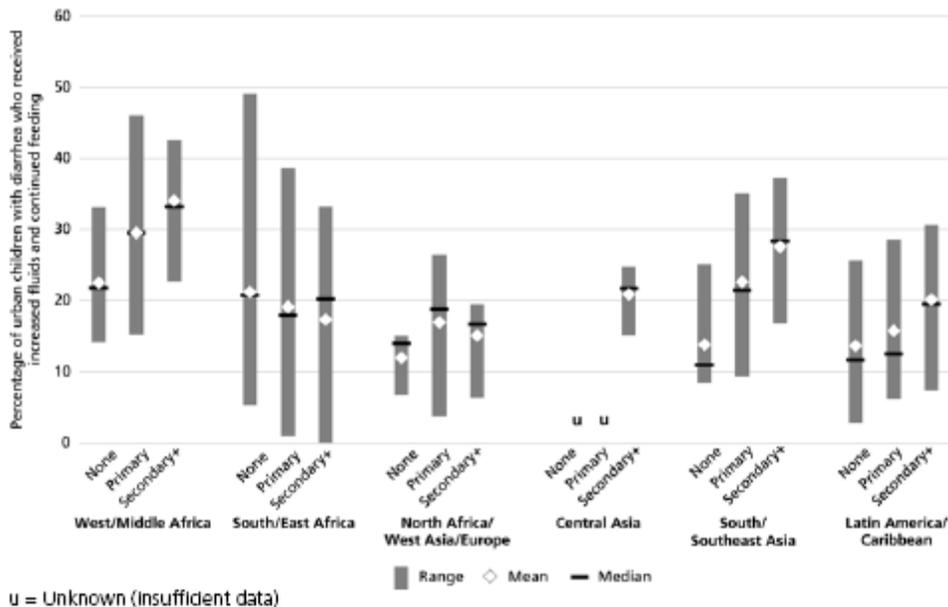
Percentage of children under age three with diarrhea in the two weeks preceding the survey who received oral rehydration solutions (ORS or RHF), by residence and mother's education, Demographic and Health Surveys 1996-2002

Survey	Urban				Number of children	Rural				Number of children
	Highest level of education			Total		Highest level of education			Total	
	None	Primary	Secondary +			None	Primary	Secondary +		
<b>West/Middle Africa</b>										
Benin 2001	33.6	(29.8)	*	36.7	129	29.8	44.4	*	33.0	340
Burkina Faso 1998-99	39.8	(42.2)	(54.5)	43.3	84	14.4	(31.6)	*	15.5	721
Cameroon 1998	(31.7)	(49.6)	50.8	44.1	106	13.9	47.2	(42.9)	30.4	323
Chad 1996-97	38.2	44.8	54.0	42.5	228	18.9	41.4	*	24.5	786
Côte d'Ivoire 1998-99	33.6	(47.9)	(43.5)	40.2	85	21.9	(31.0)	*	24.8	234
Gabon 2000	*	40.6	34.9	37.2	381	*	38.0	(42.1)	39.4	112
Ghana 1998	(27.0)	*	(51.4)	38.9	90	30.0	25.4	36.1	30.6	302
Guinea 1999	52.0	(39.1)	(54.3)	49.3	179	37.1	(51.6)	*	38.4	609
Mali 2001	49.2	72.9	61.1	55.3	288	24.8	19.8	*	24.6	1,301
Mauritania 2000-01	35.6	48.9	29.5	39.1	320	31.8	(33.6)	*	32.6	333
Niger 1998	52.5	49.2	(46.7)	51.2	231	22.3	29.9	*	22.9	1,432
Nigeria 1999	38.8	(74.0)	(76.5)	60.8	124	36.6	56.5	77.6	47.8	366
Senegal 1997	29.1	35.6	(29.4)	31.5	242	31.1	46.9	*	33.3	529
Togo 1998	30.2	33.4	(40.2)	33.5	234	18.5	22.3	(33.0)	20.0	914
Median	35.6	44.8	50.8	41.4		24.8	35.8	42.1	30.5	
Mean	37.8	46.8	48.2	43.1		25.5	37.1	46.3	29.8	
<b>South/East Africa</b>										
Comoros 1996	(34.9)	*	*	35.7	70	26.8	(33.3)	*	29.9	174
Eritrea 2002	(59.3)	75.2	(72.2)	69.6	162	47.4	56.8	*	49.4	396
Ethiopia 2000	58.5	(63.3)	61.4	60.6	150	14.0	22.3	*	15.6	1,782
Kenya 1998	*	86.5	*	81.9	103	66.7	66.2	62.5	65.7	446
Madagascar 1997	*	31.9	54.7	42.3	212	14.5	16.6	28.3	18.0	746
Malawi 2000	(36.6)	52.5	(51.6)	50.0	171	44.3	50.2	(62.6)	48.6	1,439
Mozambique 1997	(73.8)	64.1	*	66.8	247	31.4	48.0	*	40.3	540
Namibia 2000	*	(67.5)	64.2	65.5	138	65.7	44.5	70.0	58.2	244
Rwanda 2000	(7.6)	35.0	(31.8)	29.0	117	16.2	18.7	(39.5)	19.0	853
South Africa 1998	*	(87.4)	80.7	82.2	207	93.0	79.4	84.6	83.8	301
Tanzania 1999	*	(55.7)	*	55.7	49	63.6	53.6	*	55.7	266
Uganda 2000-01	(34.4)	47.4	65.5	52.6	104	44.6	41.5	(43.1)	42.5	985
Zambia 2001-02	*	54.4	64.6	58.6	315	38.3	55.0	67.2	52.8	702
Zimbabwe 1999	*	(65.5)	(70.8)	68.0	111	55.4	65.2	75.3	67.9	261
Median	36.6	63.3	64.4	59.6		44.5	49.1	62.6	49.0	
Mean	43.6	60.5	61.8	58.5		44.4	46.5	59.2	46.2	
<b>North Africa/West Asia/Europe</b>										
Armenia 2000	*	*	(41.6)	(41.6)	38	*	*	42.5	41.0	50
Egypt 2000	(29.3)	(32.7)	24.7	27.0	208	42.8	47.6	40.8	42.8	422
Jordan 2002	*	(12.1)	22.3	22.2	529	*	(26.0)	20.9	22.6	174
Turkey 1998	26.9	34.6	34.9	33.0	414	17.9	23.9	(37.9)	23.4	327
Yemen 1997	45.7	41.8	43.5	44.5	486	33.3	43.1	(43.5)	34.6	1,858
Median	29.3	33.6	34.9	33.0		33.3	34.6	40.8	34.6	
Mean	34.0	30.3	33.4	33.7		31.3	35.2	37.1	32.9	
<b>Central Asia</b>										
Kazakhstan 1999	*	*	41.6	41.6	65	*	*	21.3	22.6	82
Kyrgyz Rep. 1997	*	*	(32.1)	(32.1)	38	*	*	46.8	46.8	156
Turkmenistan 2000	*	*	(55.5)	(56.0)	50	*	*	(49.0)	(50.1)	29
Uzbekistan 1996	*	*	(43.3)	(43.3)	35	*	*	(30.5)	(30.5)	33
Median	u	u	42.4	42.4		u	u	38.6	38.6	
Mean	u	u	43.1	43.3		u	u	36.9	37.5	
<b>South/Southeast Asia</b>										
Bangladesh 1999-00	(89.6)	(72.6)	(79.6)	79.7	61	69.5	69.4	(76.1)	70.8	258
Cambodia 2000	(25.4)	23.8	(53.8)	33.9	110	11.9	23.2	41.0	21.2	878
India 1998-99	28.4	34.7	42.1	36.3	1,338	24.0	27.9	34.7	26.8	4,464
Indonesia 1997	*	44.4	43.9	42.8	315	50.1	45.3	48.2	46.2	911
Nepal 2000	(35.6)	*	(37.3)	37.7	53	27.0	37.0	50.2	30.3	926
Philippines 1998	*	(38.7)	48.8	46.7	178	*	36.4	47.9	42.0	255
Vietnam 1997	*	*	*	*	15	*	(35.7)	56.5	48.2	163
Median	32.0	38.7	46.4	40.3		27.0	36.4	48.2	42.0	
Mean	44.8	42.8	50.9	46.2		36.5	39.3	50.7	40.8	
<b>Latin America/Caribbean</b>										
Bolivia 1998	*	55.2	53.4	54.1	512	40.8	38.7	43.9	39.9	437
Brazil 1996	(51.4)	57.1	53.2	54.5	326	(38.9)	53.2	*	53.7	118
Colombia 2000	*	38.2	30.8	33.7	314	*	26.5	(34.4)	29.6	165
Dominican Rep. 2002	(34.1)	34.4	24.3	30.1	736	43.5	40.4	32.7	38.7	427
Guatemala 1998-99	(72.0)	35.8	(45.2)	44.4	163	33.2	29.0	*	30.1	289
Haiti 2000	52.1	52.3	52.7	52.4	371	34.5	37.3	(64.2)	37.5	823
Nicaragua 2001	(56.0)	51.4	61.6	56.5	269	53.7	56.1	(55.6)	55.2	364
Peru 2000	*	37.4	38.0	38.0	653	36.2	34.6	26.9	33.1	687
Median	52.1	44.8	49.0	48.4		38.9	38.0	39.2	38.1	
Mean	53.1	45.2	44.9	45.5		40.1	39.5	43.0	39.7	

Note: Figures in parentheses are based on 25-49 unweighted cases. An asterisk indicates that a figure is based on fewer than 25 unweighted cases and has been suppressed.

u = Unknown (too few cases to calculate estimate)

Figure 3.12.1  
**Percentage of urban children under age three years with diarrhea in the two weeks preceding the survey who received increased fluids and continued feeding, by mother's education and region**



Lower mothers' education is more consistently associated with an increased probability of recent ALRI symptoms in young children in urban areas than in rural areas. Looking at regional average prevalence by level of education, prevalence of ALRI symptoms among urban children decreases with increasing maternal education in South/East Africa, South/Southeast Asia, and Latin America/Caribbean. Seventeen of the 42 intra-country differentials computed for urban children whose mothers have no completed years of education versus one or more completed years of secondary education are positive values exceeding five percentage points, in comparison with six negative values of the same magnitude found in Burkina Faso, Côte d'Ivoire, and Gabon in West/Middle Africa, and in Ethiopia, Kenya, and Tanzania in South/East Africa.

In rural areas, the average prevalence decreases most strongly in the Latin America/Caribbean region. The intra-country differences in ALRI symptom prevalence between rural children with mothers in the lowest versus the highest education categories were computed. These differentials exceed positive five percentage points in just 8 out of 42 countries, 4 of which are in Latin America/Caribbean (Brazil, the Dominican Republic, Guatemala, and Nicaragua).

### **Educating women = healthier children?**

Javier Escobal; Group for the Analysis of Development (GRADE), Peru, id21 Development Research Reporting Service, 2005

<http://www.eldis.org/go/home&id=46043&type=Document>

Peru has the second highest malnutrition rate in South America. Stunted growth resulting from chronic nutritional deficiency and leading to diminished intellectual capacity is common among children, particularly those from rural areas. There has been large investment in primary

healthcare facilities over the last ten years, in an attempt to solve the problem. But usage of these facilities is low.

Better education for women could be the solution, according to research from the Young Lives project in Peru. The project found that over 25 percent of children aged between 6 and 18 months were stunted and chronically malnourished and that this was more prevalent among rural children. Mothers living in rural areas have an average of four years schooling compared to nine years if they live in urban areas. This implies that a mother's educational level directly affects a child's nutritional status. The more educated the mother is, the healthier the child. In areas with many educated mothers, the entire community's health improves because the mothers share health advice and information. In households where mothers are less educated improved public services, such as sewerage facilities, improve child health.

Policymakers concerned with improving child health should invest in:

- long-term programmes that aim to reduce education gaps and improve the average schooling level of Peruvian women
- nutrition related training programmes for uneducated and under-educated rural women, to improve children's health in the short term
- improving public facilities, such as sewerage facilities and road networks, in areas where low-educated mothers are concentrated.

### **Mortality Burden and Socioeconomic Status in India**

June Y. T. Po1, S. V. Subramanian, *PLoS ONE*, February 2011, Volume 6, Issue 2

[http://www.hsph.harvard.edu/faculty/sv-subramanian/files/pone\\_2011\\_6\\_2\\_e16844\\_po\\_subramanian.pdf](http://www.hsph.harvard.edu/faculty/sv-subramanian/files/pone_2011_6_2_e16844_po_subramanian.pdf)

Multiple studies have illustrated strong link between education levels of the head of household and mother with childhood mortality.

### **Maternal education and child survival: a comparative study of survey data from 17 countries**

Bicego G.T. and Boerma J.T., *Social Science and Medicine* 36,1207-27, 1993

<http://www.sciencedirect.com/science/article/pii/027795369390241U>

A uniform analytical methodology was applied to survey data from 17 developing countries with the aim of addressing a series of questions regarding the positive statistical association between maternal education and the health and survival of children under age two. As has been observed previously, the education advantage in survival was less pronounced during than after the neonatal period. Strong but varying education effects on postneonatal risk, undernutrition during the 3–23 month period, and non-use of health services were shown—although a large part of these associations are the result of education's strong link to household economics. Differential use of basic health services, though closely tied to a mother's educational level, does little to explain the education advantage in child health and survival. However, the issue of the actual quality of services measured in the DHS is raised. Other issues concerning the roles of the pattern of family formation and differential physical access to health services are explored and discussed.

#### 4. Level of Education Needed

##### **The effect of Educational Attainment on Survival and Health**

John G. Cleland and Jeroen K. van Ginneken, International Encyclopedia of Public Health  
Pages 295-303, 2008

<http://www.sciencedirect.com/science/article/pii/B9780123739605005542>

Maternal education has a strong impact on infant and child mortality; on average a rise of one year of maternal schooling is associated with a 6-9% decline in under-five mortality. Literacy, in the narrow sense of ability to read and write, cannot be the only crucially important cognitive skill implicated. Even one to three years of maternal schooling is associated with a large reduction in the risks of childhood death and this modest exposure to primary schooling is rarely sufficient to impart lasting reading and writing skills. However, even a few years at school may improve oral literacy, namely the understanding of decontextualised language (i.e. formal distanced language in which meaning resides in the words and syntax alone rather than in shared contextual understandings). The language of school teachers, health staff and mass media is decontextualised.

The identification of intervening mechanisms greatly strengthens the case for a causal interpretation of the schooling - survival link. The balance of evidence suggests that even a modest exposure to primary school may allow girls to identify more closely with the outside world of health institutions and equip them with the cognitive skills to access and comply with services and advice on offer. What is beyond doubt is that educated mothers have a much greater propensity to use modern health services - both preventive and curative - than less educated mothers. This appears to be the major, though perhaps not the only, pathway of influence.

##### **Industrialised countries**

From a historical point of view, education has had an enormous long-term impact on health and mortality. One could summarise its impact by saying that, statistically speaking, each time a nation succeeded in providing its population with one more year of education, adult mortality declined by 5 to 7 percent.

A serious concern for health policy makers in industrialised countries is that over time, absolute inequalities in education did not diminish and that in a number of countries, mortality of the lowest educational group declined less fast than in the highest educational group.

Evidence was summarised on the role of distal and proximate factors that explain the education-mortality relationship. A combination of economic, psychosocial and behavioural factors explained this relationship in a few Western countries. Economic factors contributed most to the explanation which means that improving the economic situation of lower educated people may substantially reduce educational inequalities in adult mortality.

##### **Women's education, child welfare and child survival: a review of the evidence**

Hobcraft J., *Health Transition Review*, 1993; 3: 159-175

[http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=Search&term=Health Transit Rev\[Jour\]+AND+3\[Volume\]+AND+159\[page\]](http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed&cmd=Search&term=Health+Transit+Rev[Jour]+AND+3[Volume]+AND+159[page])

Child mortality rates among mothers with at least 7 years of schooling were 58% lower than among those without any education.

## **Why we need to rethink the strategy and time frame for achieving health-related Millennium Development Goals.**

Özaltın E, Subramanian SV, *International Health* (2011)

<http://www.sciencedirect.com/science/article/pii/S1876341311000490>

At mean height, an increase in wealth quintile from lowest to highest and 18.8 years in education were needed to achieve a two-thirds reduction in mortality, whilst at a 40 cm increase in height from the mean, a joint increase in wealth quintile from 1 to 5 and only 8.4 years in education were needed.

At mean height and the lowest wealth quintile, 23 years of education or an increase in wealth quintile from 1 to 5 and 9.9 years in education were needed to achieve a 50% reduction in stunting. When height was increased from the mean by 25 cm, a 50% reduction was achieved for stunting even for those with no education and in the lowest wealth quintile.

At mean height and the lowest wealth quintile, 17.2 years of education or an increase in wealth quintile from 1 to 5 and 4.1 years in education were needed to achieve a 50% reduction in underweight. When height was increased from the mean by 25 cm, a 50% reduction was achieved even for those with no education and in the lowest wealth quintile.

### **5. What is the Nature of the Difference?**

#### **The effect of Educational Attainment on Survival and Health**

John G. Cleland and Jeroen K. van Ginneken, *International Encyclopedia of Public Health* Pages 295-303, 2008

<http://www.sciencedirect.com/science/article/pii/B9780123739605005542>

#### **Distal pathways of influence**

The most obvious way in which schooling may influence a mother's care of her children is by providing her with the means of acquiring and understanding correct information about prevention and cure of childhood diseases.

With regard to socio-psychological, as opposed to cognitive, factors that may mediate the relationship between maternal schooling and the proximate or direct determinants of child health, the main possibilities discussed in the research literature are: more intensive style of mother-child interaction and shifts in the valuation of children; greater influence on domestic decision-making, including health care of children; closer identification with modern institutions (including the health care system) and greater confidence and skill in accessing them.

The work of Levine and colleagues suggests that the experience of primary schooling may have a profound and lasting impression that, many years later, impacts on child-rearing styles. The essence of the hypothesis is that schooling provides a new model of verbal interaction between an adult (the teacher) and the child, in contrast to the learning process in pre-literate societies which is achieved by participation and imitation rather than verbal instruction. Girls exposed to this model at school apply it in their roles as mothers, and interact with children in a verbally active manner, which in turn leads to a verbally active and demanding child.

The possibility that educated mothers enjoy greater domestic decision-making power than uneducated ones has attracted substantial research attention, particularly in the gender-stratified societies of South Asia. As the prime caretaker of children, enhanced autonomy in this regard might pay high dividends in the speed and nature of responses to childhood illnesses. Another set of socio-psychological mechanisms linking maternal schooling to child health outcomes concerns identification with modern institutions and confidence in interacting with them. Once again, the potential relevance of these factors to health-care seeking behaviour is obvious, because it is well documented that skill and determination is often required to access adequate services in many low income settings.

### **Proximate pathways of influence**

Following the well known framework of Mosely and Chen, there are four main proximate pathways of influence. One of the strongest and most consistent links between maternal schooling and health behaviour concerns use of preventive health services. Across 28 national surveys, complete immunisation coverage rose from 41% for one year old children of mothers with no schooling, to 54% among those with incomplete primary schooling and further to 65% and 74% among the completed primary school and secondary or higher school categories. Resort to curative health services is strongly related to maternal schooling. Evidence from 30 Demographic and Health Surveys shows, with very few exceptions, a monotonic positive association between schooling and the probability that a sick child was taken to a medical facility.

With regard to domestic hygiene, a study in rural Bangladesh provides positive evidence. One of the very few features that distinguished educated from uneducated mothers was the former's greater emphasis on cleanliness. This behavioural difference, it was suggested, did not stem from any realisation of the health implications but from the acquisition of new codes at school which were considered socially desirable and persisted into adulthood.

The research evidence shows emphatically that better educated mothers are able to protect their children against growth faltering and death. Whether this enhanced ability stems directly from the schooling experience or whether schooling selects for (and perhaps reinforces) pre-existing characteristics that favour mothering skills remains uncertain and may never be resolved beyond doubt because a prospective study spanning a generation would be required. While the advantages accruing to the offspring of educated mothers are remarkably pronounced and pervasive, typically persisting in societies with high levels of child survival and a good health infrastructure, secular improvements in the education of girls has not been the main driving force behind child survival gains of the past 50 years. These gains have been recorded in all educational strata and thus the forces of change transcend the characteristics of individual families.

### **The benefits of educating women**

John Cleland, *The Lancet*, Volume 376, Issue 9745, Pages 933 - 934, 18 September 2010  
[http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(10\)61417-1/fulltext#bib20](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(10)61417-1/fulltext#bib20)

The lack of a threshold in the maternal education-child survival relationship suggests that the obvious causal pathway - better comprehension of disease causation, prevention and cure - may only be part of the explanation. It has led to investigations of many possible behavioural links, including better domestic hygiene, more intense mother-child interactions and greater maternal decision-making power. However, the pathway that can muster the strongest empirical support concerns use of child health services. Even a modest exposure to primary schooling increases a mother's propensity to seek modern preventive and curative services for her

children. It appears that schooling engenders in adulthood a greater identification with the outside world of health institutions and the confidence and skills to access services and comply with advice.

It is likely that the symbiotic effect of schooling and health service utilisation lies behind the central result of the paper by Gakidou et al., namely that improvements in the education of women of reproductive age may account for half the reduction in under-five mortality since 1970 in the 175 countries studied. This contribution is far greater than that of increasing income, a finding consistent with most previous studies. Tellingly, income and educational increases are only modestly correlated. Countries differ in the proportion of national wealth that they invest in mass schooling and those countries that decide to give a priority to education no doubt differ from those with other priorities. Analyses of states that achieved high life expectancy despite low income levels, such as China, Costa Rica, Kerala and Sri Lanka, revealed a common characteristic: sustained political commitment to equitable access to primary schooling and health care for both sexes.

### **Childhood morbidity and treatment patterns**

Ryland S and Raggars H., Demographic and Health Surveys Comparative Studies No 27. Calverton MA: Macro International Inc. 1998

<http://www.measuredhs.com/pubs/pdf/CR8/CR8.pdf>

While mothers' education can be used as a measure of individual productivity and hence contributes to the household's economic status, it is also assumed that better educated women are more likely than less educated women to both understand and adopt practices for preventive and curative child health care as promoted through health education outreach programmes or by health care providers that may at times be at odds with customary practices.

Among children with diarrhoea for whom care was sought, the regional mean percentage who received, at any time during the illness, one of the non recommended treatments ranges from 48 percent in Latin America/Caribbean to 74 percent in Central Asia. A largely consistent and strong positive association is observed between mother's education and the administration of oral rehydration solutions to young children with diarrhoea, in both urban and rural areas and in most countries and regions.

## **6. Evidence Disputing the Relationship**

### **Infant Mortality and Mother's Education in Ondo State, Nigeria**

J.O. Adetunji, Global Reproductive Health Forum, 1999

<http://www.eldis.org/go/home&id=26552&type=Document>

A bivariate analysis of infant mortality in the 1986/87 Ondo State Demographic and Health Survey data indicates that children of secondary school graduates experienced a higher rate of infant mortality than children of less educated mothers. Although this pattern has also been shown in a few other Demographic and Health Surveys, this paper explores the Ondo State data to explain why infant mortality showed such a counterintuitive pattern in relation to maternal education. The results suggested that data errors, use of health services and quality of maternal care were not enough to explain the relationship. Rather, results of a logistic regression analysis showed that breast feeding duration and maternal age at childbirth were statistically the most significant variables for predicting infant survival in Ondo State. The

inverse relationship between mothers' education and infant mortality rates that was not shown by bivariate analysis came out clearly only after controlling for the effect of breastfeeding duration. The linkage between these findings and broader social and economic realities of Nigeria was provided through reviews of available information. The conclusion from the study was that, although breastfeeding and maternal age showed up as the most statistically significant variables, they apparently are just the variables that effectively captured the effects of the harsh economic conditions, especially among secondary school graduates, that prevent most young mothers from translating their child-rearing ideals into reality.

### **Child health inequities in developing countries: differences across urban and rural areas**

Jean-Christophe Fotso, *International Journal for Equity in Health*, 2006, 5:9  
<http://www.equityhealthj.com/content/5/1/9>

The results of this study indicate that maternal and fathers' education, community socioeconomic status and other measurable covariates at the mother and child levels only explain a slight part of the within-urban differences in child malnutrition.

### **The effect of Educational Attainment on Survival and Health**

John G. Cleland and Jeroen K. van Ginneken, *International Encyclopedia of Public Health*  
Pages 295-303, 2008  
<http://www.sciencedirect.com/science/article/pii/B9780123739605005542>

### **Selectivity, confounding and causation**

In low-income countries, a host of factors influence the probability of enrolment and retention of girls in school, including parental education and aspirations and the child's ability. To what extent does the strong statistical association between maternal schooling and child health reflect these potentially powerful forces of selectivity? Might length of schooling simply be a marker of the inter-generational transmission of privilege?

The authors of the study state that they are aware of only two studies (both from Nicaragua) that have attempted to reassess the maternal education-child survival link after controlling for characteristics of the mother's family of origin. Using data relating to adult sisters who differed in educational attainment, Behrman and Wolfe found that maternal education effects on infant survival and nutritional status were no longer statistically significant when family characteristics were controlled. Conversely, Sandiford found little attenuation of the association between mother's literacy and under-five mortality when the literacy of maternal grandparents along with other socio-economic factors were introduced into the statistical model.

Sandiford's study is also one of the very few to have assessed whether non-verbal intelligence (as measured by Raven's Coloured Progressive Matrices) and an internal locus of control (i.e. belief in personal ability to determine outcomes) can account for the literacy-child survival relationship. Non-verbal intelligence was found to be higher in the literate than the illiterate group and this difference accounted for about one-third of the literacy-survival relationship. Furthermore it was found that intelligence was a much stronger predictor of under-five mortality among the offspring of illiterate than of literate mothers. Similarly, an internal locus of control accounted for some of the literacy-survival relationship.

In contrast to this inconclusive evidence concerning the extent to which the education-survival relationships may be a spurious artefact of antecedent factors such as family characteristics or intelligence, many studies have reassessed the relationship after adjustments for contemporary economic factors. Though a few exceptions have been reported, the results of the large cross-

national studies are supported by most localised studies. Broadly speaking, income and wealth account for about half of the unadjusted association between maternal education and child survival. Typically maternal education remains a stronger predictor of survival than indicators of income.

While it is well established that maternal education is not merely a proxy for income or wealth, causal attribution of the education-mortality link remains uncertain. It is likely that some of its predictive strength is attributable to factors that influence school enrolment and retention rather than directly to the experience of schooling itself. On the other hand, it is entirely plausible to argue that schooling does exert profound influences on girls that persist into adulthood in ways that influence child health and survival.

### **Child mortality in India: The community-level effect of education**

Kravdal O., *Population Studies*, 2004; 58: 177-192.

<http://www.jstor.org/stable/pdfplus/4148228.pdf?acceptTC=true>

It is widely recognised that education effects in many previous studies of child mortality in less developed countries may have been seriously biased because of omitted factors. There are limitations to individual level factors and the effect of community education should be looked at as well. Clearly, more attention should be devoted to the possible impact of community education, without downplaying the effect of the mother's own education. It seems that both factors are important, and that they may operate through a wide range of health and health-care variables. The mechanisms that link community education with these variables may involve, for example, the quality of the health-care institutions, the prevalence of potentially fatal contagious diseases, the sanitation systems, imitation of behaviour, or transmission of health knowledge and attitudes. The exploration of these mechanisms will be important subjects of future studies.

### **Childhood morbidity and treatment patterns**

Ryland S and Raggars H., *Demographic and Health Surveys Comparative Studies No 27*. Calverton MA: Macro International Inc. 1998.

<http://www.measuredhs.com/pubs/pdf/CR8/CR8.pdf>

In Guatemala, urban mothers with no formal education are significantly more likely to have taken a sick child to a health provider than mothers with at least one completed year of secondary school. A similar pattern is seen across wealth categories for urban areas of Guatemala. This suggests that primary health care resources, at least in urban areas, may have been targeted at the time of the survey toward lower income families (and thus less educated parents).

### **Why we need to rethink the strategy and time frame for achieving health-related Millennium Development Goals**

Özaltin E, Subramanian SV, *International Health*, (2011)

<http://www.sciencedirect.com/science/article/pii/S1876341311000490>

A database of 735,970 children from 109 Demographic and Health Surveys conducted between 1991 and 2008 in 54 countries was compiled. Modified Poisson regression models were used to estimate the association between child mortality/undernutrition and maternal education, wealth and height. Stochastic simulations of regression results were then used to evaluate changes in maternal height, education and wealth required to halve stunting and underweight and to reduce mortality by two-thirds. At mean height, 25 years of education were needed to achieve a two-thirds reduction in mortality, and halving the prevalence of stunting and underweight required 23

years and 17 years of education, respectively, for the poorest wealth quintile. When height was increased from the mean by 25 cm, the prevalence of both growth outcomes was halved, even for those with no education and in the poorest wealth quintile. These results indicate that contemporaneous interventions will achieve MDG targets more readily in populations with greater accumulated health stock.

Previous studies have failed to consider the importance of prenatal intergenerational factors influencing childhood undernutrition and mortality. Maternal height, which is a function of the nutritional and environmental exposures during the mother's childhood, has been shown to be a robust prenatal intergenerational predictor of offspring mortality, stunting and underweight. The authors build on this evidence and conduct a comparative assessment of the importance of maternal height (an intergenerational marker of poor health) and household wealth and maternal education (commonly used markers of contemporaneous and post-natal socioeconomic and environmental conditions) for reducing child undernutrition and mortality in the context of MDG 1 and MDG 4 in 54 developing countries.

By including education and wealth in the model, the authors risk post-treatment bias, i.e. bias due to controlling for variables partially caused by the key causal variable, in this instance height. For example, if childhood conditions are associated with maternal education, wealth and stature (and maternal stature is associated with her child's outcomes), including education and wealth will bias the stature coefficient downward. The coefficient on height may also be biased down from including wealth owing to the pathway from stature to wealth.

With these considerations in mind, these results suggest that in order to achieve MDG targets, interventions with intergenerational payoffs should be given greater weight.

These findings indicate that early life factors are important, not only for the subsequent health of a woman (as reflected in her attained stature), but also for her offspring's health, and highlight the long-term effects of mother's poor health stock. The MDGs, and explicit target setting, have been very effective for mobilisation of resources. However, failure to reach MDG targets by 2015 may not necessarily reflect a failure of efforts or programmes. It may be that, due to intergenerational persistence of poor health, it will take considerably longer to eliminate avoidable undernutrition and deaths among children. Further, a holistic approach to health and development in the form of intergenerational investments and equity is necessary to achieve MDG targets. These findings provide critical empirical support for such an approach to reducing undernutrition and mortality among children in developing countries.

## 7. Additional References

- (1) Caldwell JC. Maternal education and child survival: an examination of Nigerian data. *Population Studies* 1979; 33:395-413.
- (2) Cleland J. Maternal education and child survival: further evidence and explanations. In: Caldwell J, Findlay S, Caldwell P et al., eds. *What we know about health transition: The cultural, social and behavioural determinants of health*. Canberra: Australian National University Press, 1990.
- (3) International Institute for Population Sciences (IIPS) and Macro International. *National family Health Survey (NFHS 3), India 2005-6*. Mumbai: IIPS, 2008.
- (4) Preston SH. Mortality and development revisited. *Population Bulletin of the United Nations* 1985; 18: 34-40.

- (5) Halstead SB, Walsh JA, Warren KS eds. Good health at low cost. New York: The Rockefeller Foundation, 1985.
- (6) Caldwell JC. Routes to low mortality in poor countries. *Population and Development Review* 1986; 12: 171-220.
- (7) Barker, D.J., Forsen, T., Uutela, A. et al. (2001). Size at birth and resilience to effects of poor living conditions in adult life: longitudinal study. *British Medical Journal*. 323, 1273-1276.
- (8) Behrman, J. and Wolfe, B.L. (1989). Does more schooling make women better nourished and healthier? Adult sibling random and fixed effects estimates for Nicaragua. *Journal of Human Resources*, 24, 644-663.
- (9) Caldwell, J.C. (1979) Education as a factor in mortality decline: an examination of Nigerian data. *Population Studies*, 33, 395-413.
- (10) Davey Smith, G., Hart, C., Hole, D. et al. (1998). Education and occupational social class: which is the more important indicator of mortality risk? *Journal of Epidemiology and Community Health*, 52, 153-160.
- (11) Hobcraft, J.N., McDonald, J.W., Rutstein, S.O. (1984) Socio-economic factors in infant and child mortality: a cross-national comparison. *Population Studies*, 38,193-223
- (12) LeVine, R.A. LeVine, S.E., Schnell, B. (2001) "Improve the woman": mass schooling, female literacy and worldwide social change. *Harvard Educational Review* 71,1-50.
- (13) Mackenbach, J.P., Bos, V., Anderson, O., et al. (2003). Widening socioeconomic inequalities in mortality in six Western European countries, *International Journal of Epidemiology* 32, 830-837.
- (14) Pensola, T. and Valkonen, T. (2002). Effect of parental class, own education and social class on mortality among young men, *European Journal of Public Health*. 12, 29-36.
- (15) Preston, S. and Elo, I. (1995). Are educational differentials in adult mortality increasing in the United States?, *Journal of Aging and Health*, 7, 476-496.
- (16) Sanidford, P., Cassel, J. Sanchez, G and Coldham, C. (1997). Does intelligence account for the link between maternal literacy and child survival? *Social Science & Medicine* 45, 1231-1239.
- (17) van Oort, V., van Lenthe, J. and Mackenbach, J. (2005). Material, psychosocial, and behavioural factors in the explanation of education inequalities in mortality in the Netherlands. *Journal of Epidemiology and Community Health*, 59, 214-220.
- (18) Wolfe, B.L. and Behrman, J.R. (1982) Determinants of child mortality, health, and nutrition in a developing country. *Journal of Development Economics*, 11, 163-93.
- (19) Caldwell, J.C., Caldwell, P. (1985) Education and literacy as factors in health. In Halstead SB. Walsh JA., and Warren KS (eds) *Good health at low cost*. New York: Rockefeller Foundation, 181-185.
- (20) Cleland, J.G. and Van Ginnekan, J.K. (1988) Maternal education and child survival in developing countries: the search for pathways of influence. *Social Science and Medicine* 17, 1357-1368
- (21) Desai, S. and Alva, S. (1998) Maternal education and child health: is there a strong causal relationship. *Demography* 35, 71-81.
- (22) Khang, Y., Lynch, J.W. and Kaplan, G.A. (2004). Health inequalities in Korea: age- and sex-specific educational differences in the 10 leading causes of death. *International Journal of Epidemiology* 33, 299-308.
- (23) Molla, M.T., Madans, J.H. and Wagener, D.K. (2004). Differentials in adult mortality and activity limitation by years of education in the United States at the end of the 1990s. *Population and Development Review* 30, 625-646.

- (24) Mosely, WH and Chen L. (1984) An analytical framework for the study of child survival in developing countries. *Population Development Review* 10(Supplement), 25-48.
- (25) Schultz, T.P. (2002) Why governments should invest more to educate girls. *World Development*, 30,207- 225.
- (26) Shkolnikov, V.M., Leon, D.A., Adamets, S. et al. (1998). Educational level and adult mortality in Russia: an analysis of routine data 1979 to 1994. *Social Science and Medicine* 47, 357-369.
- (27) Horton (1986), Behrman and Deolalikar (1990), Barrera (1990), Behrman (1988), Thomas, Strauss, and
- (28) Henriques (1990). For reviews of the determinants of child anthropometric indicators, see Cochrane,
- (29) Leslie, and O'Hara (1982); Martorell and Habicht (1986); and Strauss and Thomas (1994).
- (30) Mohan VR, Muliyl J (2009) Mortality patterns and the effect of socioeconomic factors on mortality in rural Tamil Nadu, south India: a community-based cohort study. *Trans R Soc Trop Med Hyg* 103: 801–806.
- (31) Badari S, Gopal YS, Devaramani SC (1991) Infant mortality, its components and correlates: findings from a longitudinal study in rural Karnataka, India. *Genus* 47: 89–108.
- (32) Rajna PN, Mishra AK, Krishnamoorthy S (1998) Impact of maternal education and health services on child mortality in Uttar Pradesh, India. *Asia Pac Popul J* 13: 27–38.
- (33) Howe, LD, SRA Huttly & T Abramsky. 'Risk factors for injuries in young children in four developing countries: the Young Lives Study', *Tropical Medicine & International Health*, 11, (pp. 1557-1566), 2006.

## 8. Additional information

### Author

This query response was prepared by **Catherine Holley, C.Holley@ids.ac.uk**

### Contributors

Professor John Cleland, LSHTM  
 Professor Subramanian, Harvard University  
 Javier Escobal, GRADE  
 Betty Kirkwood, LSTHM

**About Helpdesk reports:** The HDRC Helpdesk is funded by the DFID Human Development Group. Helpdesk Reports are based on up to 2 days of desk-based research per query and are designed to provide a brief overview of the key issues, and a summary of some of the best literature available. Experts may be contacted during the course of the research, and those able to provide input within the short time-frame are acknowledged.

For any further request or enquiry on consultancy or helpdesk services, please contact [justask@dfidhdc.org](mailto:justask@dfidhdc.org)

**Disclaimer**

*The DFID Human Development Resource Centre (HDRC) provides technical assistance and information to the British Government's Department for International Development (DFID) and its partners in support of pro-poor programmes in education and health, including nutrition and AIDS. The HDRC services are provided by three organisations: Cambridge Education, HLSP (both part of the Mott MacDonald Group) and the Institute of Development Studies. The views in this report do not necessarily reflect those of DFID or any other contributing organisation.*