

## Helpdesk Report: Education and Nutrition

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

### Query:

- \* What is the evidence on educational outcomes from nutrition?
- \* What is the evidence on nutritional outcomes from education?

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### 1. Overview

#### **Nutrition and Education, Briefing Paper of the UN Standing Committee on Nutrition**

Matthew Jukes, Judith McGuire, Frank Method, and Robert Sternberg

[www.unscn.org/files/Publications/Briefs\\_on\\_Nutrition/Brief2\\_EN.pdf](http://www.unscn.org/files/Publications/Briefs_on_Nutrition/Brief2_EN.pdf)

This short briefing paper provides a good introduction to the key issues in nutrition and education, specifically on how poor nutrition limits intellectual development. It is a 'quick review of the evidence' and touches upon nutritional issues such as growth retardation in under-five children; low birth-weight as iron-deficiency anaemia. It also highlights the various ways in nutritional status can be improved and the evidence on its links with educational outcomes.

#### **The Impact Of Health And Nutrition On Education**

Jere R. Behrman, World Bank Res Obs (1996) 11 (1): 23-37. doi: 10.1093/wbro/11.1.23

<http://wbro.oxfordjournals.org/content/11/1/23.short>

This is a broad review of the evidence (until the publication year) on the effect of health and nutrition on education. It presents an analytical framework which considers cognitive achievement as an indicator of schooling success. Individual, family and community variables influence cognitive achievement rather than nutrition alone. The paper stresses on the importance of accounting for the influence of these variables, to be able to analyse causal effects. It reviews various studies including those which have examined the effect of IDA, parasitic infections, food supplementation, as well behavioural studies. Overall, the paper concludes that better nutrition is associated with better educational outcomes but also points to the difficulties in attributing causality due to data issues, effects of 'unobserved variables', etc.

## **Key Facts**

### **Impact of Nutrition on Education**

*(Taken from Nutrition and Education, Briefing Paper of the UN Standing Committee on Nutrition)*

#### **Growth Retardation → Reduction in Mental Capacity and Adverse School Performance**

Thirty-six percent of children under five are growth retarded (that is, their height-for-age is low). This figure may rise to around 50 percent for school-age children. Growth retardation is associated with a substantial reduction in mental capacity and adverse school performance, even in mild to moderate cases, and ultimately leads to reduced work productivity.

#### **Iodine Deficiency → Lower IQ, Reduced Mental Capacity and Cognitive Function in School Children**

An estimated 1.6 billion people worldwide are iodine deficient. Iodine deficiency is associated with an average 13.5 point reduction in IQ for a population. Deficiency in school children leads to reduced cognitive function while deficiency during fetal life can have profound and irreversible effects on the child's mental capacity: "cretinism" due to iodine deficiency is still found in mountainous and floodplain areas of the world.

#### **Low Birth Weight → Poor Cognitive Performance and Poor Attention Span in School**

Seventeen percent of infants are born with low birth weight (under 2.5 kilograms), resulting in poorer cognitive performance during infancy, although this effect is overshadowed by that of malnutrition. In the longer term, children born with a low birth weight have a poor attention span in school.

#### **Iron Deficiency Anaemia → Reduction in Cognitive Ability and School Performance**

Fifty-three percent of school-age children suffer from iron deficiency anaemia. Reduced cognitive abilities, on the order of 1 standard deviation, are associated with anaemia in both infants and school-age children with similar reductions in school performance.

#### **No Breakfast + Malnourished Background → Poor School Performance**

When children go to school without breakfast, their performance goes down by around 0.1 standard deviations (4 percentiles) but only if they are malnourished or from poorer backgrounds.

#### **Undernourished Children → Later Enrolment, Compounding Intellectual Impairment**

Undernourished children (low height-for-age) tend to be enrolled later in school than better-nourished children. This could be because parents deem shorter children to be younger, because they do not believe the children are physically large enough to attend school, or perhaps because they are investing more in the better-nourished children. In any case, late enrolment compounds the problems of intellectual impairment caused by nutritional deficits.

#### **How can these problems be resolved?**

The first three years of life, plus life in the womb, are the most important periods in terms of mental, physical, and emotional development. It is during these critical windows of time that basic human capital is formed. Most growth failure occurs between 6 months and 24 months of age. Early damage due to anaemia, iodine deficiency, and chronic malnutrition can only partially be reversed in later life. Preventive programmes, therefore, must be accorded high priority.

#### **Increased Height and Birth Weight → Greater Learning Capacity and Income**

There is ample evidence that increased height, working both through physical capacity and through learning capacity and school performance, results in increased adult wages and productivity. One analysis of U.S. data finds that an increase in birth weight of one pound

leads to an increase of 7 percent in lifetime earnings. Another study in Brazil finds that a 1 percent increase in height results in a 2.4 percent increase in adult male earnings. The impact of the nutrition-related cognitive improvements alone is 1.3:1.

### **Impact of Education on Nutrition**

#### **Better Educated Parents → Decrease in Child Stunting**

Semba et al (2008) In Indonesia, if the mother was better educated it led to a decrease of between 4.4% and 5% in the odds of child stunting; and if fathers were better educated it led to a decrease of 3% in the odds of child stunting. Therefore, maternal education had a greater impact.

In Bangladesh, better education in mothers led to a 4.6% decrease in the odds of child stunting; and better education in fathers led to between 2.9% and 5.4% decrease in the odds of stunting. While maternal education was important, educating fathers was equally important.

Miller and Rodgers (2009) In Cambodia, mother's education is strongly inversely associated with stunting, but not small birth size or wasting.

#### **School Feeding Programmes → Increased Test Scores, Enrolment, Attendance, Improved Nutrition and Increased BMI**

Akhter (2004) School enrolment increased by 14.2%, the likelihood of drop-out reduced by 7.5%, and attendance increased by 1.3 days each month, test scores increased by 15.7 percent points. The programme improved children's nutritional levels as the food provided was in addition to the child's normal diet in nearly 97% of the cases. It improved the children's BMI by an average of 0.62 points (4.3%) increase to the average BMI of children in the control group.

#### **Fathers' Education → Lower Risk of Child Under 5 Being Underweight**

Rayhan and Khan (2006) Father's education and prevalence of underweight were inversely related. Risks of being underweight 0.98 and 0.70 times lower for children of father who attended primary and secondary school respectively compared to the children of illiterate fathers.

Smith and Haddad (2000) Father's education is important as he is usually the main earner and decision maker. Greater education plays an important role in ensuring greater nutritional status of the children in the household.

#### **Mothers' Education → Lower Risk of Child Under 5 Being Stunted, Wasted and Underweight**

Rayhan and Khan (2006) Children of illiterate mothers were 52.6% stunted, 12.2% wasted and 55.7% underweight, these proportions dropped drastically among children whose mothers attended secondary school or higher.

Smith and Haddad (2000) Improvements in female secondary school enrolment rates were estimated to be responsible for 43% of the total 15.5% reduction in the rate of underweight children in developing countries during the period 1970-95.

## **2. Effects of intra-uterine growth retardation; low birth-weight**

### **Maternal and child undernutrition: consequences for adult health and human capital**

CG Victora et al, *The Lancet*, Volume 371, Issue 9609, Pages 340 - 357, 26 January 2008  
[www.thelancet.com/journals/lancet/article/PIIS0140-6736\(07\)61692-4/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(07)61692-4/fulltext)

This paper looks at the links between maternal and child undernutrition and consequences in adulthood – such as height, schooling, income or assets, etc. The paper does this by analysing data from five cohort studies (in Brazil, Guatemala, India, the Philippines and South Africa); and by doing a systematic review of studies from low and middle income countries.

Amongst other important findings, the paper found through the systematic review as well as the data analysis that undernutrition was strongly associated with less schooling. Poor foetal growth, or stunting in the first two years of life has irreversible effects. Lower school attainment is one such effect. Others include shorter adult height; reduced income, etc. The reviews showed that birthweight is positively associated with cognitive skills but in some cases IUGR did not have any measurable effect. Data analysis showed that in Guatemala, for example, height and head circumference (at 2 yrs) were inversely associated with educational attainment. Stunting between 12 and 36 months was associated with poor cognitive performance and/or lower school grades in middle childhood.

#### **Developmental potential in the first 5 years for children in developing countries**

SG McGregor, *The Lancet*, Volume 369, Issue 9555, Pages 60 - 70, 6 January 2007

[www.thelancet.com/journals/lancet/article/PIIS0140-6736\(07\)60032-4/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(07)60032-4/fulltext)

This is a cross-country analysis of the long term impact of undernutrition and poverty on children's cognitive abilities. It uses childhood stunting and the number of people living in absolute poverty as the indicators to predict education outcomes such as the number of years in schooling, reading and math test scores and attained grades. The paper finds that both stunting and poverty are closely associated with poor cognitive ability in early life and in turn is associated with poor educational outcomes in schools too.

#### **Child development: risk factors for adverse outcomes in developing countries**

S P Walker et al, *The Lancet*, Volume 369, Issue 9556, 13-19 January 2007, Pages 145-157

[www.thelancet.com/journals/lancet/article/PIIS0140-6736\(07\)60076-2/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(07)60076-2/fulltext)

This paper identifies four key risk factors for child development – stunting, inadequate cognitive stimulation, iodine deficiency and iron deficiency anaemia. The paper reviews studies to show how IUGR, low birthweight, underweight, stunting, and the micronutrient deficiencies are associated with poorer mental, motor, social-emotional, or neurophysiologic activities in infants. For example, in Jamaica comparing, IQ scores of stunted and non-stunted Jamaican children from age 9-24 months to 17-18 years, shows that stunted children consistently have lower scores.

### **3. Effects of poor infant nutrition (low weight, stunting, breastfeeding)**

#### **Early childhood nutrition and academic achievement: a longitudinal analysis**

Paul Glewwe, Hanan G. Jacoby, Elizabeth M. King, *Journal of Public Economics* 81 (2001) 345–368

[www.sciencedirect.com/science/article/pii/S004727270001183](http://www.sciencedirect.com/science/article/pii/S004727270001183)

This paper draws from a unique longitudinal data set that followed a large sample of children in the Philippines from just before their birth until the end of their primary education (over a period of 12 years). This is a non-experimental study. It analyses the child's life through three periods: the first two years; from two years to the minimum age for primary school enrolment and; the primary school period. It looks at educational outcomes such as primary school enrolment; grade repetition, current grades and drop-out. The paper finds that about 19% children delayed entry to school, at least 27% children repeated a grade but drop-out was quite low at 4%. Almost half the children in the sample were stunted. Through regression analysis, the paper establishes that there is a positive and causal relationship between nutrition and academic success. The paper also finds that different schooling inputs, home environment, parental influences, do not explain why malnourished children perform poorly in school. There is also no strong association between nutrition and learning effort such as home work time or school attendance. Finally the paper finds that height for age is strong indicator for early childhood nutritional status.

### **The Impact of Early Childhood Nutritional Status on Cognitive Development: Does the Timing of Malnutrition Matter?**

P Glewwe and E King, *World Bank Econ Rev* (2001) 15 (1): 81-113.

<http://wber.oxfordjournals.org/content/15/1/81.short>

This paper uses longitudinal data from the Philippines (same as above paper) to analyse whether malnutrition in the first six months of life has a more damaging effect on cognitive abilities than in later infancy. It finds that malnutrition in the second year of life has a greater negative impact than in the first year.

### **Impact of early childhood health and nutrition on access to education in developing countries**

Matthew Jukes, *Paediatrics and Child Health*, Volume 17, Issue 12, December 2007, Pages 485-491

[www.sciencedirect.com/science/article/pii/S1751722207002557](http://www.sciencedirect.com/science/article/pii/S1751722207002557)

This is a broad review of the issues around child nutrition and education. It discusses the impact of micronutrients and early childhood stunting, as well as that of pre-natal and post-natal infections. It reviews some of the evidence on their effect on pre-school attendance and concludes that stunting and anaemia are conditions that are prevalent in younger children and which are associated with poor preschool and primary attendance.

### **Effects of early childhood psychosocial stimulation and nutritional supplementation on cognition and education in growth-stunted Jamaican children: prospective cohort study**

S P Walker et al, *The Lancet*, Volume 366, Issue 9499, 19-25 November 2005, Pgs 1804-07

<http://www.sciencedirect.com/science/article/pii/S0140673605675745>

This paper analyses data from a study on Jamaican children. The look at the effect of early interventions on cognitive abilities and education in 103 stunted children and compare them with 64 non-stunted children. An earlier paper on this cohort reported on the effects of nutritional supplements when they were 9 to 24 months. This paper now looks at the long-term effects on the children who are now aged 17-18 years. Compared with no intervention, stimulation resulted in higher test scores on IQ tests, verbal ability tests, picture vocabulary tests, verbal analogies, and reading tests. Overall, stunted non-stimulated children had significantly poorer scores than non-stunted children on 11 of 12 cognitive and educational tests. Stunting in early childhood was associated with cognitive and educational deficits in late adolescence, which were reduced by stimulation at a young age.

### **Long term consequences of early childhood malnutrition.**

H Alderman, J Hoddinott J and B Kinsey, *Oxf Econ Pap*. 2006;58:450–74.

[http://oep.oxfordjournals.org/content/58/3/450.abstract?ijkey=13430cf79d68e525fd34cae39d7dde0c6c0cfaeb&keytype=tf\\_ipsecsha](http://oep.oxfordjournals.org/content/58/3/450.abstract?ijkey=13430cf79d68e525fd34cae39d7dde0c6c0cfaeb&keytype=tf_ipsecsha)

This paper looks at the impact of pre-school malnutrition on human capital formation. It specifically looks at its impact on number of grades of schooling completed. The data for this paper is drawn from longitudinal surveys of households and children from three resettlement areas of rural Zimbabwe. Using econometric analysis the paper finds that better height-for-age in pre-school children is associated with better height as school age children as well as better schooling (number of grades of schooling completed). If a child in Zimbabwe had the same kind of nutrition as a child in developed nation, by adolescence, the child would be 3.4 cms taller than the current height, would have had an extra 0.85 grades of schooling, and would have started school six months earlier.

### **Evidence on the long-term effects of breastfeeding: Systematic Reviews And Meta-Analyses**

B L Horta et al , 2007, World Health Organization

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.172.551&rep=rep1&type=pdf>

This is a comprehensive review of studies on the long-term effects of breastfeeding. It looks at outcomes such as blood pressure, diabetes, obesity, etc. but also importantly its effect on intellectual performance. To assess the impact on intelligence tests, data from eight studies that controlled for intellectual stimulation at home were reviewed and information on infant feeding in infancy was collected (having at least one month duration of breastfeeding). The review found that overall, performance in intelligence tests was higher among those subjects who had been breastfed. Three studies showed a positive association of breastfeeding in school performance in late adolescence or young adulthood.

#### **Weight Gain in the First Two Years of Life Is an Important Predictor of Schooling Outcomes in Pooled Analyses from Five Birth Cohorts from Low- and Middle-Income Countries**

R Martorell et al, *Journal of Nutr.* February 2010 140: 2 348-354

<http://jn.nutrition.org/content/140/2/348.full?sid=8d08d0ec-6f0c-4846-ba10-173ca1960424>

Nutrition interventions aimed at women and children under 2 y are among the key strategies for achieving the MDG of universal primary education by 2015.

#### **4. Iron deficiency anaemia in school age children**

##### **Effect of iron supplementation on mental and motor development in children: systematic review of randomised controlled trials**

HPS Sachdev et al, *Public Health Nutrition*: 8(2), 117–132, 2004

[http://journals.cambridge.org/download.php?file=%2FPHN%2FPHN8\\_02%2FS136898000500194a.pdf&code=2db00e55aebc2cce9a5cdd4ecca8b84c](http://journals.cambridge.org/download.php?file=%2FPHN%2FPHN8_02%2FS136898000500194a.pdf&code=2db00e55aebc2cce9a5cdd4ecca8b84c)

This is a systematic review of studies which have looked at the effect of iron supplementation on the cognitive and motor development of children. It looked at 17 RCTs which met the search criteria including those from developed and developing nations (seven in Asia, three in Europe, three in North America, two in South America, one in Africa, location of one not clear). Most of the studies were conducted in infants and toddlers, while in six trials older children were evaluated. The review concluded that iron supplementation improves mental development score modestly. And this is particularly evident amongst those above 7 years of age and in those who are initially anaemic or iron-deficient. However, there was no firm evidence that iron supplements improved developmental outcomes in children below 27 months of age.

##### **Long-Term Developmental Outcome of Infants with Iron Deficiency**

Betsy Lozoff et al, *N Engl J Med* 1991; 325:687-694 September 5, 1991

[www.nejm.org/doi/full/10.1056/NEJM199109053251004](http://www.nejm.org/doi/full/10.1056/NEJM199109053251004)

This is a follow-up evaluation of a group of children in Costa Rica who were studied and treated during their infancy for their iron status. About 85% of the children who were studied in the previous round, and were now 5 years old, were now put through comprehensive clinical, nutritional, and psycho-educational assessments. The study found that all the children currently had iron status and growth. But, children who were moderately or severely iron-deficient as infants had lower scores on tests at school entry than the rest of the children. These children also came from poorer households and their scores were significantly lower than others.

##### **A Review of Studies on the Effect of Iron Deficiency on Cognitive Development in Children**

Sally Grantham-McGregor and Cornelius Ani, *Journal of Nutrition.* 2001;131:649S-668S

<http://jn.nutrition.org/content/131/2/649S.short>

This review of studies suggests that it is unclear whether the poor educational outcomes in children who have been iron-deficient in infancy is due to their nutritional status or due to poverty. It argues that only one RCT has established the clear benefits of iron supplementation to infants (less than 2 years) and hence a causal link cannot be conclusively established. There is evidence that children who are older than 2 years can benefit from it but this too is not conclusive.

## 5. Parental education

### **How does mother's education affect child height?**

*The Journal of Human Resources*; Vol. 26, No. 2, Spring, 1991

[www.jstor.org/pss/145920](http://www.jstor.org/pss/145920)

This study looks at the data from the Brazilian Demographic and Health Survey to establish that maternal education has a large and significant impact on child height both in rural and urban areas of Northeast Brazil. This is mainly due to mothers' access to information through newspapers, TV, radio, etc. has a positive effect. In urban areas where women are semi-literate, education seems to have some effect.

### **Mother's Education and Children's Nutritional Status: New Evidence from Cambodia**

J E Miller and Y V Rodgers, *Asian Development Review* vol. 26, no. 1, pp. 131–165, 2009

[www.adb.org/Documents/Periodicals/ADR/pdf/ADR-Vol26-1-Miller.pdf](http://www.adb.org/Documents/Periodicals/ADR/pdf/ADR-Vol26-1-Miller.pdf)

This study uses Cambodia's DHS data from 2005, to look at how maternal education has an impact on birth-size, stunting and wasting. It analysed data on over 3,500 children (0 to 59 months) with data on birth size and other anthropometric information, and mothers' level of schooling (none, primary, secondary). The multi-variate regression analysis showed that mother's education was strongly inversely associated with risks of both small birth size and stunting, but not with wasting.

### **Effect of parental formal education on risk of child stunting in Indonesia and Bangladesh: a cross-sectional study**

R D Semba et al, *The Lancet*, Volume 371, Issue 9609, Pages 322 - 328, 26 January 2008

[www.thelancet.com/journals/lancet/article/PIIS0140-6736\(08\)60169-5/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(08)60169-5/fulltext)

This paper looks at whether the length of maternal and paternal education has an impact on stunting in children under the age of 5 years. It looks at data from 590,570 families in Indonesia and 395,122 families in Bangladesh and finds that:

- Stunting in Bangladesh (50.7%) is more prevalent than in Indonesia (33.2%).
- In Indonesia, if the mother was better educated it led to a decrease of between 4.4% and 5% in the odds of child stunting; and if fathers were better educated it led to decrease of 3% in the odds of child stunting. So maternal education had a greater impact.
- In Bangladesh, better education in mothers led to a 4.6% decrease in the odds of child stunting; and better education in fathers led to between 2.9% and 5.4% decrease in the odds of stunting. While maternal education was important, educating fathers was equally important.

### **Impact of maternal education about complementary feeding and provision of complementary foods on child growth in developing countries**

A. Imdad, M. Yawar Yakoob, and Z.A. Bhutta (2011), *BMC Public Health*, 11(Suppl. 3):S25

[www.biomedcentral.com/1471-2458/11/S3/S25](http://www.biomedcentral.com/1471-2458/11/S3/S25)

This is a systematic review of randomised and quasi-experimental studies on the impact of complementary foods with or without nutritional counselling, and of nutritional counselling alone. Reviewing the 17 studies which met the selection criteria, this paper finds that both interventions have a significant effect on weight gain and growth of children 6 to 24 months of age. While complementary foods with or without nutritional education for mothers increased children's weight by 0.25 kg, and height by 0.54 cm; education of mothers alone led to 0.30kg gain in weight and 0.49 cm gain in height.

## 6. School health and feeding

### **School Feeding for Improving the Physical and Psychosocial Health of Disadvantaged Students**

B Kristjansson et al (2006), *Campbell Systematic Reviews* 2006 14, DOI:

10.4073/csr.2006.14

<http://campbellcollaboration.org/lib/download/113/>

This is a systematic review which looks at the impact of school feeding programmes, which provide food to poor children with the aim of improving their health as well as educational outcomes. The review of 18 studies includes RCTs as well as controlled before-after studies, half which were conducted in low-income countries and others in high-income countries. The review found that the RCTs conducted in low-income countries found that school feeding helped children to gain 0.39 kg over 19 months; and the before-after studies found that they gained 0.71 kg over 11.3 months. The results were mixed for high-income countries as well as for height gain. Also, in low-income countries, school attendance improved as well as children scored consistently higher in standardised maths tests.

### **Realist review to understand the efficacy of school feeding programmes**

T Greenlagh et al, *BMJ* 335 : 858 doi: 10.1136/bmj.39359.525174.AD (2007)

[www.bmj.com/content/335/7625/858.full](http://www.bmj.com/content/335/7625/858.full)

This is a follow-up to the above Cochrane review, which looks more closely at the studies to see what determines success or failure of SFPs. All 18 studies were analysed again to find that SFPs are efficacious mainly when:

- The group is nutritionally deficient and the intervention is correcting it rather than meeting short-term hunger.
- Schools are efficient and well organised, local people are involved in designing the programme, and there is adequate supervision to see that the food is eaten.
- Local ingredients, cooking methods are used.

### **Impact Of Feeding Children In School: Evidence From Bangladesh**

Akhter U. Ahmed, IFPRI Report (2004)

[www.lcgbangladesh.org/fsn/reports/ifpri%20final%20report\\_school%20feeding%20in%20bangladesh.pdf](http://www.lcgbangladesh.org/fsn/reports/ifpri%20final%20report_school%20feeding%20in%20bangladesh.pdf)

This paper reviews the school feeding programme launched in Bangladesh by the government and the WFP. It provides a mid-morning snack to primary school children in some of the highly food insecure places of Bangladesh. This evaluation included a number of surveys at the household, school and community level. It found that school enrolment had increased by 14.2%, the likelihood of drop-out had reduced by 7.5%, and attendance increased by 1.3 days each month, test scores increased by 15.7 percent points. The programme improved children's nutritional levels as the food provided was in addition to the child's normal diet in nearly 97% of the cases. It improved the children's BMI by an average of 0.62 points (4.3%) increase to the average BMI of children in the control group.

## **School Feeding Programs In Developing Countries: An Analysis Of Actual And Potential Impact**

B Levinger, USAID report, 1986

[www.schoolsandhealth.org/sites/ffe/Needs%20Assessment/pnaal060.pdf](http://www.schoolsandhealth.org/sites/ffe/Needs%20Assessment/pnaal060.pdf)

This report examines the relationships among School Feeding Programmes, school attendance, enrolment, cognitive development, and academic performance. It includes information from four types of studies which assess the impact of SFPs on attendance and enrolment. Broadly the review finds that:

- School feeding programmes was a positive determinant of school enrolment, attendance and performance.
- External factors in addition to SFPs have an effect on cognitive development and achievement.
- Several studies had methodological weaknesses and hence conclusively significant relationships could not be established.

## **Deworming drugs for treating soil-transmitted intestinal worms in children: effects on growth and school performance**

D.C. Taylor-Robinson, A.P. Jones, and P. Garner (2007), Cochrane Database of Systematic Reviews, Issue 4. Art. No.: CD000371. DOI: 10.1002/14651858.CD000371.pub3

[www.mrw.interscience.wiley.com/cochrane/clsystrev/articles/CD000371/frame.html](http://www.mrw.interscience.wiley.com/cochrane/clsystrev/articles/CD000371/frame.html)

This is a systematic review of trials which targeted de-worming treatment to children, particularly those which focused on improving growth and school performance. The review identified 34 such trials, which looked at the effect of single or multiple doses of de-worming drugs. Only some trials looked specifically at their effect on school performance. The review found that after a single dose of drugs, children's weight improves but this does not get better with further doses. Only in one study, there was any evidence of an improvement in school performance. The review concludes that the evidence is therefore not enough to conclusively say that school de-worming programmes have any positive effect on school performance.

## **7. Other useful resources**

### **Benefits of early childhood interventions across the world: (Under) Investing in the very young**

M. Nores and W.S. Barnett (2010), *Economics of Education Review*, 29 (2), 271–282.

doi:10.1016/j.econedurev.2009.09.001

[www.sciencedirect.com/science/article/pii/S027277570900106X](http://www.sciencedirect.com/science/article/pii/S027277570900106X)

This is a systematic review of 56 studies from Europe, Asia, Africa, Central and South America, and include RCTs as well as quasi-experimental studies, on the impact of different types of childhood interventions. It looks at interventions such as cash transfers, nutrition programmes, educational programmes and combinations of these.

### **Maternal and Child Undernutrition**

Lancet Series, 2008

[www.thelancet.com/series/maternal-and-child-undernutrition](http://www.thelancet.com/series/maternal-and-child-undernutrition)

### **The Effects of Iron Deficiency and Anemia on Mental and Motor Performance, Educational Achievement, and Behavior in Children – An annotated bibliography**

C Nokes et al

<http://idpas.org/pdf/119AEffectsofIronDeficiency.pdf>

### **Wikipedia entry on the impact of health on intelligence**

[http://en.wikipedia.org/wiki/Impact\\_of\\_health\\_on\\_intelligence#Micronutrients\\_and\\_vitamin\\_deficiencies](http://en.wikipedia.org/wiki/Impact_of_health_on_intelligence#Micronutrients_and_vitamin_deficiencies)

## **8. Additional Information**

### **Author**

This query response was prepared by Shanti Mahendra and Catherine Holley,  
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*With many thanks to Stuart Gillespie (IFPRI) for useful suggestions*

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