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Can maternal education hinder, sustain or enhance the benefits of early life interventions? Evidence from the Young Lives Longitudinal Study

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Abstract

Introduction

It is well established in the empirical literature that education produces benefits that are beyond income and employment (Haveman and Wolfe, 1984: Grossman, 2005; Feinstein et al., 2006). Consider, for instance, the benefits of providing uneducated adults with the ability to read, write and understand basic concepts needed for their engagement in the knowledge society. It is likely that uneducated adult women benefit in terms of increased confidence and self-efficacy. For uneducated parents, there are benefits of in terms of better health, nutrition and cognitive development for their children. Society as a whole can benefit from having more educated people, who can be actively engaged in civic and social matters.

Although the evidence to back up the wider benefits of education is substantial, there is a strong debate as to whether observed differences in outcomes are driven by differences in social class, income, education, poverty, employment or any other factor. In almost every country there are marked differences in health, social and civic participation between individuals with high levels of education and those with low levels of education (Schuller et al., 2004). But these differences are also established if one uses income or social class instead of education as an indicator of socioeconomic status. Whether it is class, education or income that dominates as cause seems to be of little importance. Yet, there are complex interactions between social class, education, income and other background and contextual factors which must be understood in order to establish how is that education can generate wider outcomes for individuals, their families and society as a whole.

This background paper focuses on the complementarities that education can bring to the multiple and sometimes interrelated interventions, from government and other national and international organisations, in the context of development. The international community and national governments around the world are committed to fighting poverty, reducing social and economic inequalities and improving the overall quality of life of individuals, in particular those living in extreme poverty and who are most in need (as indicated by the MDG, EFA, and other global initiatives signed and agreed by many countries). Therefore, resources have been invested to improve health and education, provide social protection and other anti-poverty interventions to improve the wellbeing of individuals and families. It is in this context that this paper raises the question: can education hinder, sustain or enhance the expected benefits of other interventions?

To address this question, the paper focuses on the benefits of early life interventions for children who participated in the Young Lives Longitudinal Study. Early life interventions have been called upon the WHO Independent Commission on the Social Determinants of Health to close the health gap in one generation (CSDH, 2008). In particular, we use mothers' access to antenatal care services as an example of an early life intervention. The benefits of antenatal care for children will be measured in terms of improved nutrition. Crucial for this research is the role of maternal education and its interaction with early life interventions. We hope that this paper provides clear evidence that is useful for the 2013 Education for All Global Monitoring Report which will examine the wider benefits of education in the context of development.

Review of Evidence

Education is considered to be a key policy instrument to reduce the vicious cycle of poverty which is transmitted between generations (CSDH, 2008; EFA-GMR, 2007). In particular, education is crucial for empowering women (Ross and Mirowsky, 1999), giving them knowledge and skills not only to participate in the labour market and to be better members of society, but also to be more efficient at bringing up their children (Feinstein et al., 2008). This is because women with higher levels of education place more value in their own health and the health of whom they care for (Grossman, 2005). Education can provide women with the knowledge to endow a cognitively stimulating environment for their children; an environment which can enhance child health, as well as physical, emotional and cognitive development (Duckworth and Sabates, 2005; Feinstein et al., 2008). Well-nourished and positively stimulated children can perform better socially and academically in school, thus providing an opportunity to break the intergenerational cycle of disadvantage (Grantham-McGregor et al., 2007).

The impact of maternal education on child nutrition has three primary causal pathways with several secondary or indirect pathways (Adato, et. al. 2011). Among the key pathways, maternal education impacts on child nutrition through increased knowledge of health issues (Richards et al., 2012). Second, maternal education can increase awareness of consumption of healthy foods and supplements, and thirdly, maternal education can change traditional attitudes towards child health and nutrition (Bellessa Frost, et al., 2005). Indirectly, maternal education can change gender norms and relations, providing women with increased autonomy and control over decisions which are related to child health (Richards, et al., 2012). Maternal education can also reduce the likelihood of income poverty and social exclusion, thus removing financial constraints, enabling families to achieve better living conditions, increasing their ability to pay for social services and improving their social relations; all of these factors can ultimate improve child developmental outcomes (Houweling and Kunst, 2010; Guliani, et al., 2012).

There are many empirical studies which have focused on the impact of maternal education on child health, and in particular on child nutrition. Most studies acknowledge a theoretical pathway but the empirically approach is that commonly known as 'black box'[1]. Findings from that wide literature have been reviewed in detailed by Currie (2009). In particular, Currie (2009) highlighted that large differences observed in child health and nutrition according to parents' levels education are apparent from very early years and are likely to increase as children's age. Nonetheless, health differences according to parental education tend to be reduced when other socioeconomic background factors are taken into account, such as parental income, parental socioeconomic status. Still, there is strong evidence that the effects of parental education, in particular maternal education, on the health and nutrition of children is strong and remain as one of the key causal predictors (Thomas, et al. 1991; Currie and Moretti, 2003; Bellessa Frost, et al., 2005; Boyle, et al., 2006; Chevalier and O'Sullivan 2007; Currie, 2009). This particular evidence has been supported by other studies within the countries participating in the Young Lives Study. For example, Moestue and Huttly (2008) found that although the education of other family members was important for child nutrition, the education of the mother was the most important factor for improving child height-for-age in Vietnam and India (similar result was found by Wamani, et al., 2004 for the case of rural

[1] 'Black box' refers to the direct impact of maternal education on child nutrition regardless of the mechanisms by which education may have an impact. Traditionally this approach is used when the empirical research aims at establishing causality.

Uganda). Chalasani (2012) found that lack of maternal education was a strong predictor of the increase in inequality in child nutrition in India (similar results were found by Basu and Stephenson, 2005, and by Pathak and Singh, 2011, for the case of India, but using different sources of data).

Key to this paper is the claim that education does not act in isolation. Education usually interacts with other important factors and, depending on the context, it may or may not generate social benefits. One of the first empirical papers in this area was produced by Barrera (1990) for the case of Philippines. His analysis raised the question on whether there were interactions between the education of the mother and public health programmes so that the nutrition of children could be improved. He found that there were complementarities and substitutions between public health programmes and maternal education. For instance, when there was lack of community cleaning programmes or piped water connections at community level, maternal education protected children against the risk of malnutrition. When there was lack of toilet connections at community or large distance to a health clinic, maternal education did not overcome the risk of malnutrition. But when both toilet connections were available at community level (or a health clinic at the community) and mothers had high levels of education, there were great reductions in the risk of malnutrition. This result suggested complementarities between these public health programmes and maternal education.

Following the same line of research, Barrera (1991) examined the combined role of maternal education and breastfeeding practices for improving child nutrition in the Philippines. More educated mothers tend to breastfeed for shorted periods and both maternal education and length of breastfeeding are positively related to child nutrition. His result suggests that more educated women are able to breastfeed for shorted periods without impacting on child nutrition as educated mothers are able to introduce health food supplements and provide better sanitation. In this sense, both education and breastfeeding practices are important for improving child nutrition. Similarly, Christiaensen and Alderman (2001) found that income growth could be important in alleviating child stunting in Ethiopia, but the impact of income could be stronger if it is combined with programmes aimed at increasing women's education. Both income and education, supported by targeted and specific nutrition education programmes, are necessary to reduce the level of stunted and inequalities between poor and rich families (similar result was found by Boyle, et al., 2006 suing Demographic Health Surveys for 42 countries). In Peru, the education of the mother interacted with the education of other members of the community to become a strong determinant of child nutrition. In other words, the more education other members of the community had, the more likely that a single mother could find support from within the community to deal with the consequences of ill nutrition for her child, thus reducing the chances of the child suffering from malnutrition (Alderman, et al. 2003).

Dargent-Molina et al. (1994), using the case of the Cebu community in the Philippines, found that maternal education had a great protective effect for children health among the more economically and socially advantage communities, but for the more disadvantage communities there was no effect of maternal education on child health. Similar results were found by Chevalier and O'Sullivan (2007) for the case of England where increasing post-compulsory education improved child birth weight for mothers of lower socioeconomic backgrounds. More recently, Favara (2012) showed that children in Peru whose parents had no education were able to overcome the difficulties of ill nutrition in the short run if the parents had access to social networks. In particular, for children whose mothers had low

levels of education, maternal social networks were positively associated with height-for-age at age 1, but no association was found at age 5. In Ghana, children whose mothers have no education are more vulnerable to diarrhoea if there is a lack of water and toilet facilities in the home (Gyimah, 2003). In many Latin American countries, the effect of women's decision-making power over resources was greater among women with high levels of education than among women with low levels of education, suggesting that improved nutrition is likely to be more effective when there is improved education and empowerment for women (Richards, et. al. 2012).

Overall, results from the evidence presented above indicate that indeed maternal education is a key factor for improving child nutrition, but the overall role of maternal education depends on the context as well as other intervening factors. Therefore, this paper focuses not only on the direct link of maternal education to child nutrition in the short and long run, but on the role of maternal education for the effectiveness of the impact of early life interventions on child nutrition.

Country Contexts

In order to contextualise the research we present here some key information on Ethiopia, India, Peru and Vietnam.[2] This information mostly refers to the period under research, that is between 2000 and 2005.

During the last decades, Ethiopia has been affected by food security, with droughts and other negative shocks impacting on the ability of households to achieve their livelihoods. As a result, a significant proportion of poor rural households in Ethiopia have not been able to produce enough food for self-consumption. In 2000, 51% of children in Ethiopia were stunted or chronically malnourished. Another important contributing factor to malnutrition was the lack of, and in most cases inadequate, water and sanitation facilities. In 2000, more than three quarters of the population did not have access to safe drinking water and appropriate sanitation. Lack of food, combined with poverty and poor infrastructure increased the chances of children suffering from gastrointestinal problems, which produced diarrhoea and weight loss. Maternal health and education are factors closely related to child wellbeing. Although Ethiopia expanded its health services nationally between 1995 and 2000, only a minority of women had access to good quality health care services. In 2000, only 50% of pregnant women had at least 1 antenatal care visit during pregnancy (and only 38% of poor women who were pregnant). Education of the adult population remained a massive challenge in 2000, with three quarters of adult women lacking primary school and over 70% being illiterate.

India has made huge progress economically and socially for over 2 decades. Nationally, the proportion of undernourished children reduced from nearly 66% during the early 1990s to 47% in 2000 (and for Andhra Pradesh the percentage was 38% in 2000, significantly lower than the national average). The percentage of stunted children (age 0 to 3) in 2000 was 46% across India and 39% in Andhra Pradesh. Still, many children who suffer from malnutrition are likely to come from poor families living in large households, had mothers with low levels of education, and mothers who did not use health care facilities. In addition, India also suffered from supply side factors contributing to high rates of malnutrition, such as lack of

[2] Information presented here comes from different reports produces by Young Lives and available at http://www.younglives.org.uk/publications

good quality health services for both mothers and infants (for example, only 70% of women who visited the health clinic for antenatal visits received folic acid tablets and half of the births were not attended by a health professional in 2000) as well as adequate water and sanitation facilities.

Peru is a country with marked wide disparities in many social and economic indicators. Unfortunately, many of the regional inequalities have not changed much during the last decades. For instance, although infant mortality rates have fell substantially in Peru between 1990 and 2000, the rate in Lima was 24 per 1,000 live births whereas in poor rural areas of Apurimac, the rate was 100 per 1,000 live births (more than 4 times the rate of Lima). Chronic malnutrition rates in children under five dropped from 37 to 25 per cent between 1991 and 2000, although the urban-rural disparity increased. In poor rural areas, more than 40% of children suffered from chronic malnutrition in 2000. Poor targeting mechanisms, urban biased of infrastructure investment and corruption are some of the main causes of increasing disparities between poor and rich in Peru. For example, the difference in access to piped water between urban rich households and rural rich household was more than 30 percentage points. Another indicator linked to child malnutrition in Peru was teenage pregnancy, estimated to be 18% nationally for girls aged 15 to 19. Teenage pregnancy is related to school drop out and unsatisfactory developmental provision for children.

Perhaps of all the four countries examined here, Vietnam is one that made the most important improvements in overall poverty reduction and human development by 2000. The total poverty rate fell from 57% in 1991 to 37% in 2000. Infant mortality was lower than the average for East Asia and Pacific region. However, child malnutrition remained relatively high and with some important regional disparities, for instance child malnutrition varied from 28% in the South East to 58% in the Central Highlands. Research from the Young Lives team suggested that perhaps cultural feeding practices, combined with inadequate water and sanitation facilities were the factors underlying the high malnutrition rates. Interestingly, Vietnam also has achieved important improvements in adult literacy and educational attainment by 2000, with less than 20% of the adult population being illiterate, less than 25% of the population without any form of formal schooling, more than 40% of the population with completed primary education and another 35% having qualifications equivalent to at least lower secondary schooling.

Methodological Approach

Data and Sample

For this study we employ data from the first two rounds of the Young Lives Longitudinal Study (YL) (Boyden, 2006). YL is a 15-year study of childhood poverty in 4 developing countries –Ethiopia (ET), Peru (PE), Vietnam (VI), and state of Andhra Pradesh in India (AP).[3] The first round of data was collected in 2002 and focused on two cohorts of children. The youngest cohort were children aged between 6 and 17 months and the oldest cohort were children aged between 7 and 8 years old. Our research uses data from the youngest cohort exclusively since it contains information on maternal education, antenatal care as one potential intervention, and child nutrition at age 1 and 5.

[3] For simplicity, the paper refers to Ethiopia, Andhra Pradesh, Peru, and Vietnam. However, these refer to the areas of the Young Lives study.

The sample strategy for YL was based on the sentinel site surveillance for which 20 geographical sites with 100 children each were selected (Wilson et al., 2006). Geographical sites were selected based on poverty status, while households within sites were randomly selected (Wilson et al., 2006). The sample as a whole is not nationally representative, but households are representative within geographical sites. It is important to mention that since the YL sample is based on poor areas of these countries, results cannot be generalised to the whole nation. Nonetheless, working with a sample which is relatively homogenous in terms of regional poverty status enables us to study the potential role of maternal education in relation to early life interventions for children living in households most in need.

Attrition and non-response biases must be considered in any longitudinal study (Wooldridge, 2002). In YL data, households which did not participate in the second wave of the survey do not systematically differ from the rest of the households, which minimises the problems related to attrition bias (Sanchez, 2009). Item missing responses were extremely low, estimated to be between 0.9% and 3.2% of the total sample. Only children whose biological mother was the respondent at first round have been included in the analysis given that only for these children we have information about antenatal care.

Nonetheless, in order to address potential bias resulting from issues related to item missing responses, we used multiple imputation to regain respondents who were missing information on control variables. We use the ICE command in Stata (Royston, 2009) to imputed values into five datasets, with all of the predictor variables included in the imputation procedure. After imputation, our analysis sample include 1,793 (out of 1,999) households for Ethiopia, 1,893 (out of 2,011) for India, 1,921 (out of 2,052) for Peru and 1,929 (out of 2,000) for Vietnam.

Definition of Key Variables

The main outcome variable of the study is malnutrition. We use height-for-age z-score, constructed according to the WHO's child growth standards as a proxy measure of early nutritional status (Wisniewski 2010). A value below two in the z-score (also known as stunting) provides a measure of very slow growth since birth and it is considered to be a stock measure of malnutrition (Wisniewski 2010) and it is commonly used to monitor nutritional level between and within populations (Stevens, 2012). We look at the height-for-age z-score of the child at both rounds.

The first explanatory variable of main interest is maternal education. We used the variable related with mother level of education and considered the following four categories: none (0 years); incomplete primary (1-5 years); primary and incomplete lower secondary (6-9 years); lower secondary and over (10+ years). For women with uncertain information on level of education – such as adult education or religious education – we used the variable related to their ability to read and understand newspaper in the common language assigning them to the first educational category when unable to do it, and incomplete primary otherwise. Additionally the continuous version of maternal education has been constructed. However results using this variable will only be shown in the Appendix as using years of education has been criticised for being too restrictive due to the linearity assumption[4].

[4] The linearity assumption suggests that an additional year of education will have the same impact on the outcome of interest (in our case malnutrition) regardless of the level of education. Many authors have shown, however, that there are non-linear relations between education and social outcomes (Grossman, 2005; Feinstein, et al., 2006)

The second key explanatory variable is antenatal care (ANC). WHO (WHO 2003) recommendations for ANC for a normal pregnancy consist of four visits during pregnancy, with a visit within the first trimester, and a skilled practitioner during birth (doctor, nurse, or midwife). The WHO recommendations for ANC in deprived areas where YL carried out the data collection imply that only a small minority of women would be following these recommendations. For this reason we restrict our definition and considered women with good access to ANC if received at least one visit (independently from the timing and quantity) and a skilled health professional was present at delivery (doctor, midwife or nurse).

To analyse the role of maternal education on ANC (early intervention) on child nutrition we used both maternal education and ANC access to construct the following variable: No education – poor/no ANC; No education – good ANC; Primary incomplete – poor/no ANC; Primary incomplete – good ANC; Primary completed and lower secondary incomplete – poor/no ANC; Primary completed and lower secondary incomplete – good ANC; lower secondary and over – poor/no ANC; lower secondary and over – good ANC.

The following control variables have been included, based on previous research which has largely shown association with child nutritional outcome: mother's age (Fergusson and Lynskey 1993); mother's height (Subramanian, 2009); mother's religion; an indicator variable on whether the father has more, less or the same education as the mother (Moestue and Huttly); household quality, water and toilet improvement (Aber et al. 1997); length of breastfeeding (Angelsen et al. 2001); as well as child sex - to control for household gender preference in the allocation of resources such as health care and food (Hazarika, 2010) and child age. Descriptive statistics on all these variables is shown in Table 1.

Statistical Method

We model our outcome of interest, child nutrition, as a function of access to antenatal care services, maternal education, and a set of key predictors of child nutrition found to be relevant in the empirical literature (such as household poverty, access to piped water, among others). In our modelling, child nutrition at the household level is likely to be influenced by community factors, such as the availability of health services, piped water, sanitation, at the community level. For this reason, we modelled explicitly these community factors including a random effect in the regression analysis. Our modelling technique assumes that unobserved factors which can also determine child nutrition (for example women's attitudes towards food and cultural feeding practices) are left in the error term. Since these factors are likely to be related to mother's education, our results are not about causality, but remain at the level of associations.

The modelling strategy is as follow: first we modelled the bivariate relationship of maternal education and child nutrition at age 1 (and then at age 5) using random effects models. Then, we include antenatal care as control to see whether this variable has a direct effect on child nutrition and if it accounts for some of the effect of maternal education. Thirdly, we include in the model controls described above to investigate whether the effect of maternal education and antenatal care is accounted for by other observable factors. Finally, we estimate the impact of maternal education and antenatal care together on child nutrition. This last model is the interaction between maternal education and access to antenatal care. The last model will also include all controls in the model. Note that all empirical analyses use Rubin's (1996) rule for combining estimates and adjusting standard errors from imputed datasets (Royston, Carlin, and White, 2009).

Results

Effects of maternal education on child nutrition at age 1.

Table 2 shows results from models estimating the effect of maternal education on child nutrition at age 1.[5] Model 1 introduces only maternal education and community random effects. Model 2 adds antenatal care and finally Model 3 includes all controls in the analysis. Our main and most consistent finding is that maternal education at levels higher than primary schooling (6 to 9 years and 10 or more years of education) are consistently associated with lower risk of child stunting at age 1 in all countries. Compared with children of mothers without education, children of mothers with 10 or more years of education have less than 50% chances of being stunted at age 1 in Ethiopia and India and less than 75% chances of being stunted at age 1 in Peru and Vietnam (see results from Model 3, Table 2). Compared with children of mothers without education, children of mothers with 6 to 9 years of schooling have 45% less chances to be stunted in Ethiopia, 32% less changes to be stunted in India and nearly 60% less chances to be stunted in Peru and Vietnam.

Second consistent finding is that the inclusion of antenatal care in the model does not account for the direct effect of maternal education on child nutrition at age 1. The estimate of maternal education in all models remains statistically significant and its point estimate is hardly changed with the inclusion of antenatal care. These results can be shown in Model 2, Table 2. Thirdly, we do not find evidence that antenatal care has a direct effect on stunting at age 1 in Ethiopia, India or Vietnam. In Peru, however, we find that children whose mothers had antenatal care visits during pregnancy and a skilled health professional at delivery were little over 40% less likely to be stunted at age 1 compared with children whose mothers had no or limited access to antenatal care services.

Effects of maternal education on child nutrition at age 5.

Moving to the longer terms benefits of maternal education on child nutrition, Table 3 shows that maternal education is still consistently associated with lower risk of child malnutrition at age 5, but mainly for mothers with high levels of education (10 or more years).[6] In Ethiopia and India, children of mothers with 10 or more years of schooling have 55 to 60% fewer chances to be stunted at age 5 compared with children of mothers with no education. In Peru, children of mothers with 10 years or more of education have 65% fewer chances of being stunted at age 5 compared with children whose mothers have no education. In Vietnam, the effect of maternal education is large, with children whose mothers have more than 10 years of education have 90% less chances to be stunted at age 5 compared with children whose mothers have no education (see Model 3, Table 3).

Again, as for the case of short term impacts (at age 1) we found that there is very little impact of antenatal care on the relationship between maternal education and child nutrition at age 5 (see Model 2, Table 3). Most of the estimates remained unchanged in point estimate or statistical significance. We also found that only in Peru there is evidence that antenatal care is

[5] Full set of results are shown in Appendix

[6] Full set of results are shown in Appendix

associated with reductions in child nutrition at age 5. Our results showed that children whose mothers had antenatal care visits and a skilled health professional at delivery have nearly 50% chances of being stunted at age 5 compared with children whose mothers had no access or limited access to antenatal care services. For Ethiopia, India and Vietnam, we did not find evidence that antenatal care was associated with improved child nutrition at age 5.

Interaction effects of maternal education and antenatal care on child nutrition at age 1 & 5.

Key to this paper is the role of maternal education in moderating the effects of antenatal care on child stunting at age 1 and 5, that is in the short and long run. For this, we first estimated a model where maternal education is interacted with antenatal care. Results for this model are show in the Appendix. Compared with children whose mothers had no education and no or limited access to antenatal care, children whose mothers had higher levels of education and access to antenatal care have reduced chances of malnutrition at age 1 and at age 5. These reductions are 74%, 62%, 88% and 83% in Ethiopia, India, Peru and Vietnam, respectively, for the likelihood of stunted at age 1 and 77%, 60%, 82% and 91% for the risk of stunted at age 5, for Ethiopia, India, Peru and Vietnam, respectively.

Figure 1 shows the main findings to highlight which is the impact of the interaction between maternal education and access to antenatal care on stunting at age 1 and 5. On the y-axis we have the probability of stunted and on the x-axis we have maternal education for each of the 4 countries. The height of the bar represents the difference in the likelihood of being stunted for children whose mother had no access or limited access to antenatal care and those whose mothers had good access to antenatal care. Each of these differences is done by mothers' level of education. To simplify the findings, if the difference was not statistically significant, it was given a value of zero.

The first key finding is that there are complementarities between maternal education and antenatal care for improving child nutrition. In Ethiopia, children whose mothers had primary schooling and access to antenatal care had 39% less chances of being stunted at age 1 than children whose mothers of similar education but who had no access or limited access to antenatal care. For children whose mothers had 10 or more years of schooling, the difference in likelihood of stunted at age 1 was 26% between those whose mothers had access to antenatal care and those who had no access or limited access.

The second key finding is that the level of education at which we find complementarities between maternal education and access to antenatal care services differs by country. In Ethiopia we find these complementarities with maternal education at primary level and beyond lower secondary level. In India, we did not find complementarities whereas in Peru we find complementarities at lower secondary level and beyond lower secondary level. Finally, for Vietnam we only find complementarities at maternal education levels beyond lower secondary school.

The third key finding is that the gap in likelihood of being stunted, for children whose mothers had no education and no or limited access to antenatal care and those children whose mothers have the highest levels of education and access to antenatal care is substantial. Table 4 shows the predicted likelihood of being stunted at age 1 and age 5, in each country, according to whether the mother had education and access to antenatal care or no education and no access to antenatal care (other variables held constant to their mean values). In Ethiopia, children of most disadvantaged mothers had 63% probability of being stunted at age

1 whereas for children of most advantaged mothers, the probability is only 31% (32 percentage points difference). In Vietnam, children of most disadvantaged mothers had 51% probability of being stunted at age 1 whereas children of most advantaged mothers had only 13% probability of being stunted. Although these probabilities are lower than for Ethiopia (in absolute terms), there is an impressive gap of 38 percentage points between children who "have" and those who "have not".

Conclusions

This paper set out to provide evidence on the benefits of maternal education on child nutrition in four very distinct contexts (Ethiopia, India, Peru and Vietnam). The main argument of the paper is the examination of the benefits of maternal education on child nutrition during the first year of the child life and also at age 5, that is a longer term span in terms of maternal benefits. More importantly, the paper argues that maternal education can complement early life interventions to generate further benefits for children. For the particular case of antenatal care, mothers with high levels of education are more likely to use antenatal care services, to seen a health professional at delivery and to have children who are born with less complications (Guliani et al., 2012).

Our first key finding suggests that there are benefits of maternal education on reducing child malnutrition both at age 1 and at age 5. We also find that these benefits are substantial, with mothers who have the highest levels of education tend to have children who have the lowest risk of malnutrition. Of course, the benefits of maternal education estimated here may be the result of cumulative processes, whereby education provides these mothers not only with increased knowledge on health related issues (Richards et al., 2012), increased awareness of the importance to consume health foods and a balanced diet for children (Bellessa Frost, et al., 2005), improved confidence and self-esteem, improved economic potential and wider social networks (Adato, et. al. 2011). All these different mechanisms are also related to improved child nutrition. Our paper is not designed to disaggregate between these different pathways, as we do not have the measures to be able to undertake this kind of analyses. Nonetheless, our results are consistent with a number of studies pointing out the importance of maternal education (Currie, 2009).

Our second, and perhaps most important finding, is that maternal education can interact with other early life interventions to support a health development for children. In this respect it is well established that interventions to improve child nutrition must acknowledge the complexity of the context and the multiplicity of intervening factors which must be tackled in order to reduce the risk of ill-nutrition on children. For example, the Safe Mother Project in Indonesia aimed at increasing the demand for quality maternal and child health, increase the supply of health services, provided training on health related issues and targeted adolescents as a particular vulnerable group (Baird, et al., 2011). So, we cannot expect that improved access to antenatal care services or improved educational opportunities for mothers will alone support reductions in child malnutrition. The fact that there are complementarities between these two policy options does not mean that these are the only available tools for policymakers to reduce malnutrition. The approach must be holistic, seeking to invest in community access to drinking water and sanitation, health centres, health related training programmes, increased demand for locally produced products, among others.

But it is also important not to forget that the current system is already embedded in large structural inequalities (Chalsani, 2012). The gap in health and cognitive development between poor and rich children exists since early ages. Rich children will continue to benefit from better opportunities whereas poor children will continue to lag behind. The gap between rich and poor is likely to increase as children grow up. Unfortunately, the only way to deal with these inequalities is to follow the call of the independent commission on the social determinants of health inequalities that dealing with inequalities is a matter of social justice (CSDH, 2008). Only with strong targeted and redistributive programmes can current gaps be ameliorated.

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Table 1 - Variable definitions and descriptive statistics for main variables, mean and (SD)

		Ethiopia		India		Peru		Vietnam	
Variable	**Description**	*mean*	*sd*	*mean*	*sd*	*mean*	*sd*	*mean*	*sd*
Gender	Gender of the child, proportion of girls	0.47	0.01	0.46	0.01	0.49	0.01	0.49	0.01
Child age	Child's age in months	11.64	0.08	11.79	0.08	11.54	0.08	11.63	0.07
Stunting year 1	Child nutritional status, stunted lower than -2 height-for-age z-score	0.42	0.01	0.31	0.01	0.28	0.01	0.21	0.01
Stunting year 5	Child nutritional status, stunted lower than -2 height-for-age z-score	0.32	0.01	0.36	0.01	0.33	0.01	0.26	0.01
Access to antenatal care	Access to antenatal care defined if at least one visit and health professional at delivery	0.15	0.01	0.55	0.01	0.73	0.01	0.71	0.01
Mother age	Mother's age	27.43	0.15	23.66	0.10	26.84	0.15	27.16	0.13
Mother height	Mother's height in cm	158.74	0.15	151.64	0.13	149.94	0.13	152.22	0.13
Mother religion	Main religion (Ethiopia: Christian-orthodox; India: Hindu; Peru: Christian; Vietnam: None)	0.71	0.01	0.91	0.01	0.8	0.01	0.91	0.01
Mother education: none	0 years of education	0.57	0.01	0.54	0.01	0.09	0.01	0.11	0.01
Mother education: primary incomplete	1-5 years of education	0.2	0.01	0.15	0.01	0.21	0.01	0.26	0.01
Mother education: primary complete or lower secondary incomplete	6-9 years of education	0.15	0.01	0.14	0.01	0.3	0.01	0.45	0.01
Mother education: lower secondary complete and over	10+ years of education	0.08	0.01	0.17	0.01	0.41	0.01	0.18	0.01
Difference mother-father education: same level	Comparison maternal-paternal education: same level of education	0.46	0.01	0.49	0.01	0.56	0.01	0.57	0.01
Difference mother-father education: mother higher	Comparison maternal-paternal education: maternal higher than paternal	0.11	0.01	0.11	0.01	0.12	0.01	0.15	0.01
Difference mother-fathereducation: father higher	Comparison maternal-paternal education: paternal higher than maternal	0.43	0.01	0.39	0.01	0.32	0.01	0.27	0.01
Number of under 5 years old in the household	more than one	0.46	0.01	0.2	0.01	0.38	0.01	0.24	0.01
Water R1	proportion of household with improved water (piped/bought)	0.11	0.01	0.17	0.01	0.78	0.01	0.1	0.01
Water R2	proportion of household with improved water (piped/bought)	0.23	0.01	0.12	0.01	0.77	0.01	0.15	0.01
Sanitation R1	proportion of household with improved sanitation (flush/septic/pit latrine in hh)	0.21	0.01	0.25	0.01	0.77	0.01	0.49	0.01
Sanitation R2	proportion of household with improved sanitation (flush/septic/pit latrine in hh)	0.44	0.01	0.33	0.01	0.86	0.01	0.6	0.01
Length of breastfeeding	proportion of children receiving more than 6 months of breastfeeding	0.95	0.01	0.93	0.01	0.97	0.00	0.98	0.00
Household quality R1	Based on number of rooms per personand main materials for the walls, roof and	0.23	0.00	0.5	0.01	0.41	0.01	0.56	0.01
Household quality R2	Based on number of rooms per personand main materials for the walls, roof and	0.28	0.00	0.54	0.01	0.4	0.01	0.63	0.01

Table 2: Odd ratio estimate (standard error) for impact of maternal education and antenatal care on child stunting at age 1.

		Model 1		Model 2		Model 3	
		OR	Std. Sig.	OR	Std. Sig.	OR	Std. Sig.
Ethiopia	Maternal Education (reference none)						
	Maternal Education (1-5 yrs)	0.61	0.14 **	0.61	0.14 **	0.61	0.15 **
	Maternal Education (6-9 yrs)	0.58	0.17 **	0.58	0.17 **	0.54	0.20 **
	Maternal Education (10+ yrs)	0.46	0.24 **	0.46	0.24 **	0.43	0.28 **
	Antenatal Care (reference No/Partial)						
	Visit & skilled professional	--	--	0.72	0.14	0.73	0.20
	Controls	No		No		Yes	
	No. Observations	1793		1793		1793	
India	Maternal Education (reference none)						
	Maternal Education (1-5 yrs)	0.71	0.16 *	0.73	0.16 *	0.73	0.18
	Maternal Education (6-9 yrs)	0.60	0.17 **	0.62	0.17 **	0.68	0.19 *
	Maternal Education (10+ yrs)	0.40	0.18 **	0.42	0.18 **	0.42	0.22 **
	Antenatal Care (reference No/Partial)						
	Visit & skilled professional	--	--	0.83	0.11	0.84	0.12
	Controls	No		No		Yes	
	No. Observations	1893		1893		1893	
Peru	Maternal Education (reference none)						
	Maternal Education (1-5 yrs)	0.45	0.21 **	0.44	0.21 **	0.38	0.24 **
	Maternal Education (6-9 yrs)	0.35	0.21 **	0.38	0.21 **	0.40	0.26 **
	Maternal Education (10+ yrs)	0.17	0.23 **	0.20	0.23 **	0.22	0.32 **
	Antenatal Care (reference No/Partial)						
	Visit & skilled professional	--	--	0.58	0.14 **	0.57	0.15 **
	Controls	No		No		Yes	
	No. Observations	1921		1921		1921	
Vietnam	Maternal Education (reference none)						
	Maternal Education (1-5 yrs)	0.45	0.21 **	0.47	0.22 **	0.50	0.24 **
	Maternal Education (6-9 yrs)	0.34	0.21 **	0.36	0.22 **	0.38	0.26 **
	Maternal Education (10+ yrs)	0.19	0.29 **	0.21	0.30 **	0.24	0.36 **
	Antenatal Care (reference No/Partial)						
	Visit & skilled professional	--	--	0.84	0.14	0.94	0.15
	Controls	No		No		Yes	
	No. Observations	1929		1929		1929	

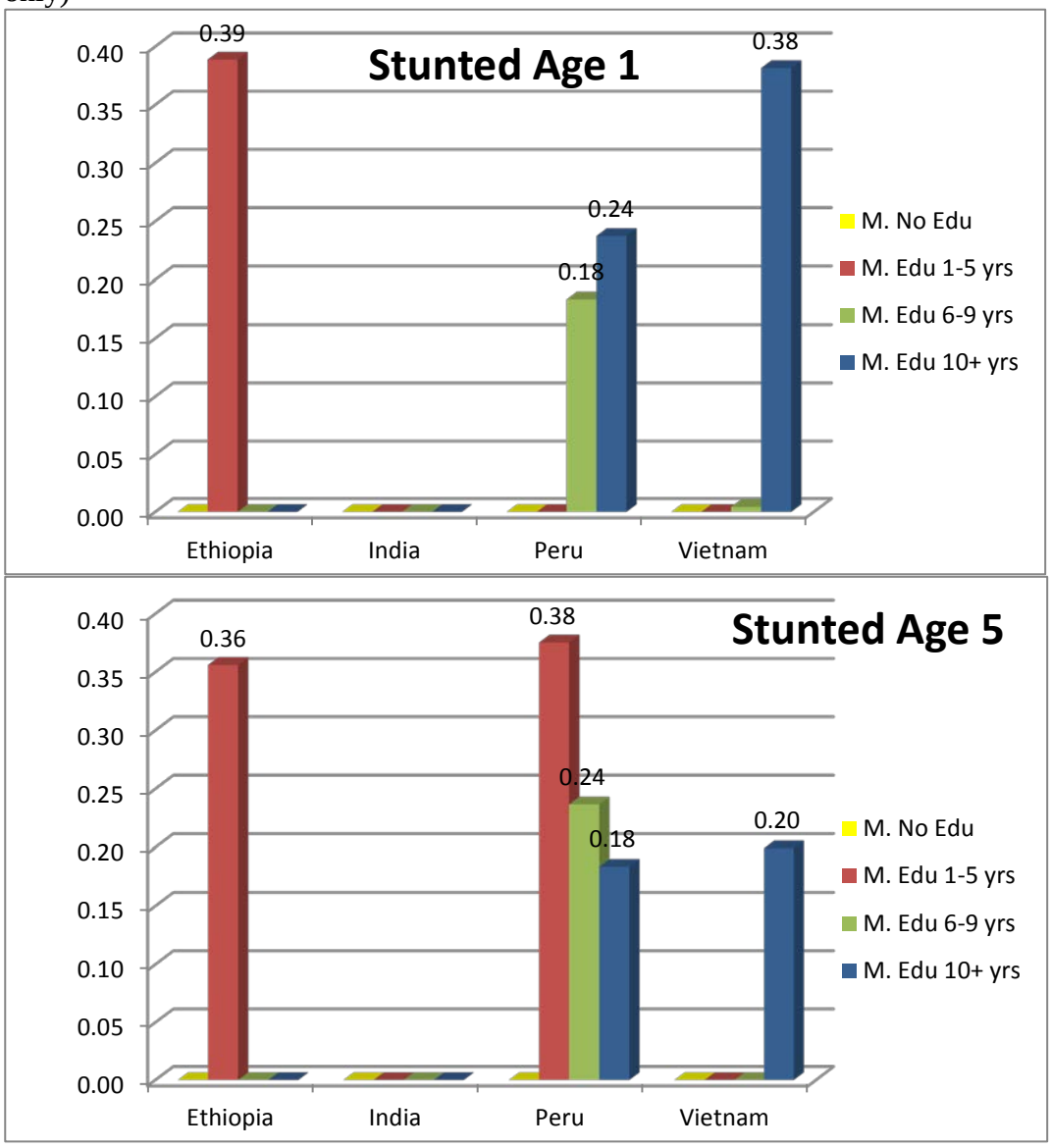
Source: Young Lives. Notes: Asterisks *, ** represent statistical significance at 5, 1% level, respectively.

Table 3: Odd ratio estimate (standard error) for impact of maternal education and antenatal care on child stunting at age 5.

		Model 1		Model 2		Model 3	
		OR	Std. Sig.	OR	Std. Sig.	OR	Std. Sig.
Ethiopia	Maternal Education (reference none)						
	Maternal Education (1-5 yrs)	0.66	0.14 **	0.68	0.14 **	0.66	0.16 **
	Maternal Education (6-9 yrs)	0.68	0.17 *	0.72	0.18 *	0.64	0.21 *
	Maternal Education (10+ yrs)	0.35	0.27 **	0.39	0.28 **	0.39	0.32 **
	Antenatal Care (reference No/Partial)						
	Visit & skilled professional	--	--	0.72	0.14 *	0.71	0.21
	Controls	No		No		Yes	
	No. Observations	1793		1793		1793	
India	Maternal Education (reference none)						
	Maternal Education (1-5 yrs)	0.72	0.15 *	0.73	0.15 *	0.70	0.16 *
	Maternal Education (6-9 yrs)	0.70	0.15 *	0.73	0.15 *	0.77	0.18
	Maternal Education (10+ yrs)	0.37	0.16 **	0.39	0.17 **	0.45	0.20 **
	Antenatal Care (reference No/Partial)						
	Visit & skilled professional	--	--	0.84	0.11	0.88	0.11
	Controls	No		No		Yes	
	No. Observations	1893		1893		1893	
Peru	Maternal Education (reference none)						
	Maternal Education (1-5 yrs)	0.66	0.21 *	0.66	0.21	0.64	0.23
	Maternal Education (6-9 yrs)	0.56	0.21 **	0.62	0.22 *	0.68	0.26
	Maternal Education (10+ yrs)	0.22	0.23 **	0.27	0.24 **	0.35	0.31 **
	Antenatal Care (reference No/Partial)						
	Visit & skilled professional	--	--	0.45	0.14 **	0.52	0.15 **
	Controls	No		No		Yes	
	No. Observations	1921		1921		1921	
Vietnam	Maternal Education (reference none)						
	Maternal Education (1-5 yrs)	0.37	0.21 **	0.39	0.22 **	0.42	0.24 **
	Maternal Education (6-9 yrs)	0.29	0.21 **	0.31	0.22 **	0.32	0.26 **
	Maternal Education (10+ yrs)	0.11	0.30 **	0.12	0.31 **	0.12	0.36 **
	Antenatal Care (reference No/Partial)						
	Visit & skilled professional	--	--	0.88	0.14	0.91	0.15
	Controls	No		No		Yes	
	No. Observations	1929		1929		1929	

Source: Young Lives. Notes: Asterisks *, ** represent statistical significance at 5, 1% level, respectively.

Figure 1: Difference in likelihood of stunted at age 1 & 5 for children whose mothers had access to antenatal care and those who did not, by mothers' education (significant results only)



Note: y-axis indicates change in the likelihood of stunted.

Table 4: Predicted likelihood of stunted for children of most advantaged and most disadvantaged mothers in terms of education and access to antenatal care.

		Predicted probabilities of Stunted					
		Most disadvantaged			Most priviledged		
		All	Female	Male	All	Female	Male
Ethiopia	Stunted Age 1	63%	56%	68%	31%	25%	36%
	Stunted Age 5	44%	41%	47%	14%	12%	15%
India	Stunted Age 1	53%	49%	56%	26%	23%	29%
	Stunted Age 5	54%	51%	56%	28%	26%	30%
Peru	Stunted Age 1	75%	68%	81%	23%	18%	29%
	Stunted Age 5	69%	70%	67%	19%	20%	18%
Vietnam	Stunted Age 1	51%	45%	57%	13%	10%	16%
	Stunted Age 5	55%	52%	58%	8%	8%	9%

Most Disadvantaged: Mother had no education and no or limited access to antenatal care

Most Advantaged: Mother had 10+ years of education and access to antenatal care

Note: Predict probabilities based on fixed terms only. All variables are fixed to their mean value. For the categorical variable 'Difference mother-father education' mean value has been set to the one for the category 'same level'.