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The structural relationship between early nutrition, cognitive skills and non-cognitive skills in four developing countries☆

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ABSTRACT

This study provides evidence about how cognitive and non-cognitive skills are acquired during childhood in four developing countries (Ethiopia, India, Peru and Vietnam), highlighting the role of early nutrition as a determinant in this process. An increase of one standard deviation in height-for-age at the age of 1 is found to have a total effect on cognitive skills at age 8 by 5.4 percent in Ethiopia, 9.0 percent in India, 7.6 percent in Peru and 8.4 percent in Vietnam. The corresponding total effect on non-cognitive skills is 1.1 percent in Ethiopia, 3.4 percent in India, 2.6 percent in Peru and 1.7 percent in Vietnam. The evidence suggests the effect of early nutrition on non-cognitive skills is indirect, mediated by cognitive skills. The effect is also relatively small in magnitude.

1. Introduction

Stunting in young children is a persistent phenomenon in developing countries. Globally, 23.2 percent of children under 5 years of age were stunted in 2015.[1] While this represents a decline compared to the 2000 figure (32.7 percent), progress has been uneven around the world, with five sub-regions still reporting stunting rates above 30 percent (Western Africa, Middle Africa, Eastern Africa, Southern Asia, and Oceania). Stunting is associated with undernutrition and is considered one of the main risk factors for sub-optimal child development (Grantham-McGregor et al., 2007). Accordingly, its eradication is a prominent feature of the 2030 agenda for sustainable development.

This study aims to expand our understanding of the role of early undernutrition in the formation of skills, going beyond the well-known impact on cognitive skills (Alderman et al., 2006; Glewwe et al., 2001). There is some evidence to suggest the existence of a link between early nutrition and behaviour. Grantham-McGregor et al. (1999) summarize results from early studies that assess behavioural dimensions of mildly to moderately underweight infants or school-aged children who were also stunted. According to these findings, underweight children were more anxious and less environmentally involved than children of normal weight, and children who were stunted between 9 and 24 months of age had lower activity levels than non-stunted children, explored their environment with less enthusiasm than those children and were less happy than them. Other studies look at the impact of clinical malnutrition on behaviour. Grantham-McGregor

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[1] Official estimates from UNICEF / World Health Organization / World Bank joint report.

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(1995) presents a review of this evidence. She finds that formerly severely malnourished children had behavioural problems similar to those mentioned above, as well as lower psychological functioning. For a recent study on the impact of clinical malnutrition, see Galler et al. (2012).

Arguably, the most compelling evidence about the relationship between early stunting and non-cognitive skills comes from a cohort study in Jamaica. Chang et al. (2002) show that children who were stunted in the first two years of life reported lower psychological functioning at age 11, compared to those that were not. Similar evidence is observed at age 17 (Walker et al., 2007). These differences included lower self-esteem, more anxiety, depressive symptoms, and anti-social behaviour.

A relationship between early stunting and non-cognitive skills is expected, given the nutrition–cognition nexus and the existence of "cross-effects" from cognitive to non-cognitive skills (Cunha and Heckman, 2008), which suggests an indirect channel through which this relationship can occur. But there might also be a direct channel in place. Walker et al. (2007) point out that a direct relationship can arise because early malnutrition affects brain structure, leading to lasting cognitive and emotional effects. See also Levitsky and Strupp (1995) and Tierney and Nelson (2009). In addition, when interpreting the results of the pioneer INCAP study in Guatemala (a randomized, nutritional intervention during early infancy), Pollitt et al. (1993) suggest that the effect of malnutrition on motor maturation and exploratory behaviour is what drives the relationship between malnutrition and the acquisition of cognitive abilities and social behaviours, an observation that has been reinforced in more recent studies (Black et al., 2004).

A possible theoretical framework to study the role of early undernutrition on the formation of skills is the technology of skill formation formulated by Cunha and Heckman (2008). This model highlights the notions that skills are self-reinforcing (self-productivity) and that cognitive skills are an input for non-cognitive skills, and vice versa (cross-productivity). In turn, the whole process is driven by parental investments, which feed both types of skills at different stages of childhood and adolescence. The authors formulate and estimate this model using panel data from the United States. Although this framework is useful for conceptualizing the process of skill accumulation, early nutritional status is not used as an input in the model. Two subsequent studies, which use data from the Young Lives longitudinal study, go further in this direction (Helmers and Patnam, 2011; Dercon and Sanchez, 2013). The first study cited estimates the skill formation model for India, while the second one uses a reduced-form approach to look at the relationship between height-for-age at the age of 8 and psychosocial competencies at the age of 12 in four developing countries. Owing to data constraints, neither of these studies was able to trace the link between early nutrition and non-cognitive skills (in the Young Lives study, the collection of indicators of non-cognitive skills for those children followed since birth took place in Round 3 of the survey, and these studies used data from the first two rounds only). Within this context, the objective of this study is twofold. First, to test the role of early undernutrition in the formation of cognitive and non-cognitive skills in developing countries using an extended version of the skill formation model in which nutritional status is allowed to play a role. Second, to analyse the mechanisms through which such relationship emerges. To achieve these objectives I use data from the first three rounds of Young Lives, a longitudinal study that tracks the lives of 12,000 children in a group of countries ranging from low-income (Ethiopia) to lower-middle-income (India) and upper-middle-income (Vietnam and Peru). For each country sample, I estimate a structural model in which height-for-age at ages 1 and 5 is an input for cognitive skills at ages 5 and 8, and for cognitive and non-cognitive skills at age 8. This rich international data set allows me to deal with measurement error and endogeneity issues, while the fact that data are available for four countries makes it possible to discuss the external validity of the results.

2. The data

Young Lives is a longitudinal study of childhood poverty that is collecting data on 12,000 children in Ethiopia, India (undivided Andhra Pradesh),[2] Peru and Vietnam. These four countries were selected to reflect a range of cultural, economic, geographical, political and social contexts, as well as common issues faced by developing countries. At the beginning of the study, Ethiopia, India and Vietnam were classified by the World Bank as low-income countries, whereas Peru was classified as a lower-middle-income country. Since then, Peru and Vietnam and, to a certain extent, India, have experienced sustained periods of economic growth. Currently Peru and Vietnam are classified as upper-middle-income countries, while India is considered a lower-middle-income economy.

Two birth cohorts are tracked in each country: a Younger Cohort, born in 2001/2; and an Older Cohort, born in 1994/5. This study uses data from the Younger Cohort. Children in the Younger Cohort have been visited in four rounds. Round 1 was administered in 2002, when the children were about 1 year old (between 6 and 18 months). Three additional survey rounds took place in 2006, 2009 and 2012, when ages were 5, 8 and 12 years, respectively. This study uses data from the first three rounds. In each country, approximately 2,000 children were sampled following using a multi-stage sampling procedure.[3] These country samples are not nationally representative. In fact, Young Lives purposively drew up pro-poor samples. Despite this, it has been found that the samples reflect the diversity of living conditions existent in each country (Outes and Sanchez, 2008; Kumra, 2008; Escobal and Flores, 2008; Nguyen, 2008). It is worth to noting that attrition levels in the first three survey rounds

[2] The state of Andhra Pradesh was bifurcated into the two new states of Telangana and Andhra Pradesh on 2 June 2014.

[3] In each country, 20 clusters were selected. Then, within each cluster 100 households with a child aged between 6 and 18 months were selected at random to participate in the study, creating cohorts of up to 2,000 children in each country. More details of the sample design can be found in Outes and Sanchez (2008) for Ethiopia, Kumra (2008) for India, Escobal and Flores (2008) for Peru, and Nguyen (2008) for Vietnam.