Nutrition, Stunting and Catch-Up Growth

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Recognition of the importance of good nutrition in early childhood has led to an increased acceptance of the 'first 1000 days' (from conception through the second year of life) as a critical window of opportunity for ensuring children have good health throughout life, with associated benefits in other areas. There are powerful arguments to say that investments made during this early period are both a foundation for better long-term development and the most efficient point of intervention to lessen the impacts of childhood poverty.

Early under-nutrition is reflected in children's physical growth trajectories, with early disadvantage stunting children's development from a very young age. However research from cohort studies is increasingly identifying that children's growth trajectories are not fully fixed in infancy. Some children are able to recover from early stunting, while others fall behind after an initial period of normal growth. Understanding what determines changes in children's post-infancy growth gives insights into the patterns of development (and interventions) which may foster more sustained healthy growth. This brief summarises key evidence to date from a series of research studies using Young Lives data to analyse children's growth, and concludes by drawing out implications for policy.

The importance of early nutrition

Good nutrition is an essential foundation for children's development. Under-nutrition is a cause of stunting (low height-for-age) and is a key factor leading to preventable child mortality, as well as being linked with greater susceptibility to illness. It is also associated with long-term effects on children's later outcomes including learning and psychosocial development.

Under-nutrition impedes the development of societies. As economies grow, the demand for a highly skilled workforce also increases, so the impact of under-nutrition in undermining children's ability to benefit from schooling, education and training is likely to become increasingly apparent.

There are considerable international and national efforts to focus greater policy attention on the impact of malnutrition. The Scaling Up Nutrition movement, is a collective effort of governments and civil society to improve nutrition. The new Sustainable Development Goals reiterate concerns to reduce child stunting. The 2015 Global Nutrition Report provides data and policy advice on how to tackle under-nutrition.

Recent emphasis has focused on the early years of life to reduce under-nutrition and this needs to remain a core priority for intervention. However evidence from Young Lives and other cohort studies show that children's growth trajectories are not determined completely during infancy: some children physically recover while others who do well initially may later fall behind. This brief discusses the implications of several recent studies of children's growth patterns and the factors that may be associated with changes in their growth trajectories.

Studies reported here use data from Young Lives to contribute to understanding of these issues. Young Lives is a multi-purpose study of childhood poverty which collects anthropometric data, such as information on children's height alongside that on their material and social circumstances. While Young Lives is not designed to be a nutritional surveillance study, it is a cohort study and contains information on the same children over a long period of time. The four country design enables checking whether findings hold across different contexts using information collected at the same age points. The data show that changes in children's height gain trajectories carry on well beyond the age of 1 year. The key policy question therefore is how to understand the potential drivers and implications of these changes.

Summary

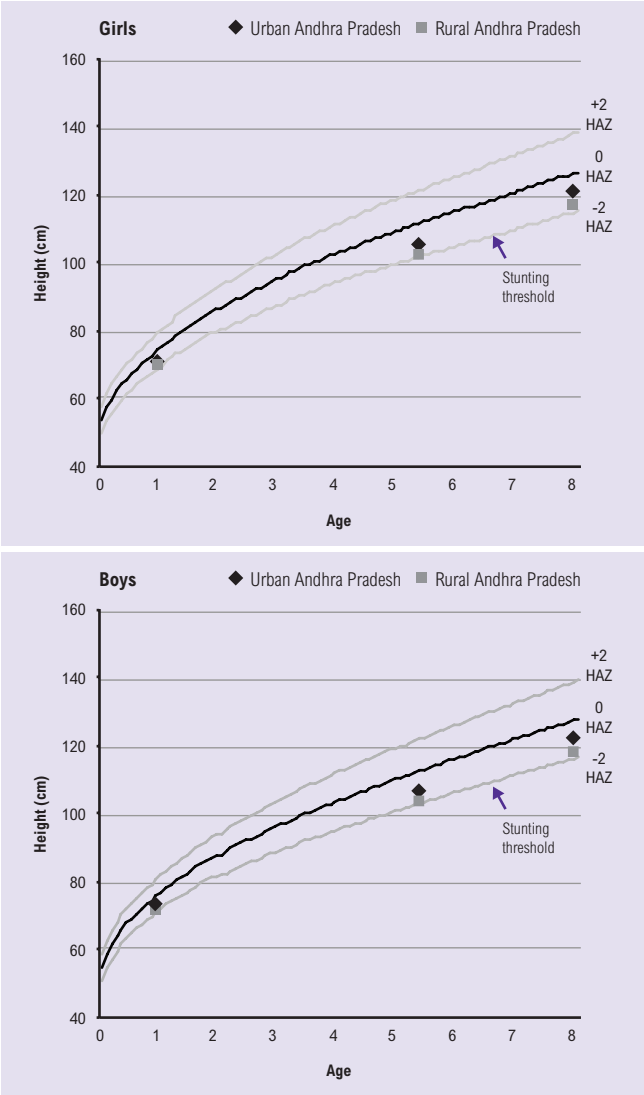
- Considerable concern exists over the prevalence of child malnutrition and the damage it causes. Under-nutrition poses a severe threat to the healthy growth and development of children and undermines societal development.
- The first 1000 days are a vital foundation for later development. Prevention of malnutrition needs to remain a core priority of policies for children.
- But growing evidence suggests changes in children's growth patterns happen beyond infancy and it is important to understand how these are triggered. This also allows us to examine the potential for policy interventions to promote catch-up growth after early malnutrition beyond the first 1000 days.
- Factors associated with this growth include maternal height, living standards, feeding programmes, water and sanitation infrastructure and parental education levels.
- Catch-up growth after the earliest period of life was associated with gains in learning, suggesting that later investments may have important benefits beyond child survival and good health.

Children's growth trajectories relate closely to family background

Children's height-for-age (HAZ) is used as a proxy to measure long-term physical development. Height-for-age compares individual children's height against a reference group of healthy and well-nourished children of the same age and gender. If a child is more than two standard deviations below this norm,[1] s/he is considered to be stunted, which is taken as an indicator of long-term malnutrition.

Figure 1 illustrates this, showing WHO growth standard for girls and boys and the average height of children in the Young Lives sample from Andhra Pradesh between 1 and 8. HAZ is below the WHO standard, showing high rates of malnutrition within the sample, particularly so in rural areas.

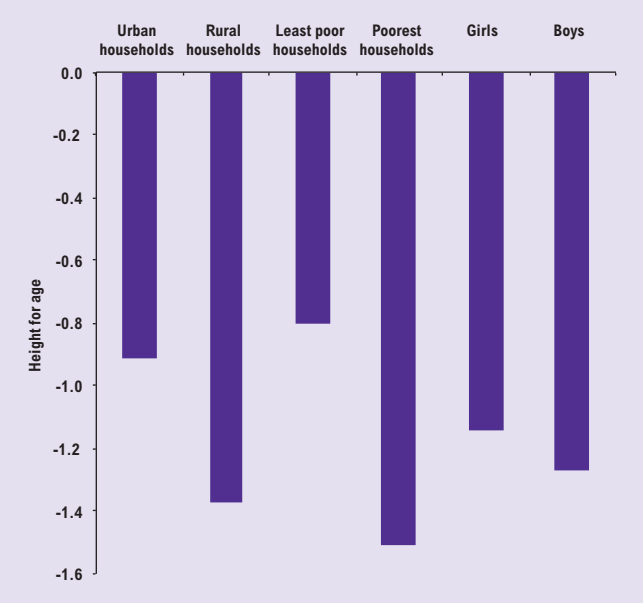
Figure 1. *Height-for-age of children in Andhra Pradesh, compared with WHO linear growth standards*



Note: This chart integrates data from Young Lives with WHO growth standards for children aged 0 to 5 and 5 to 19 years. As such this is an approximation, because some assumptions have been made to integrate the data. The Young Lives data is plotted at the average age point for the sample and WHO growth standards for 0 to 5 year olds are converted to months. WHO growth standards are available at: http://www.who.int/childgrowth/en/.

Collecting data from the same children over time shows patterns of growth and enables analysis of the extent to which height gain is determined early in life with little subsequent variation, as well as analysis of the factors which may lead to changes in their trajectories. Children in the Young Lives study (which was designed to over-sample poor children) are, on average, shorter than the WHO growth norms. At the age of around 1 year the average height-for-age scores in all four country samples were below -1 (see Lundeen et al. 2013; Schott et al. 2013). In Andhra Pradesh, Peru and Vietnam average height-for-age decreases between age 1 and 5 years, while in Ethiopia it increases. Between age 5 and 8 average height-for-age increases across all four countries. Height-for-age is closely linked to household characteristics, with considerable difference by socio-economic background. Figure 2 shows average height-for-age scores in Ethiopia at age 8, showing that average height is well below the expected norm, and particularly so for the poorest children.

Figure 2. *Average height-for-age scores at age 8 based on characteristics at age 1, Ethiopia*



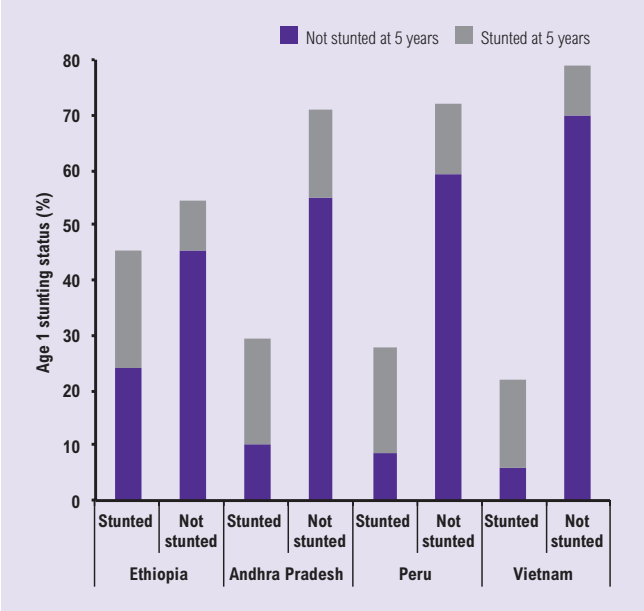
Note: Household and child characteristics (urban/rural residence, socio-economic status, etc.) are defined at age 1, with height measured at age 8. The 'poorest' and 'least poor' categories reflect households with a wealth level in the top and bottom quarters of the sample (using a composite index of access to services, housing conditions and consumer durables).

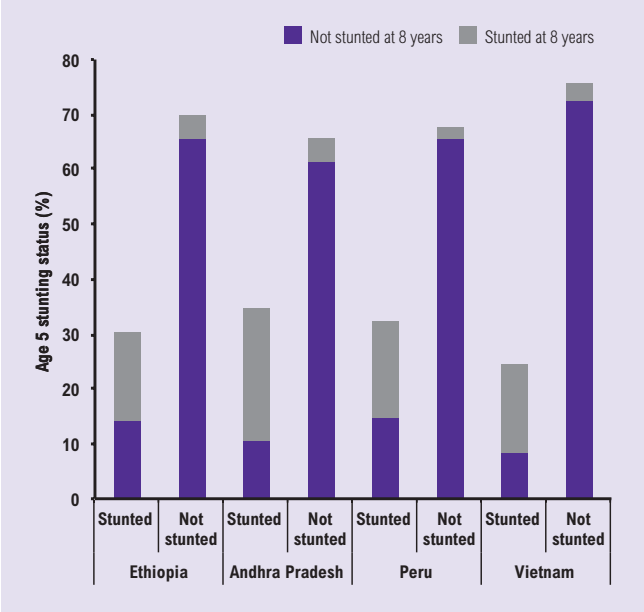
1 The standard measure for variability within normally distributed populations, where 95% of the population are assumed to lie between 2 standard deviations above or below the average. Standard deviations are also referred to as z-scores.

Incidence, extent and timing of post-infancy catch-up growth and faltering

Data collected on the same children over time highlights considerable dynamism in their growth trajectories. Figure 3 compares whether children who were initially stunted (or not) remained so as they grew up. Ethiopia has high rates of stunting in infancy and shows the largest changes. Within the Young Lives sample, 46% of the Ethiopian children were stunted at age 1, but half of these children were not stunted by age 5. One in six of the children who were not stunted at age 1 had become stunted by age 5. Most change happens in this early period, but even between age 5 and 8 years there are important changes in children's growth patterns.

Figure 3. *Changes in stunting status between age 1 and 5 years, and between age 5 and 8 years in Ethiopia*





Source: Lundeen et al. 2013

A separate study (Crookston et al. 2013) examined the size of these changes comparing stunting at age 1 and age 8 years, finding that:

- Children who were not stunted at either age point experienced on average a very small change in their average HAZ score of between -0.08 (Ethiopia) and –0.03 (Peru)
- Children who were persistently stunted experienced an improvement in their HAZ score of between 0.15 (Vietnam) and 0.83 (Ethiopia) on average
- Children who recovered from stunting by age 8 had quite a large increase in their average HAZ score of between 1.08 (Vietnam) and 1.88 (Ethiopia)
- Children who faltered in their growth trajectory experienced a substantial deterioration in their average HAZ score of between -1.45 (Ethiopia) and -0.85 (Peru).

While the emphasis in this brief is on children up to age 8, a study analysing the experiences of the Young Lives Older Cohort continues to find considerable change in height trajectories between age 8 and 15 years (Fink and Rockers 2014), suggesting continuing plasticity of growth later into childhood.

Determinants of post-infancy growth

Schott et al. (2013) explore which factors were associated with accelerated height gain. To do this they examined what could explain children's different height at age 5 and age 8, using earlier data on these children. If growth trajectories were set very young, then early height would be strongly associated with later height. They first considered what explained children's height-for-age at age 5, related to height-for-age and other circumstances at age 1 year, and repeated the analysis for children's height-for-age at age 8, dependent on height-for-age and other circumstances at age 5 years.

Height-for-age at age 1 was important in explaining height-for-age at age 5, but could not perfectly predict later height: early height did not explain between 71% (Ethiopia) and 40% (Vietnam) of what determined height at 5. And while height at age 5 was more predictive of height at age 8 than between age 1 and 5 (suggesting height trajectories became more fixed between these ages), again between 47% (Ethiopia) and 26% (Vietnam) of what determined later height was not explained by early height alone. In other words, early height is clearly important in determining trajectories, but a large element of what matters for subsequent growth was explained by other factors.

Schott et al. (2013) also examine which factors might explain these changes, analysing the household and community factors. They conclude that higher levels of parental schooling, greater household consumption expenditure, taller mothers (potentially reflecting genetics or maternal health) were important for height gain, with some evidence that better health infrastructure was also

associated with height gain. Separate analysis for Ethiopia has suggested a link between access to sanitation and catch-up growth after under-nutrition (Outes-Leon and Porter 2013). Analysis of the Indian Midday Meal Scheme (delivered through government primary schools) found it had compensatory effects for young children, reducing the negative impact of drought on children's growth (Singh et al. 2013).

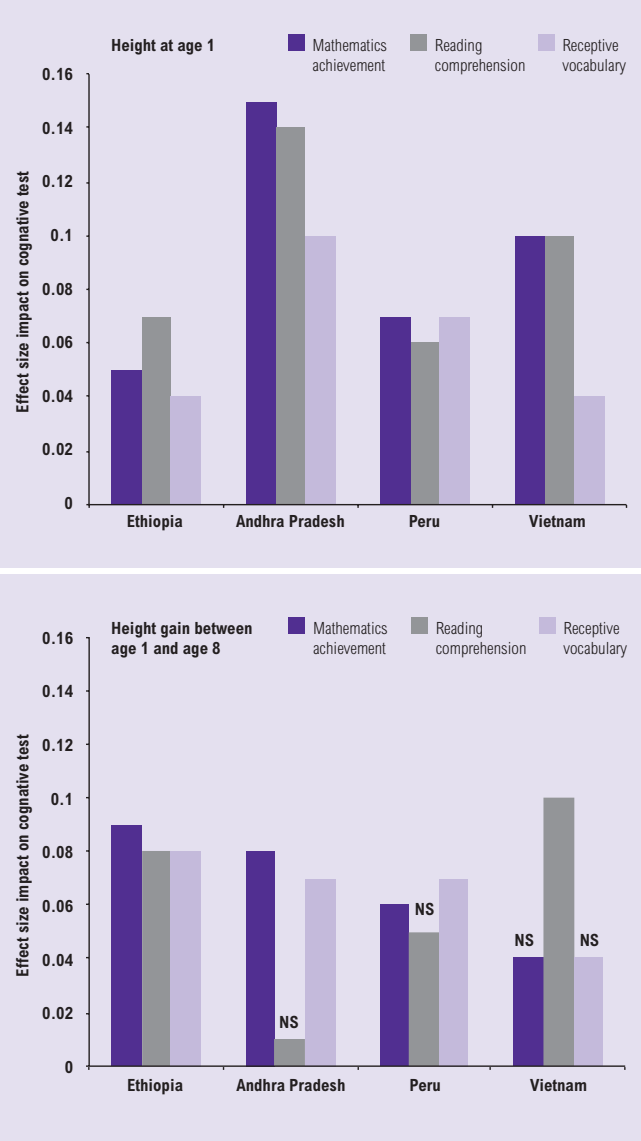
Developing a better understanding of the community and household factors that affect children's growth trajectories is an ongoing area of research within Young Lives, aiming to provide pointers for policy intervention.

Implications of catch-up growth and faltering for cognitive achievement

As we have seen, stunting is a proxy indicator for chronic under-nutrition. It matters both because of what it shows about children's physical development, and because stunting is linked with other consequences for children, including their cognitive development. This prompts the question: even if children's nutritional status improves, will that improvement extend to other aspects of their lives? And can it be expected that programmes that seek to support catch-up growth will also benefit learning outcomes?

A study by Crookston et al. (2013) examines this question using Young Lives data from the four study countries. They investigate predictors of children's learning test scores at age 8. In doing so they consider how both early height and height change between age 1 and age 8 years are associated with children's learning outcomes (see Figure 4). Their results indicate both that early height-for-age matters for children's later cognitive development, and that height gain between age 1 and age 8 (height-for-age change not predicted by initial height-for-age) was also important for later maths, reading and vocabulary scores. A link between growth recovery and faltering and cognitive achievement has also been found between the ages of 8 and 15 years for the Young Lives Older Cohort (Fink and Rockers 2014; Crookston et al. 2014).

Figure 4. *Associations between height and height change and children's achievement at age 8*



Source: Crookston et al. 2013: Table 4.

Results are significant at P<0.05 or higher unless marked Not significant (NS). Results are from regression analysis, and identify the independent effects associated with either height at age 1 (left pane) or height change between age 1 and age 8 (right pane), after taking account of a range of child, parental/household and community characteristics. Height change between age 1 and age 8 is the extent of height change which is not predicted by height at age 1.

Conclusion: scope for recovery?

Improving child nutrition and reducing high levels of stunting is a key concern in many countries. The data and analysis reported here reinforce the importance of children's early-life circumstances, but uncover a second story of change taking place after this very early period. This raises three key questions:

- Is catch-up from stunting after infancy and early childhood possible?
- Is catch-up growth followed by recovery in other domains of development that are linked to early malnutrition?
- If it is, what factors are most effective in bringing about this recovery?

To reduce the effects of under-nutrition requires both early and sustained action. The focus on early nutrition has led to recognition of the importance of public health strategies to reduce childhood diseases, of addressing childcare practices, of feeding supplementation and better healthcare provision. The papers reviewed for this brief focus on changes in relative height gain up to age 8 years, with changes before age 5 years being the greatest. The studies provide evidence that catch-up growth was also associated with gains in learning.

What are the implications for policy to tackle child stunting?

First, early investments are best and so great attention should be given to improving the quality and coverage of early interventions (including health care, feeding and supplementation). Reaching poor children with such services ought to be a key priority to address under-nutrition.

Second, although early is best, some children fall behind in their growth status after infancy. Early interventions alone will be insufficient to eliminate under-nutrition. Trialling and testing the potential of post infancy interventions for children's growth and development may open up new avenues to meet global commitments to tackle child stunting.

Third, the evidence in this brief indicates key priority areas for action to support post infancy recovery.

- Maternal height is an important determinant of children's growth and recovery. Policies to investing in adolescent girls' health and nutrition are important in and of themselves, but they may also pay off in better child health in the next generation.
- Poverty is linked with stunting and children being less likely to show growth recovery. There is consensus on the need for greater social protection coverage. This message highlights the importance of prioritising social protection extensions for households with children.
- Community infrastructure, including sanitation and health services is linked with growth recovery, reinforcing the importance of those services to children's healthy development.
- Later plasticity in children's growth, combined with rising primary school enrolment points to the school as a platform for interventions to boost health and nutrition. Embedding services such as school feeding, or other forms of supplementation, within schools has the potential to bring benefits beyond improved attendance and concentration levels and towards more sustained gains in child health.

Prevention is better than cure, so most attention needs to be directed to the period before and just after birth. But later change matters too and interventions in later childhood could have the advantage of supporting those children whose growth falters after initially normal growth. Capitalising on second chances could provide a new avenue to achieve global targets on improving children's healthy growth.

FURTHER READING AND RESOURCES

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