Choice Not Genes

Probable Cause for the India-Africa Child Height Gap

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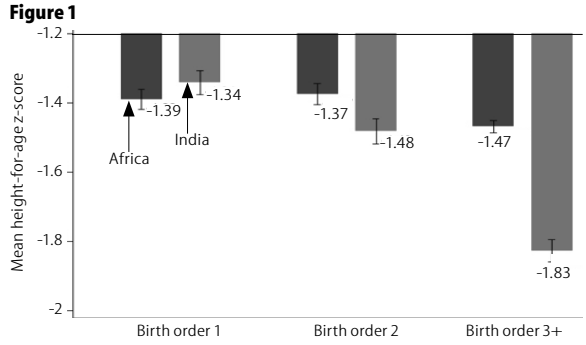
In his article, "Does India Really Suffer from Worse Child Malnutrition Than Sub-Saharan Africa?", Arvind Panagariya makes an impassioned case against accepting traditional measures that indicate that Indian children suffer from worse malnutrition than their African counterparts. This phenomenon – that Indian children are more stunted despite the country's better performance on an array of other health and development indicators – was dubbed the "South Asian Enigma" in an article by Ramalingaswami et al in 1996. In explaining the enigma, Panagariya comes down squarely on the genetic side, naming the problem as "the use of common height and weight standards around the world to determine malnourishment, regardless of differences that may arise from genetic, environmental, cultural, and geographical factors". He suggests that either protein/micronutrient consumption or region-specific height norms should be used to gauge malnutrition.

In our study, however, the common international height standard reveals patterns of stunting variation *within families*, suggesting differential allocation of resources within the household as the cause of India's height disadvantage. Using data from the Demographic and Health Surveys (DHS) for Sub-Saharan African countries and India, we show that height-for-age is in fact *higher* in India than Africa for firstborns.

India's disadvantage only appears with the second-born child and becomes more pronounced for third and higher order births. The birth order gradient in child height-for-age is twice as large in India as in Africa, and large enough to account for the entire India-Africa height gap. These facts point to an environmental explanation for India's high rate of child stunting.

In our analysis, we use DHS for 25 Sub-Saharan African countries conducted between 2004 and 2010 (27 surveys in total) and the 2005-06 round of India's National Family Health Survey (NFHS), which uses the DHS questionnaire. This yields a sample of 1,74,000 children less than five years of age for whom anthropometric data are available.

Figure 1



We assess children's height-for-age z-scores constructed based on the World Health Organisation (WHO) reference group that comprises children of the same age and sex from Brazil, Ghana, India, Norway, Oman and the United States (de Onis et al 2004). A z-score of 0 means that a child is at the median of the reference group, or typical for children of that age and sex worldwide. The units of the z-score are standard deviations of the worldwide distribution, so a z-score of -1.0 means that the child's height is 1.0 standard deviations below the median for his or her reference group.

The data show that there is indeed an Indian disadvantage in child-height relative to Sub-Saharan Africa. While the mean height-for-age z-score for the African subsample is-1.44, the mean height-for-age z-score for the Indian subsample is -1.58. This Indian height deficit compared to Africa of -0.14 standard deviations of the worldwide distribution is highly statistically significant (p-value <0.01). A regression-adjusted difference that corrects for sampling differences in survey year and child age reveals the same gap of -0.14.

Our key finding is that the India/Africa gap in mean height-for-age z-score varies significantly by birth order. While height-for-age is *higher* in India compared to Sub-Saharan Africa for firstborns, a deficit appears beginning with the second-born child and becomes more pronounced for third and higher order births, at which point Indian children have a mean height-for-age lower than that of African children by 0.35 standard deviations of the worldwide distribution. Figure 1 provides a graphical representation.

The same pattern – a much steeper birth order gradient in child height in India than in Africa – is seen when using only between-sibling variation and thus controlling for family background and parental characteristics, and is present for both boys and girls. We find the same patterns if we examine stunting, which is an indicator for having a z-score less than -2:firstborns in India are less likely to be stunted than firstborns in Africa, but for later-born children the reverse is true with the prevalence of stunting significantly higher in India than Africa.

Why Are Higher Birth Order Children Shorter in India?

Our results do not fit well with the genetics-based explanation advanced by Panagariya because it is unlikely that a difference in genetic potential across Indians and Africans will express itself differentially across birth order.

It could be suggested that our findings (and the Indian height deficit in general) are an artefact of mortality selection, where a greater proportion of weaker and therefore shorter children survive in India relative to Africa. However, for mortality selection to explain the birth order effect we would need India's infant survival to be especially high for later-born children since this is where the Indian height disadvantage is largest. But in fact the opposite pattern is seen: the infant survival rate in India is particularly high at low birth order.

A different suggestion could be that Indian women are unhealthier than African women at the start of childbearing due to poor health in childhood and adolescence. This maternal health channel is an important contributor to the "gradual catch-up" hypothesis (Deaton and Drèze 2009), according to which it takes time for a historically malnourished population to meet their genetic potential, even when their nutrition improves. A society's poorer treatment of mothers may lead to a legacy of malnutrition that lasts over several generations – longer than other contributing factors.

However, the impact of mother's height (a summary measure of a woman's health inputs during childhood and adolescence) on child height does not vary much with birth order. Thus, while gradual catch-up may be at play, it appears that the birth order gradient in child height reflects contemporaneous choices by households rather than the die having been cast when the mother entered her childbearing years.

The birth order pattern we find in the India-Africa height gap suggests, therefore, that the malnutrition gap is not an artefact of measurement, differential infant survival, or initial maternal health.

Our results point strongly toward a contemporaneous environmental explanation: variation of stunting within households is determined by parental preferences and their decisions concerning when services and household resources are utilised. The within-family patterns cast doubt on simple *access* to services (such as healthcare or sanitation infrastructure) as the explanation for variations in child height, since such access rarely varies substantially with the child's birth order. The apparent explanation is *take-up* of services. In our paper, we explore two classes of explanation for the sharp drop-off in take-up of health services in India – reductions in household resources allocated to higher birth order pregnancies and children, and son preference – and summarise our results here.

Regarding household resource-based explanations, for later born children, parents' resources, both money and time, might get diluted among more children, and this dilution could be stronger in India or have larger implications for child health. In terms of money, Indian parents may spend on the first child and then run out. The reasons for this could be a particular Indian short-sightedness or different time profiles of

income between regions, with Africans getting richer as they age, but not Indians. "Economies of scale" may also be at work, according to which each additional child requires fewer household resources in Africa. An analysis of food consumption patterns across Indian and African mothers shows a relatively greater decline in food consumption among Indian mothers at higher birth order. However, this decline is concentrated only among pregnant Indian women, which weighs against different time profiles of income. Some evidence against differential economies of scale comes from the sample of Indian couples where we see both the husband and wife's consumption. We observe that consumption declines across successive pregnancies are concentrated among women and do not extend to their husbands.

Thus, it appears that Indian households disinvest relatively more in women across successive pregnancies.[1] Child health could well be an unintended consequence of this pattern: women's food consumption and body mass index decline with successive pregnancies and this would affect fetal health and breastfed children's health.

We also find that arguably time-intensive prenatal and postnatal health inputs such as prenatal check-ups, maternal iron supplementation, childbirth at a health facility, child vaccinations, and postnatal check-ups exhibit a stronger drop-off with birth order in India than Africa. These differences in take-up may go hand in hand with less attention from parents, which makes later-born children more susceptible to environmental conditions, such as neighbourhood sanitation (Spears 2013). Later-born children could be more exposed to disease because parents' attention is divided among more children, and a less careful childcare provider steps in such as an older sibling.

Later in life, we also see a steep drop-off in parents' investment in the education for higher birth order children in India, which points to a decision about children, rather than an unintended consequence.[2]

The observed pattern of household choices is consistent with a much stronger preference for earlier born children in India than elsewhere (a preference for earlier born children is observed in most societies). We examine whether such a preference may, at least partially, reflect a cultural norm of eldest son preference. A large literature documents very strong preference for sons in south Asia and, in particular, favouritism towards the eldest son in the family.[3] If a couple does not have a son yet, the future child could be the family's first son, and, in India, this would mean an especially high level of in utero health investments, when parents usually do not know the sex of the child. Thus, eldest son preference might help explain the birth order gradient in child height even among girls.

The evidence on prenatal inputs supports this idea: once the family has a son in India, prenatal inputs decline with subsequent pregnancies. Girls born before the eldest son actually fare better than boys born after the eldest son, and girls born after the eldest son fare the worst. Consistent with this, the data show that at birth, the height differential between boys and girls is similar in India to Africa; however, over time a significant gender gap emerges wherein the height differential between boys and girls in India exceeds that in Africa.

Measuring the Measure

Panagariya presents data showing India's often remarkable performance on other health indicators relative to Sub-Saharan Africa, and concludes that genetics is the key to unlocking the paradox of Indian children's short stature. He calls for a revamping of the methodology underlying the measurement of malnutrition indicators.

The disparity between economic and malnutrition indicators across India and Africa is indeed counter-intuitive. However, in contrast to Panagariya's conclusion, our study points to a household-choice-based explanation. Further, we would argue that following Panagariya's suggestion to focus future efforts on repairing the indicators for stunting could cause researchers to fail to study the forces that drive uneven allocation of resources within households.

An effective approach to south Asian malnutrition may require identifying the norms that lead to the declining resources given to a woman over the course of her marriage and the uneven choices across children. Researchers and policymakers could then develop specific interventions that seek to change these norms or, alternatively, incentive programmes that encourage Indian households to spread their resources between parents and across children more equitably.

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NOTES

1 A possible contributor is that women in India often travel to their natal home to have their first births, and the resources and care provided there could be higher than for subsequent births that take place in the marital home.

2 It is possible, though, that schooling has higher returns for children who were well-nourished in their early life, but it seems more likely that the schooling patterns point to a broad-based emphasis on the well-being of earlier born children in India.

3 See, for example, Dyson and Moore (1983), Das Gupta (1987), and Pande (2003).

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