Hidden Undernutrition: How universal standards may bias estimates of childhood undernutrition around the world
Joseph Hackman and Daniel Hruschka

Research Questions
1. Do universal standards bias stunting estimates around the world?
2. Does HAZ vary independent of resources across populations?

Modeling Resource-Independent Variation in HAZ

Data:
- 190 harmonized Demographic and Health Surveys (DHS)
- 60 countries around the world
N=1,093,809 children (1-5yrs)

Model:
Nonlinear Multi-Level Model with random intercepts, controlling for known resource inputs to height:
- Absolute wealth
- Sanitation and disease
- Diet indicators
- Health care access
- Sex, urbaniy, sibling size, and maternal education.

Residual variation between populations cannot be attributed to differences in resource access, and reflects the resource-independent variation in population HAZ.

Validating the Two Components

Fig 5: bHAZ is uncorrelated with indicators of resource deprivation, while mean aHAZ of a country shows strong associations with indicators of malnutrition. aHAZ is the component that tracks resource inputs and deprivation.

Fig 6: Adjusting universal cutoffs (A) for population bHAZ. We measure the distance between the bHAZ and the WHO Standard cutoffs in a reference population (B). This converts the WHO Standard cutoffs into a specific amount of aHAZ. Any child that fails to accure a minimum aHAZ will be considered stunted. For populations with larger bHAZ this will raise the cutoffs (C), for populations with smaller bHAZ it will lower the cutoffs (D).

Implications For Tracking Stunting in Tall Populations

Fig 7: Using India as our well established reference population, we find that the adjusted cutoffs leads to:
- Increases in estimates of stunting in all world regions.
- Largest increases were in populations with tall bHAZ — concentrated in Sub-Saharan Africa and parts of Latin America and Caribbean.
- 14% increase in severe stunting in Sub-Saharan Africa alone.
- Increases in severe stunting — Zimbabwe (25%), Swaziland (22%), Morocco (22%); Haiti (20%), Nicaragua (15%), Paraguay (18%), Bolivia (12%).

This approach could identify previously missed hotspots of child malnutrition and help resolve long-standing debates about differences in stunting in India and Africa.

Acknowledgements and References