Periods of Child Growth from 1 to 8 Years in Ethiopia, India, Peru and Vietnam: Key Distal Household and Community Factors

by

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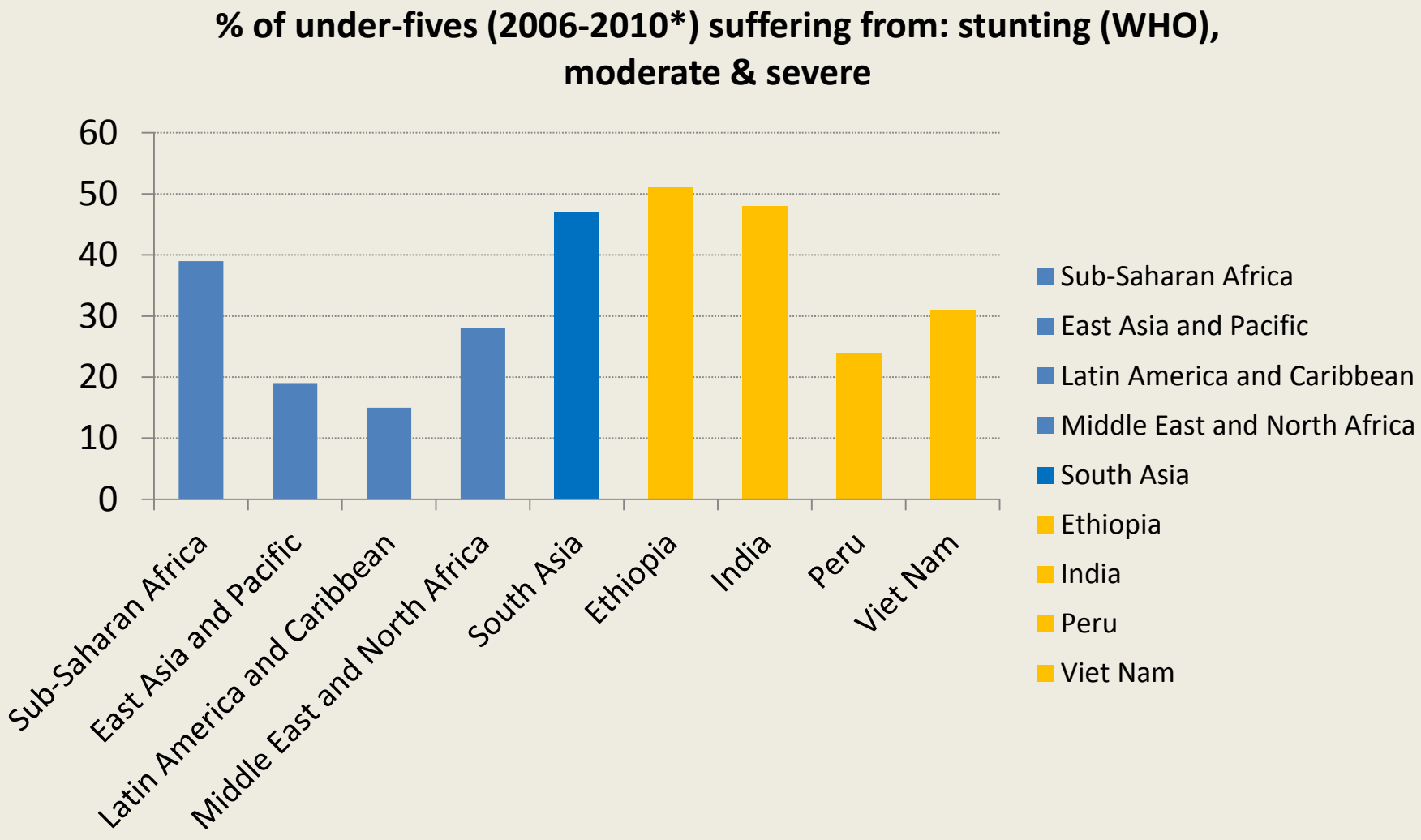
Introduction

- Chronic undernutrition is a major global health challenge, particularly in low- and middle-income countries (LMICs).
- About 171 million children under age 5 years in developing countries are stunted (i.e., at least two standard deviations below the median in height-for-age z-score, HAZ)(Onis et al. (2011))

Introduction



Introduction

- Literature has shown nutrition in the first 2-3 years of life important for:

Child survival
Reduction of morbidity
Motor development
School participation (age of entrance, grade repetition, grades completed, absenteeism, dropping-out)
Performance on tests of cognition and achievement
Socioemotional performance
Adult wage rates
Child anthropometrics for the next generation

Introduction

- Some claim growth failure essentially irreversible after about 2 years of age for children in developing countries (Checkley et al. 2003, de Onis 2003, Martorell et al. 1994, 2010, Walker et al. 1996)
- A few studies suggest significant post-infancy growth faltering and recovery in children in developing countries (e.g., Crookston et al. 2010, Crookston et al. 2011)
- What are correlates of unpredicted growth and key periods when recovery is possible?

Young Lives Study

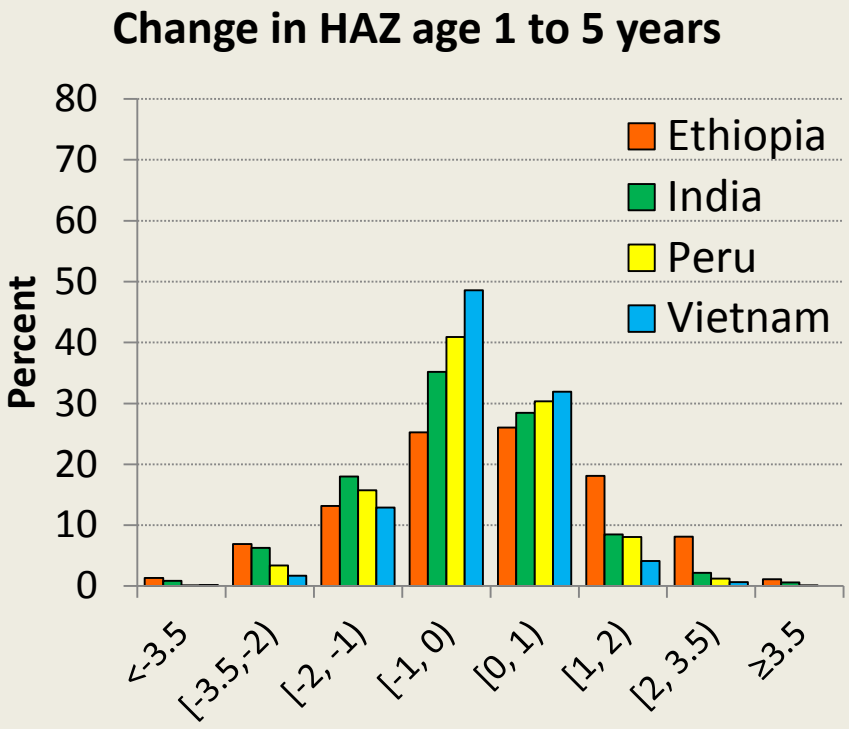
- Longitudinal study of poverty led by Department of International Development at the University of Oxford, with research and policy partners in Ethiopia, India, Peru and Vietnam
- Fairly representative of the population, except the highest part of the income distribution
- Involves roughly 12,000 children (8,000 enrolled at ages 6 to 18 months, 4,000 at age 8 years)
- We use data on younger cohort, collected at ages ~1, 5, and 8 in 2002, 2006, 2009

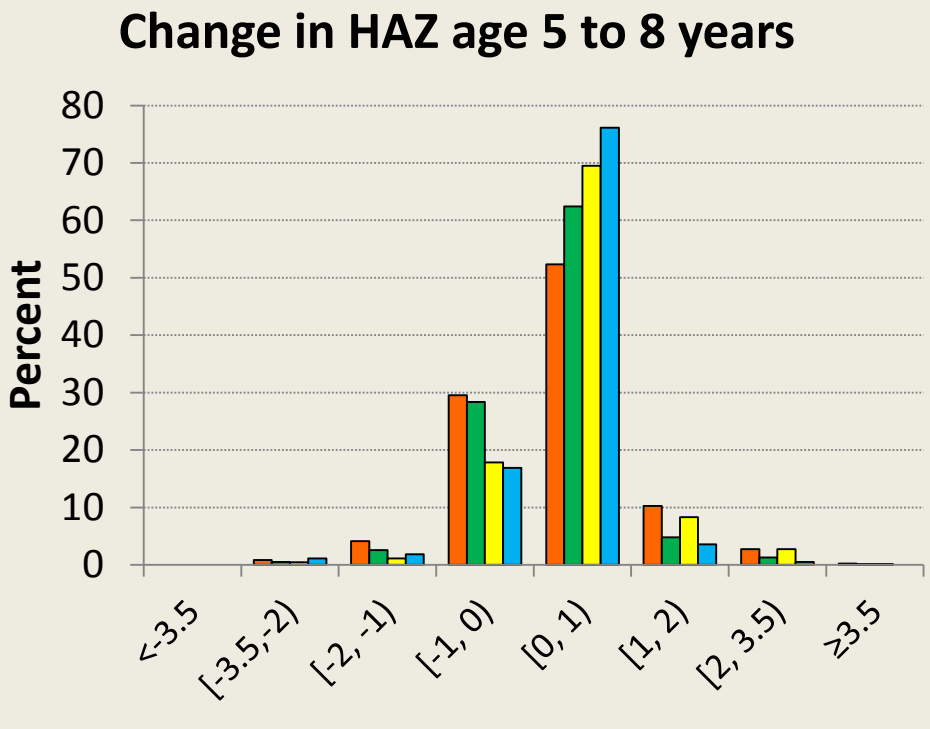
Introduction

- Analyze three key growth “periods”,
  - HAZ at about age 1 year
  - Change from 1 to 5 years
  - Change from 5 to 8 years

  in all four Young Lives countries

Change in HAZ, 1-5 and 5-8 years





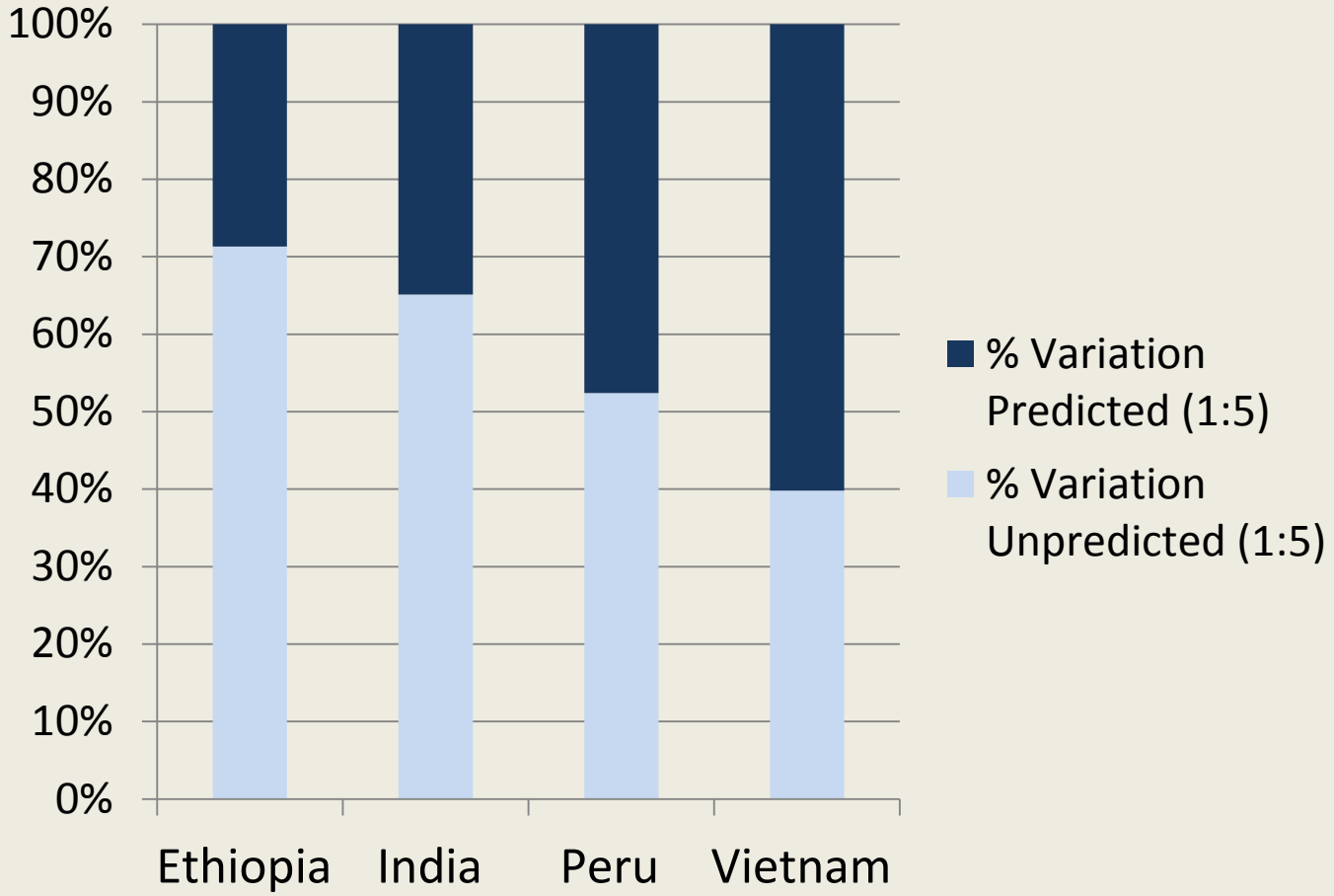
Unpredicted change in HAZ

- Regress HAZ at end of period on HAZ in beginning of period and age dummies alone:

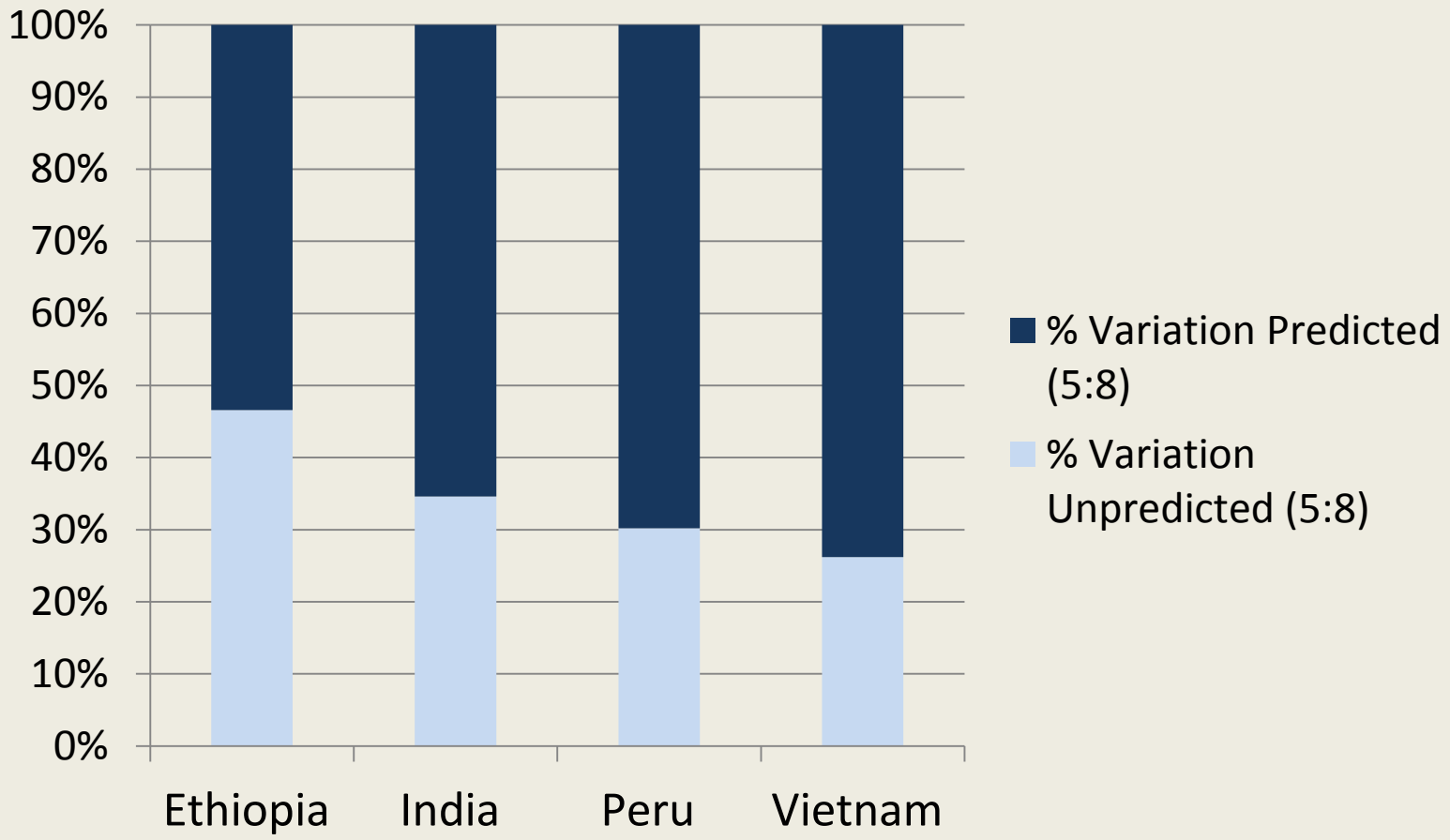
$$HAZ(5) = a + b*HAZ(1) + c\ (age1) + d(age2) + e(age3)$$

$$HAZ(8) = a + b*HAZ(5) + c\ (age1) + d(age2) + e(age3)$$

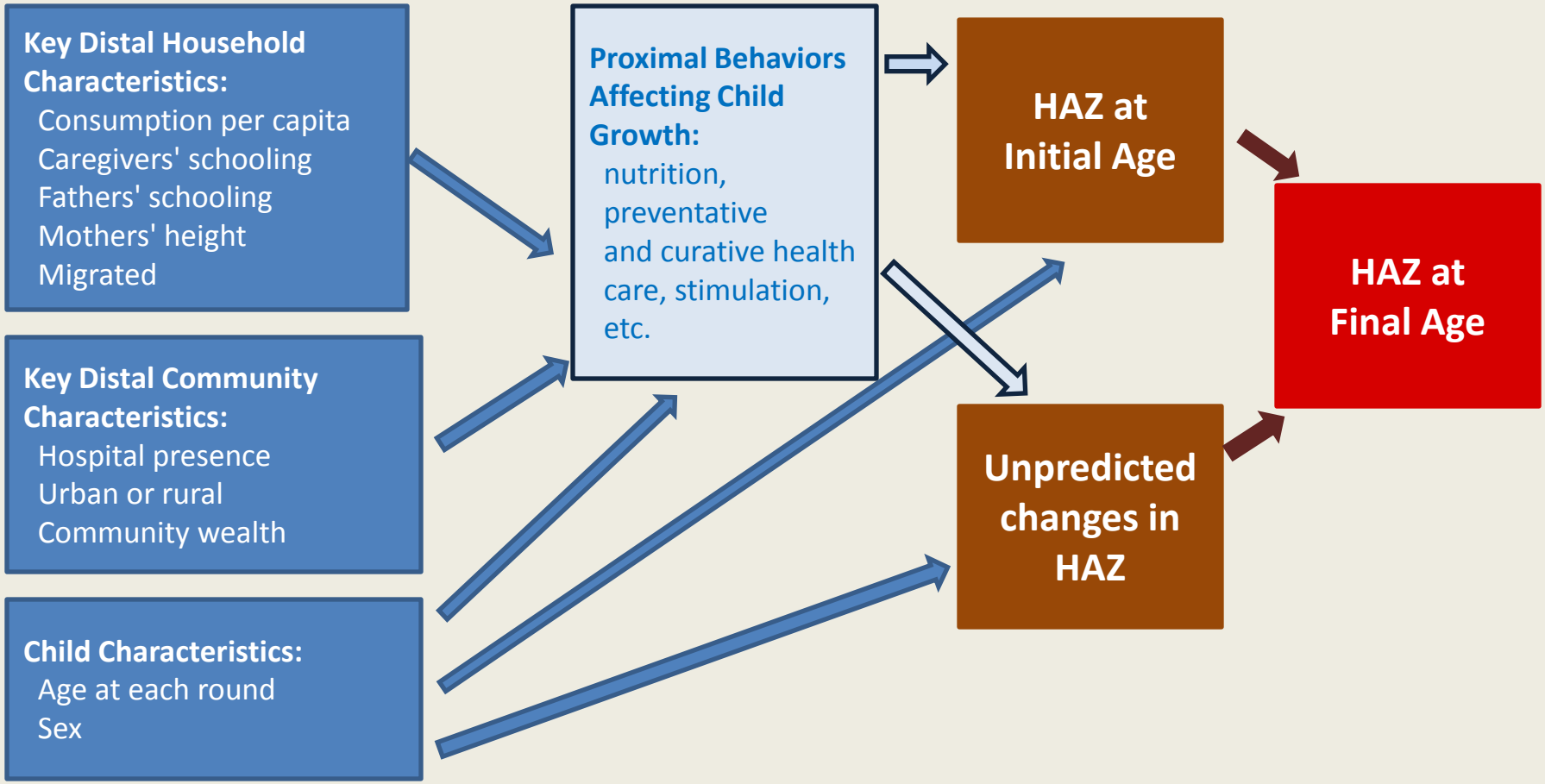
Predicting change in HAZ at age 5 with only HAZ at age 1 (and age dummies)



Predicting change in HAZ at age 8 with only HAZ at age 5 (and age dummies)



Key Determinants of Child Growth



Approach

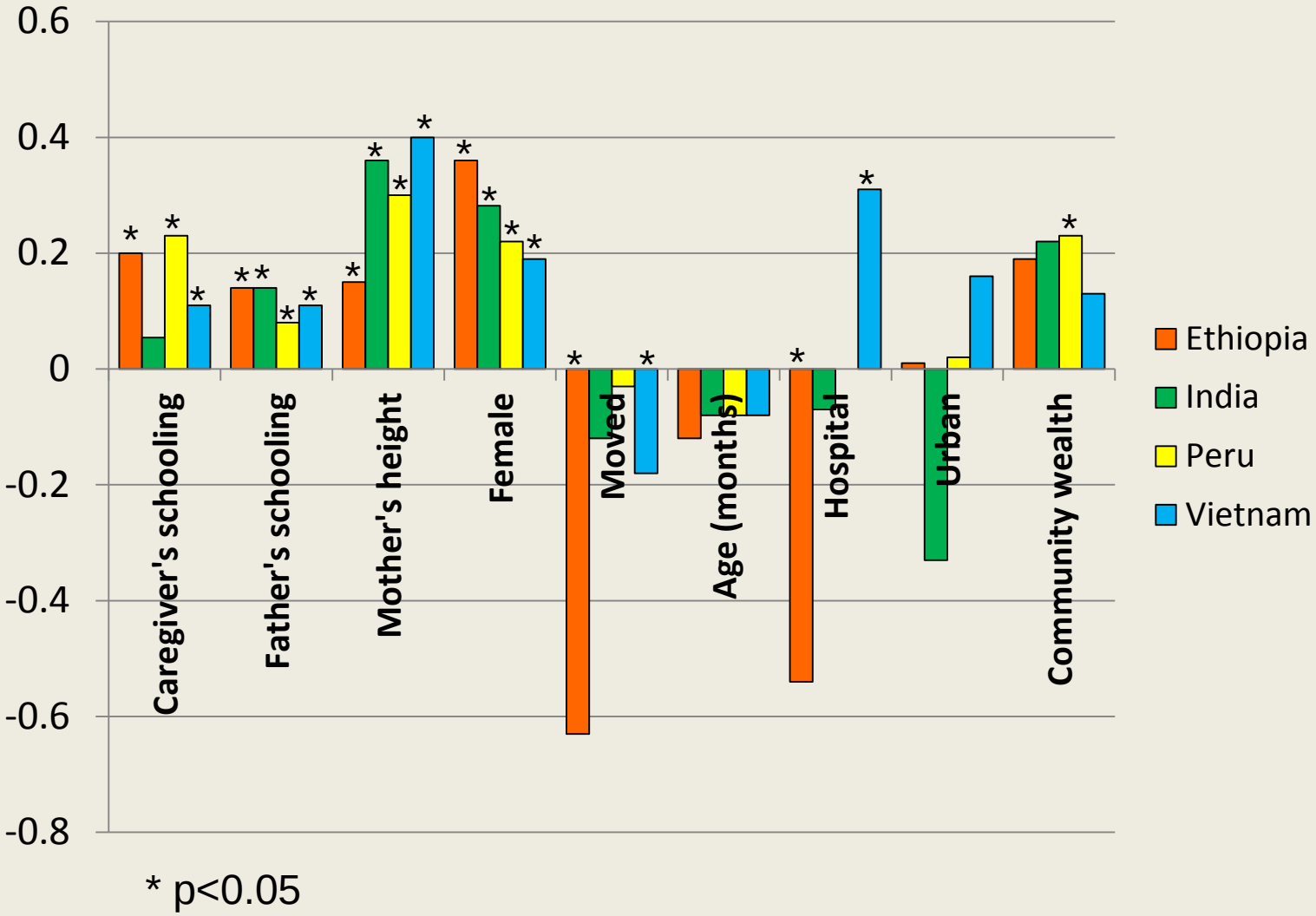
- Conducted multivariate regressions of HAZ(1), uHAZ(1:5) and uHAZ(5:8) on these distal characteristics
- Regressions conducted separately by country
- Use multiple imputation to fill in missing values of the independent variables
- Allow for clustering of errors by community
- Test for heterogeneity in coefficients by country, test for heterogeneity by urban/rural status and male/female sex

Associations with HAZ(1)

Consumption quintile, coefficient estimates

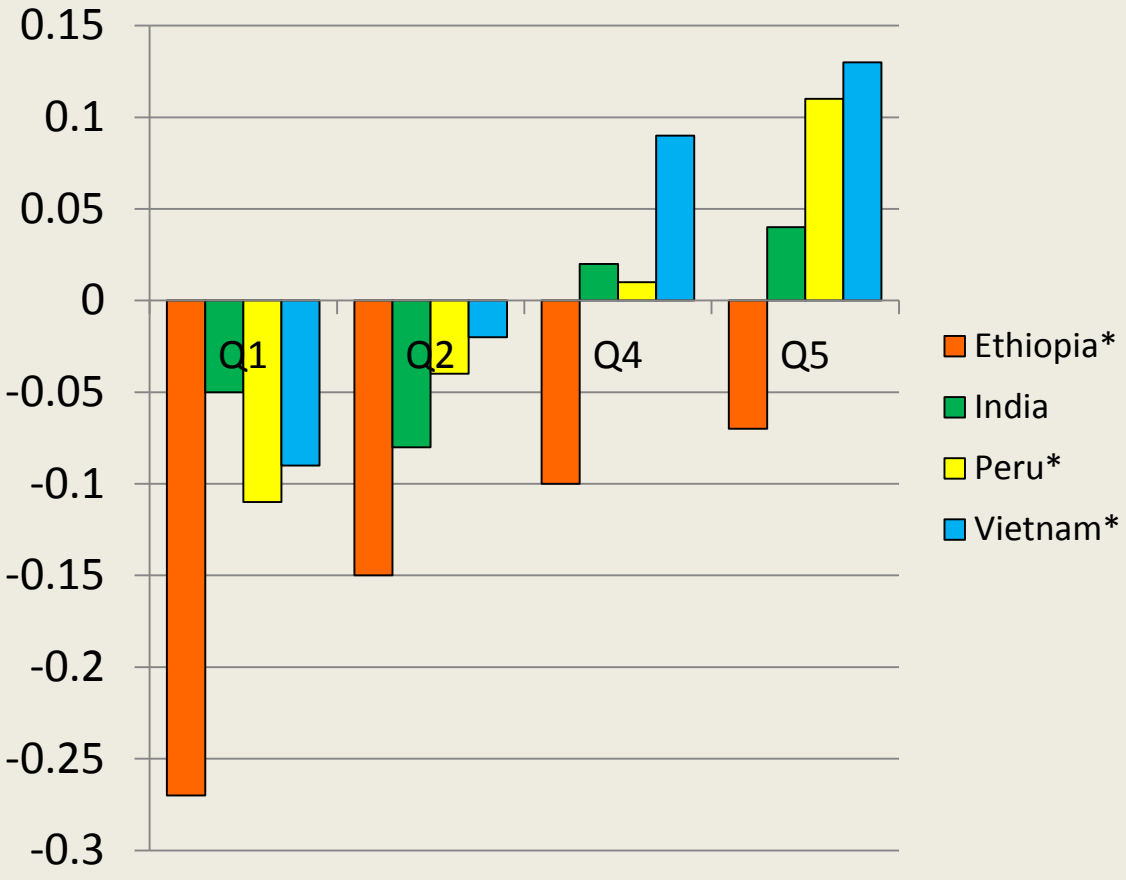
* p<0.05

Associations with HAZ(1)



Associations with uHAZ(1:5)

Consumption quintile, coefficient estimates



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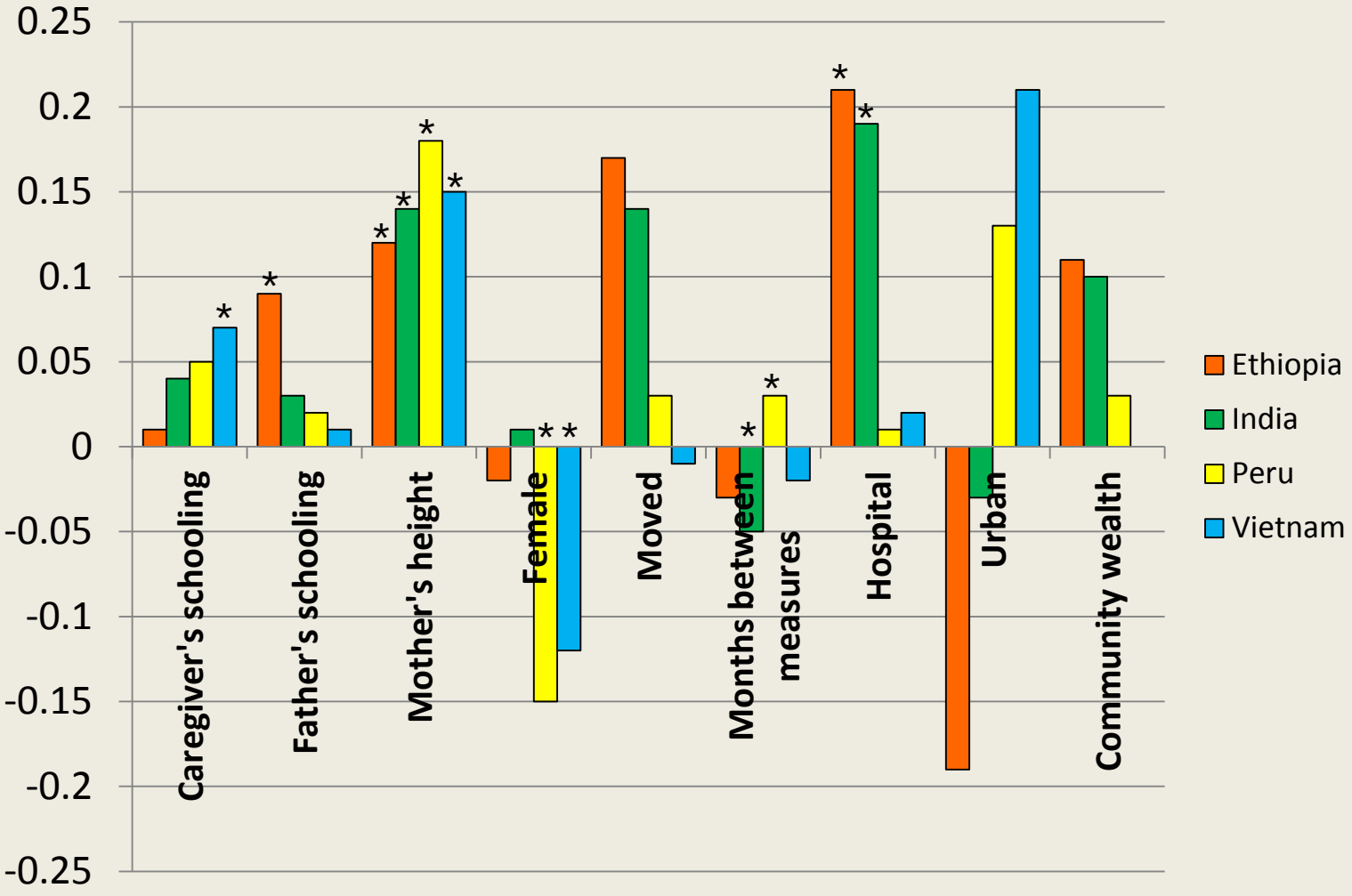
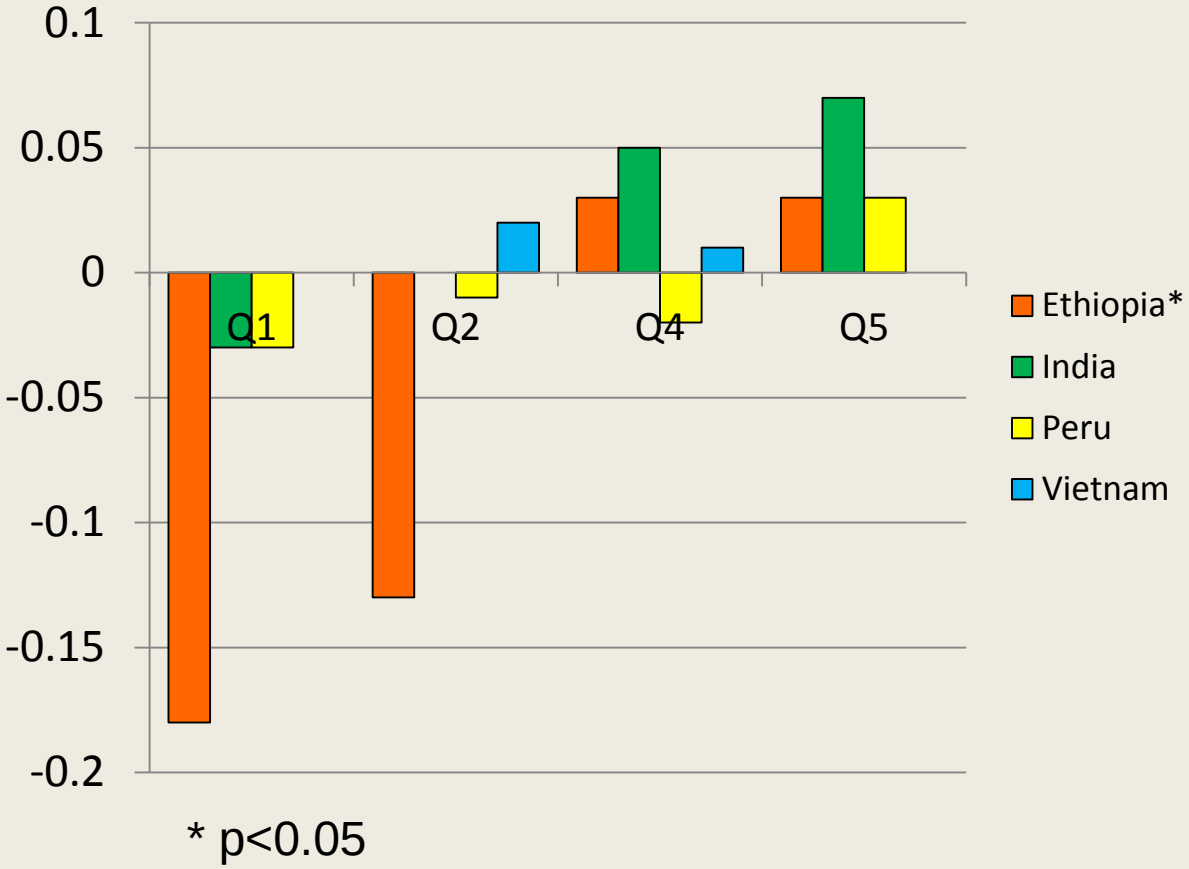
Associations with uHAZ(1:5)



* p<0.05

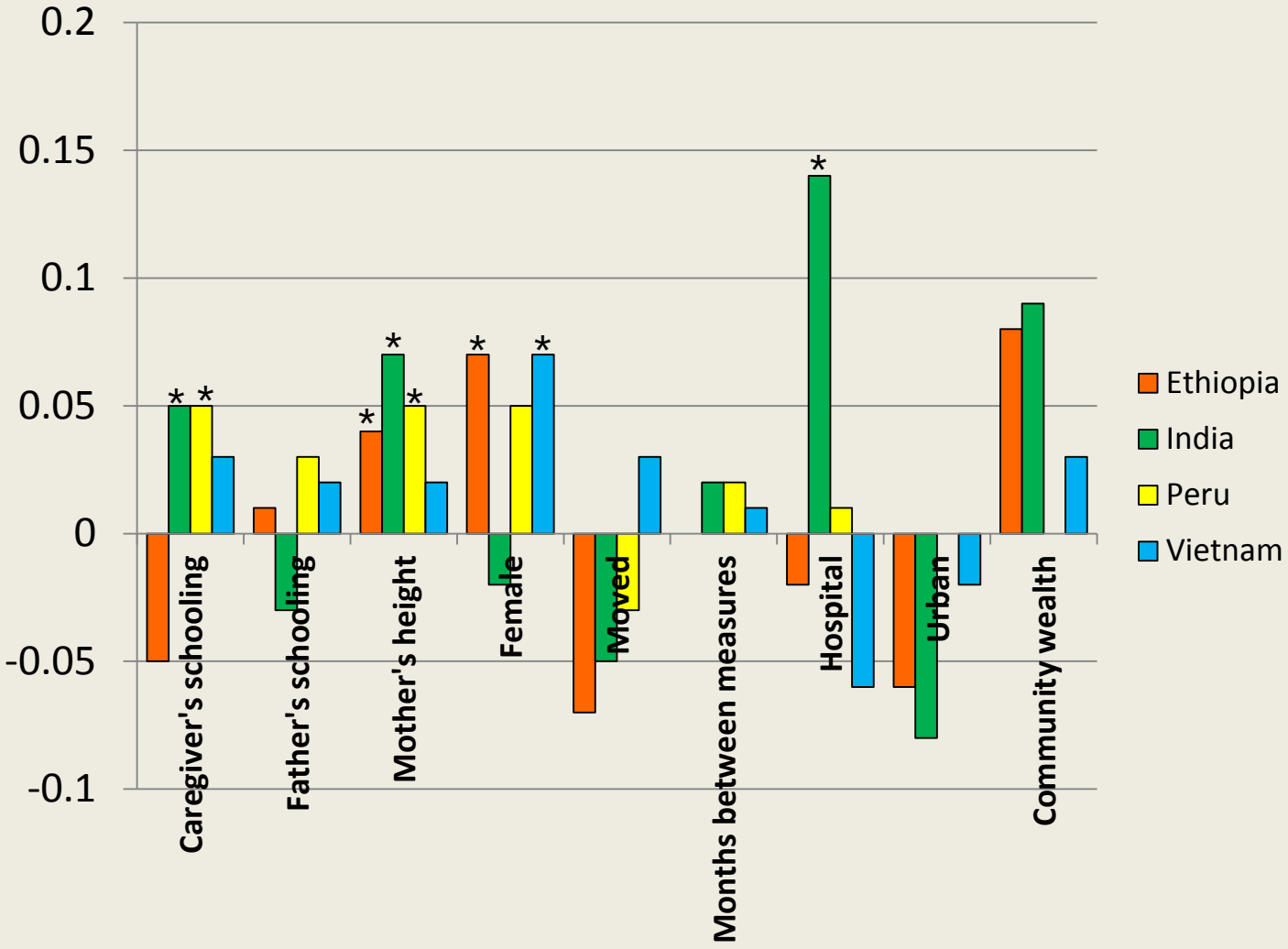
Associations with uHAZ(5:8)

Consumption quintile, coefficient estimates



* p<0.05

Associations with uHAZ(5:8)



* p<0.05

Significant Associations

Household characteristics:	HAZ(1)	uHAZ(1:5)	uHAZ(5:8)
Consumption quintile	I,P,V	E,P,V	E
Caregiver's schooling	E,P,V	V	I,P
Father's schooling	E,I,P,V	E	
Mother's height	E,I,P,V	E,I,P,V	E,I,P
Child female	E,I,P,V	P,V	E,V
Child moved after age 1	E,V		
Time between measurements	(n/a)	I,P	
Age in R1	E,I,P,V	(n/a)	(n/a)
Community characteristics:			
Community has hospital	E,V	E,I	I
Urban site			
Community wealth	P		
Rsquared	0.14-0.28	0.09-0.16	0.02-0.07

Heterogeneity by Country

Outcome	**Heterogeneity in coefficients**	No statistically significant difference in coefficients	
HAZ(1)	•Consumption •Caregiver's schooling •Mother's height •Female •Moved after R1 •Hospital presence	•Father's schooling •Age at R1 •Urban •Community wealth	
uHAZ(1:5)	•Father's schooling •Hospital presence •Female	•Consumption •Caregiver's schooling •Mother's height •Moved after R1	•Months between measures •Urban •Community wealth
uHAZ(5:8)	•Caregiver's schooling •Female •Hospital presence	•Consumption •Father's schooling •Mother's height •Moved	•Months between measures •Urban •Community wealth

Heterogeneity by Urban/Rural

Outcome	Significant differences by urban/rural status (country)	No statistically significant difference by urban/rural status	
HAZ(1) * E,P,V	•Consumption quintile (E,V) •Female (E,P) •Hospital presence (P) •Community wealth (V)	•Mother's schooling •Father's schooling •Mother's height •Moved	•Months between measures
uHAZ(1:5) *E,P,I,V	•Consumption quintile (V) •Mother's height (I) •Months between measures (V) •Hospital presence (E,I,P,V)	•Mother's schooling •Father's schooling •Female	•Moved •Community wealth
uHAZ(5:8) *E,P,I,V	•Consumption quintile (V) •Father's schooling (V) •Female (I) •Hospital presence (I)	•Mother's schooling •Mother's height •Moved	•Months between measures •Community wealth

* Interactions jointly significant at $p<0.05$ for these countries

Heterogeneity by Sex (=Female)

Outcome	Significant differences by urban/rural status (country)	No statistically significant difference by urban/rural status	
HAZ(1) *E,P,V	•Father's schooling (P)	•All other variables	
uHAZ(1:5) * E	•Father's schooling (E)	•All other variables	
uHAZ(5:8) *I		•All variables	

* Interactions jointly significant at $p<0.05$ for these countries

Discussion

- Father's schooling in Ethiopia only positive for boys uHAZ(1:5)
- Hospital presence in rural areas associated with higher uHAZ(1:5) for all countries

Discussion

- These key determinants very important for predicting HAZ(1)
- Mother's height, consumption quintile, and parental schooling maintain importance for uHAZ(1:5) and uHAZ(5:8)
- Greater heterogeneity in coefficients by country for HAZ(1), but only for parental schooling, female, and hospital presence for uHAZ measures

Discussion

- The key characteristics predict more of the variation in uHAZ(1:5) than uHAZ(5:8)
- For uHAZ, fewer covariates significant for ages 5-8y than 1-5y
- Consistent with the hypothesis that the growth period 1 to 5y is more responsive to household and community characteristics than the growth period 5-8 y.

Discussion

- However, to the extent that we know the same covariates may be determining HAZ at age 1 (or HAZ at age 5), we may be **underestimating** the importance of some of these key household and community characteristics

Acknowledgements

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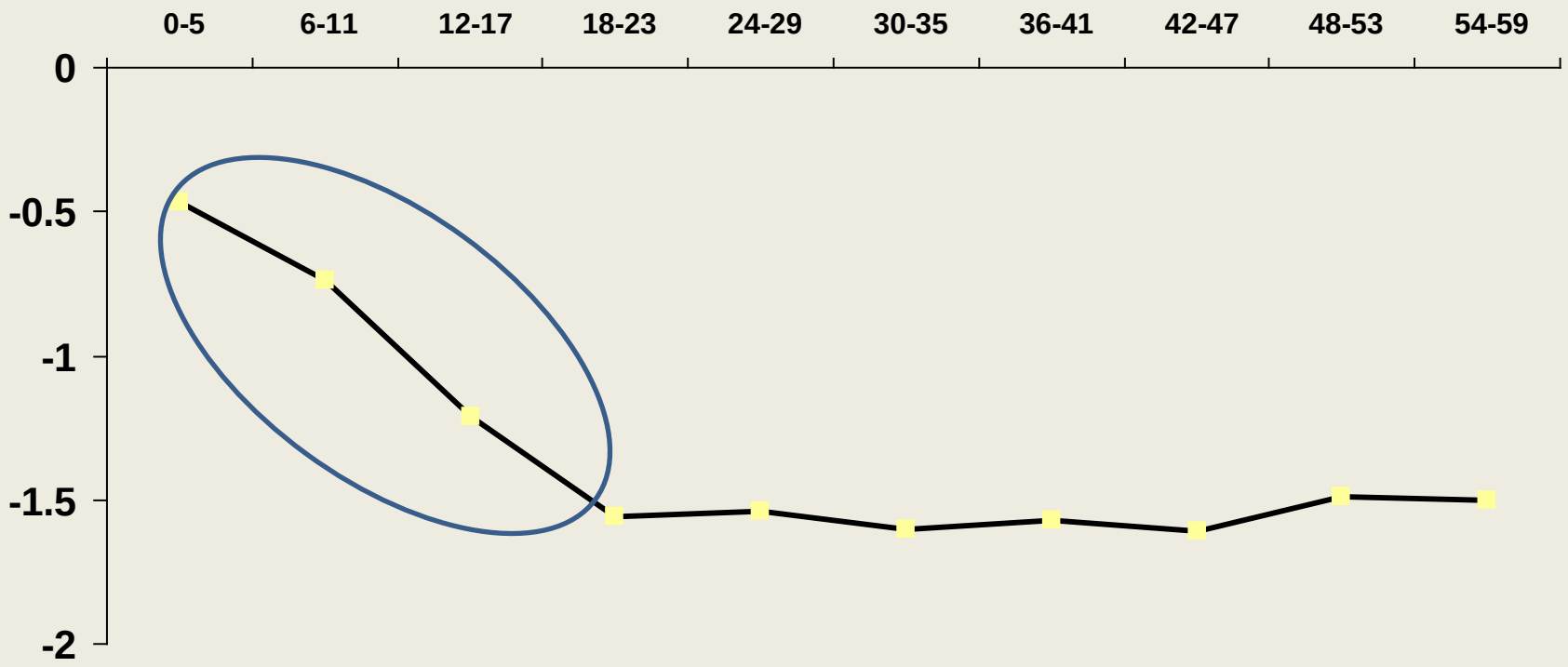
Young Lives Study

Typical Age Patterns for HAZ vs. Months below for Peru in 2000: Implications for Current Study with Measurements at 6-18 mo.



Growth Recovery and Faltering

- Non-negligible moves in and out of stunting between ages 1 and 8:

	Total	Percent Stunted at age 1	Percent of Stunted Recover by Age 8	Percent of Non-Stunted Falter by Age 8	Percent of Total Persistently Stunted (ages 1, 5, 8)	Percent of Total Never Stunted (ages 1, 5, 8)
Ethiopia	1,757	46.5	65.6	9.4	13.9	43.0
India	1,825	30.1	44.6	17.8	15.5	51.7
Peru	1,847	27.6	49.3	8.5	13.3	57.6
Vietnam	1,837	21.4	44.5	9.6	11.2	67.1