Working Paper 113

Young Lives
An International Study of Childhood Poverty

Dynamics of Changing Nutritional Status of Children in Andhra Pradesh

Priya Rampal

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The data used come from Young Lives, a longitudinal study of childhood poverty that is tracking the lives of 12,000 children in Ethiopia, India (in Andhra Pradesh), Peru and Vietnam over a 15-year period. **www.younglives.org.uk**

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Contents

Abstract

This paper examines the dynamics of nutritional status of children in the state of Andhra Pradesh in India in the years of 2002, 2006 and 2009 based on a sample of a cohort of 2000 children born in the year 2001-02. It observes whether a child who was malnourished (in terms of stunting, wasting and underweight) during early childhood (infancy) switches to a healthy status (catches-up) as he grows up, or whether a child who was not malnourished during early childhood grows up to be a malnourished (falters). Results suggest persistence in the nutritional status of children over the data points. The analysis is done separately for region, ethnic group, religion, location, wealth quartile and gender using nutrition mobility matrices.

Key Words: *Young lives, nutritional status, growth faltering, persistence, nutrition mobility matrix, stunting, wasting, underweight*

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Author's Bio

Priya Rampal is a PhD student at the Indira Gandhi Institute of Development Research, Mumbai, India. This paper is preliminary part of the author's PhD dissertation and should not be cited without prior permission.

1. Introduction

In spite of there being reductions in the prevalence of malnutrition of around fifty percent between 1975-79 and 2004-05, one in three malnourished children of the world lives in India (Deaton and Dreze, 2009). In 2005, around 46 per cent of all children below the age of three are stunted, 47 per cent are underweight and at least 16 per cent are wasted (NFHS-3). Those children for whom malnourishment has persisted deserve special attention. Who are these children and what are the factors that keep them malnourished? Is there any mobility in the nutritional status of children or persistence is observed? These are important questions and fairly little is known about the same child's nutritional status at multiple points in time. This is because of lack of panel datasets on the same set of children.

The current study is an effort to study first, the prevalence of malnutrition using the three indices of stunting, wasting and underweight and second, to study the mobility in the nutritional status of children that is, whether a child who was malnourished during early childhood (infancy) switches to a healthy status as he grows up or a child who was not malnourished during infancy grows up to be malnourished. Mapping these transitions will help illuminate whether there is a persistent influence of early childhood status later in life or not. Studying this is possible using the Young Lives study. The Young lives is a long term research project following two cohorts of children: 2000 children born in 2001-02 and 1000 children born in 1994-95 in each of the four countries of Ethiopia, Peru, India (in the state of Andhra Pradesh) and Vietnam. Three rounds have been completed in the year 2002, 2006 and 2009 (Galab et al, 2003). Data on anthropometric measures (height and weight) have been collected for the child in each round thereby helping us map the transitions in nutritional status at three points in time. We map the transitions for the younger cohort of children in this particular study. The first six years of life (particularly the first two years) of a child's life have a great and lasting influence on the quality of life as the health, nutrition, education and development opportunities given to a child at this time largely determine his or her health and well being for the entire lifetime (Victoria et al., 2010, Naudeau et al., 2011). Our first data point is for the child when he/she is less than 2 years; the second between 4 and 5 years; and third, when the child is about 8 years old. It is in these years that various dynamics for height and weight are at play and it would be interesting to

observe whether the transitions at these points in time fit the conceptual framework as established by the nutritionists.

The next section spells out the anthropometric measures used to study the conceptual framework empirically. Section 3 provides the conceptual background for the current study as established by nutritionists. Section 4 provides a more detailed description of the data. Section 5 outlines the methodology and shows how the empirical work fits the conceptual framework and Section 6 concludes.

2. Anthropometric measures [1]

Height for age: Low height-for-age index or inadequate linear growth or stunting identifies past undernutrition or chronic malnutrition. It stems from a slowing in the growth of the foetus and the child and resulting in a failure to achieve expected length as compared to a healthy, well nourished child of the same age. It is associated with a number of long-term factors including chronic insufficient protein and energy intake, frequent infection, sustained inappropriate feeding practices and poverty. A stunted child may be adequately nourished now.

Weight for age: Low weight-for-age index identifies the condition of being underweight, for a specific age. The advantage of this index is that it reflects both past (chronic) and/or present (acute) undernutrition (although it is unable to distinguish between the two). It is used as an indicator to assess changes in the magnitude of malnutrition over time. A stunted but overweight child can appear normal using weight for age.

Weight for height: Low weight-for-height or inadequate ponderal growth or wasting helps to identify children suffering from current or acute undernutrition and is useful when exact ages are difficult to determine. It is appropriate for examining short-term effects such as seasonal changes in food supply or short-term nutritional stress brought about by illness.

BMI for age: This indicator overcomes the drawback of weight for height measure which does not take into account age of the child and is therefore, a better measure for wasting. In our paper, we use BMI for age as an indicator of wasting.

[1] http://www.fantaproject.org/downloads/pdfs/anthro_2.pdf accessed in September 2012

All these are expressed as Z-scores. The Z-score system expresses the anthropometric value as a number of standard deviations or Z-scores below or above the reference mean or median value. A value less than -2 indicates malnutrition.[2]

3. Conceptual framework

The first two years of a child's life are considered the critical window of opportunity for prevention of malnutrition. This is because, first, the growth rates in the first few years are higher than at other times after birth and thus adverse factors have a greater potential for causing growth retardation early in life than in later years. Second, young children have high nutritional requirements per kilogram of body weight because of their needs for growth. Third, immunological systems develop and mature with time so younger children are more susceptible to frequent and severe infections than older children with mature immune systems. Last, they are vulnerable to the effects of poor parenting (Martorell, 1999). It is in these years that ensuring good nutrition yields the greatest returns in terms of education, income, chronic diseases and other outcomes (Victoria et al., 2010; Naudeau et al., 2011).[3]

WHO growth standards show that preschool children, from different parts of the world, have the same growth pattern if they have optimal nutrition and socioeconomic conditions. However at some point in early infancy, growth rates begin to falter, particularly before one year of age in case of inadequate dietary intake and poor health conditions manifested at the household level by inadequate food security, inadequate care for mothers and children and poor access to health services (UNICEF, 1990; Goulet, 2010). Faltering growth is referred to describe the growth of the children who are not reaching their true potential.

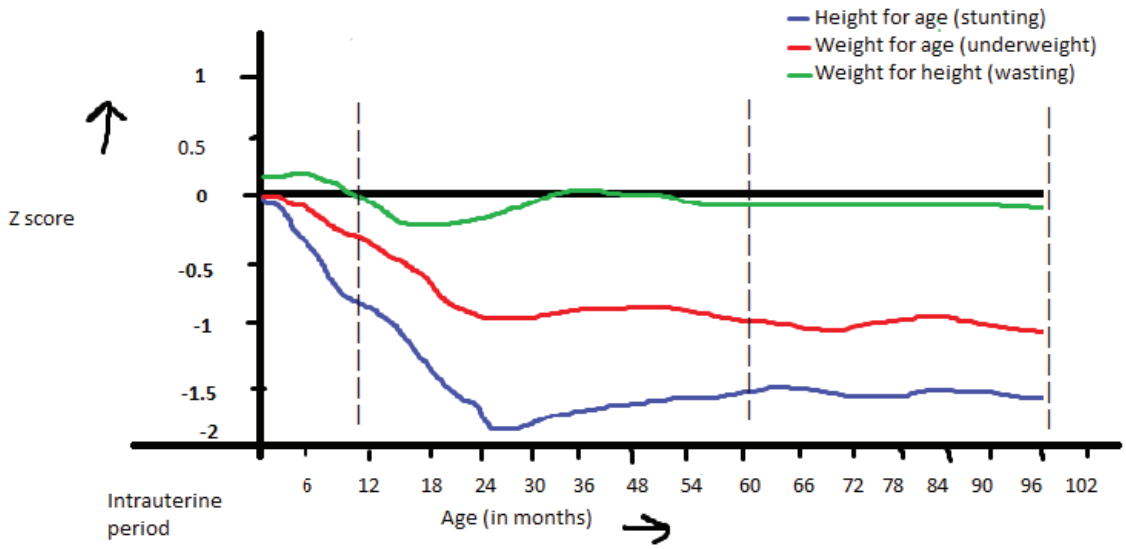
Studies (Richard et al, 2012(1), Richard et al., 2012(2), Victoria et al., 2010) have demonstrated that height for age decreases throughout the first 2–3 years of life in many developing countries, whereas weight for height tends to falter during a more limited age

[2] 4 All Z-scores were calculated using WHO software of igrowup for children below 5 years of age and who2007 for children above 5 years of age accessed on http://www.who.int/childgrowth/en/

[3] From conception to adulthood, growth can be divided into various phases: intrauterine, infancy, childhood and adolescence. Prenatal growth and infancy are the most rapid growth periods. These are also the years when the child is most vulnerable to malnutrition. (Goulet, 2010) However the first 24 months are referred to as the window of opportunity for prevention of malnutrition.

window in the first year of life, after which weight for height stabilizes or increases. Weight is maintained or regained under periods of nutritional stress at the expense of height. If a child has an acute illness or dietary deficiency that result in weight loss, linear growth may slow down or cease until weight is recovered. Once the child regains weight, linear growth will continue and given adequate nutritional resources and no further infections, catch-up growth may occur, returning the child to the original growth trajectory; however, in developing countries, dietary intake is consistently inadequate and infectious diseases are common, impeding the process of catch-up growth and leading to persistent height deficits. The relationship between linear and ponderal faltering has been documented in literature. However, this has not been studied in detail in the present work.

Figure 1: The window of opportunity



Source: Stylized diagram based on Shrimpton et al., 2001 and Victoria et al., 2010

4. Data

In the first round in the year 2002 (Table-1), 2011 children were surveyed of which 1081 were males with an average age of 11.82 months and 930 were females with an average age of 11.87. The range of ages of children in the sample was between 5 and 21 months. The same set of children was followed up in the years of 2006 and 2009. The attrition rate of our sample is about 4%. In terms of gender and region, the sample is well balanced. The sample is largely rural. Eighty seven percent of the respondents follow Hinduism.

Table 1: Sampling details for the Younger cohort born in the year 2001-02[4]

	Younger cohort					
	2002		**2006**		**2009**	
Total	2011		1950		1936	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
Gender	1081	930	1039	911	1041	895
Region						
Coastal Andhra	361	339	354	334	349	326
Rayalseema	313	293	299	280	302	285
Telangana	407	298	385	295	390	284
nk	.	.	.	2	.	.
Religion						
Christian	52	47	9	9	47	44
Muslim	96	54	87	56	86	50
Buddhist	8	6	1	0	7	6
Hindu	925	822	942	846	901	794
Sikh	0	0	.	.	.	.
nk	0	1	.	.	0	1
Caste						
Scheduled Caste	190	180	178	176	180	173

[4] Andhra Pradesh has been divided into three agro climatic zones of Coastal Andhra, Rayalseema and Telangana. These regions have widely different natural resources, historical legacies and institutional arrangements. The state is also home to people following different religions and belonging to different social castes. The social classes are divided into four categories: Scheduled castes, Scheduled tribes, backward classes and other castes. The Scheduled Castes (SCs) and the Scheduled Tribes (STs) are two groupings of historically disadvantaged people that are given express recognition in the Constitution of India. The Backward classes (BCs) include people belonging to aboriginal tribes, Vimukhti Jatis and Vocational groups. They also include SCs converted to Christianity. The erstwhile upper classes belong to the category of other classes (OCs).

Scheduled Tribe	158	135	142	108	156	127
Backward Class	479	445	477	456	471	433
Other Class	254	170	241	169	234	162
mixed	.	.	0	1	.	.
nk	.	.	1	1	.	.
Location						
Rural	800	706	767	684	780	684
Urban	281	224	272	227	261	211
Wealth quartiles						
First	259	226	156	114	94	74
Second	441	413	466	430	381	360
Third	324	248	323	284	448	380
Fourth	57	43	94	83	118	81
Age						
Average age (in months)	11.82	11.87	64.28	64.25	96.03	96.01
Maximum	20	21	74	76	106.4	106.3
Minimum	5	5	54	55	86.2	86.56

Note: nk denotes not known.

In the second round in the year 2006, 1950 children were surveyed of which 1039 were males with an average age of 64.28 months and 911 were females with an average age of 64.25. The range of ages of children in the sample was between 54 and 76 months. In the third round in the year 2009, 1936 children were surveyed of which 1041 were males with an average age of 96.03 months and 895 were females with an average age of 96.01. The range of ages of children in the sample was between 86.2 and 106.3 months.

Table 2: Sampling details for the older cohort born in the year 1994-95

	Older Cohort					
	2002		**2006**		**2009**	
Total	1008		996		975	
	Male	*Female*	*Male*	*Female*	*Male*	*Female*
Gender	495	513	485	509	478	497
Region						
Coastal Andhra	172	178	170	175	168	172
Rayalseema	152	155	146	156	142	150

Telangana	171	180	169	178	168	175
nk	.	.	.	.		
Religion						
Christian	24	24	6	7	24	24
Muslim	34	36	33	32	34	33
Buddhist	5	3			5	3
Hindu	432	449	446	470	415	436
Sikh	0	1	.	.	0	1
nk	.	.	.	.	.	.
Caste						
SC	109	103	102	100	103	101
ST	47	62	42	58	45	61
BC	239	229	239	246	233	223
OC	100	119	101	104	97	112
mixed	.	.	0	1	.	.
nk	.	.	1	0	.	.
Location						
Rural	367	390	357	388	355	380
Urban	128	123	128	121	123	117
Wealth quartiles						
First	111	126	69	66	109	124
Second	216	223	201	223	210	216
Third	143	136	166	166	135	132
Fourth	25	28	49	54	24	25
Age						
Average age(in months)	95.59	95.88	147.76	148.01	176.4	176.64
Maximum	101	103	158	157	156	60
Minimum	87	87	135	133	192	192

Note: nk denotes not known.

5. Methodology

At the outset, we discuss the prevalence of malnutrition in the state of Andhra Pradesh. At the state level, 38% of the children are underweight, 39% are stunted and nine percent are wasted. In our sample, we observe that 32% of the children are stunted, 31% are underweight and 19% are wasted in the first round.

Table 3: Percentage of children wasted, stunted and underweight in the three rounds

	Round 1	Round 2	Round 3
Wasted (ZBMI)	0.19	0.19	0.28
Underweight (ZWFA)	0.32	0.44	0.46
Stunted (ZHFA)	0.31	0.36	0.29

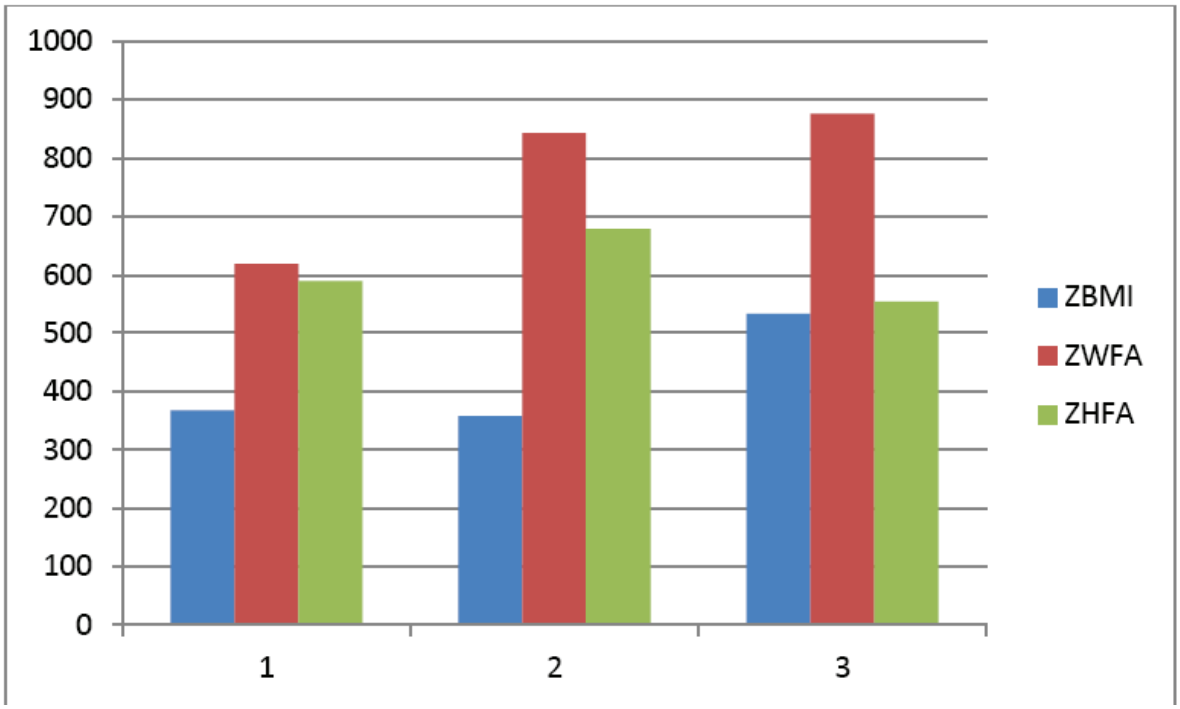
Table 4: Number of malnourished and not malnourished children in the three rounds

	Round 1	Round 2	Round 3
Malnourished	368, 618, 589	358, 841, 679	533, 874, 554
	(-2.69, -2.78,-3.02)	(-2.58, -2.67,-2.65)	(-2.74, -2.76,-2.63)
Not malnourished	1536, 1286, 1315	1546, 1063, 1225	1371, 1030, 1350
	(-0.63, -0.94,-0.57)	(-0.85, -1.21,-1.07)	(-0.89,-1.11,-0.93)
Total	1904, 1904, 1904	1904, 1904, 1904	1904, 1904,1904
	(-1.03,-1.54,-1.33)	(-1.17,-1.86,-1.63)	(-1.41,-1.87,-1.42)

Note: The three numbers indicate the number of children wasted, underweight and stunted in each round. Numbers in parenthesis indicate the average Z-score of children in terms of wasting, underweight and stunting respectively. Detailed Table in annexure.

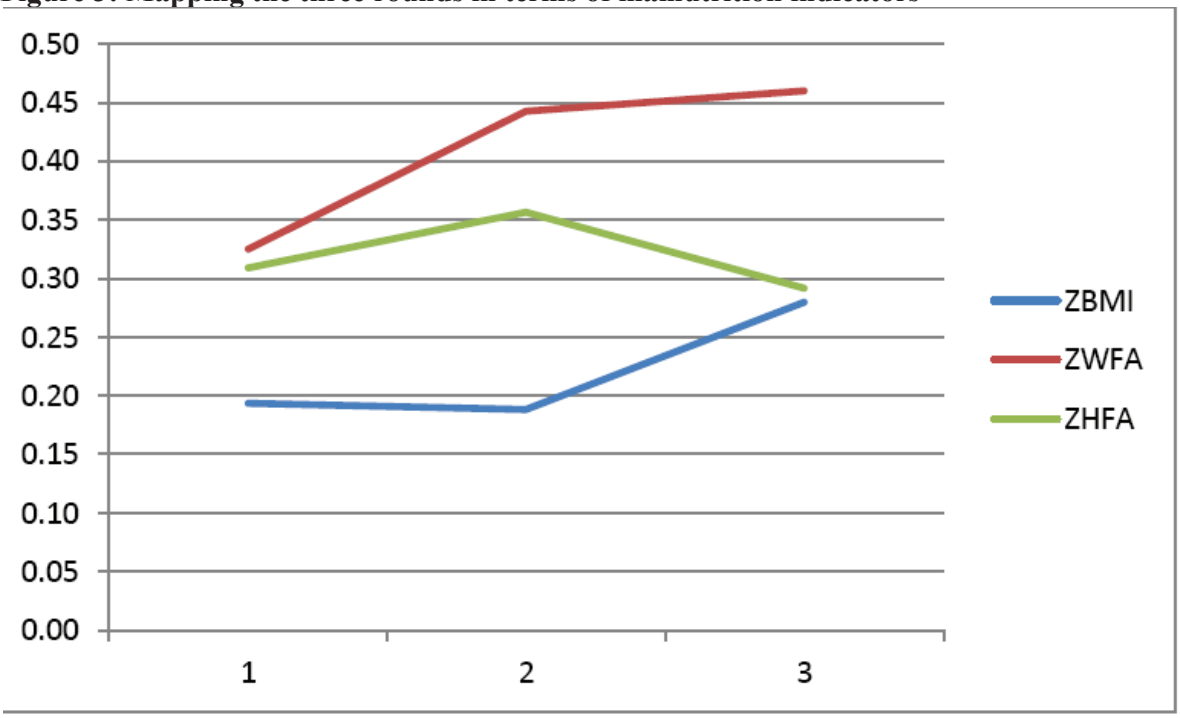
At the aggregate level, we observe that our three data points fit the conceptual framework set by the nutritionists. Stunting shows an increasing trend between the first and second data point clearly demonstrating height for age decreases throughout the first 2–3 years of life and then stabilizes between the second and third data point. Wasting, which is a short term measure of malnutrition shows little increase in the first few years reinforcing the fact that once weight is maintained at the expense of height in the initial years and then linear growth continues though catch up might be difficult. Underweight, which is an aggregate measure of both stunting and wasting, shows an increase in prevalence between the first and second data point while it shows stability between the second and third data points.

Figure 2: Prevalence of malnutrition



Note: The graph represents the wasted, underweight and stunted children in the three rounds.

Figure 3: Mapping the three rounds in terms of malnutrition indicators



Note: The graph maps how Z-score behaves over the three rounds for the three indicators of stunting, wasting and underweight

To study, the extent and the various patterns of mobility in the nutritional status of children in Andhra Pradesh, we use nutrition mobility matrices.[5]

Table 5: Nutrition mobility matrices for the overall sample

Weight for age in 2006			Height For Age in 2006			BMI in 2006		
Weight for age in 2002	Underweight	Not underweight	Height For Age in 2002	Stunted	Not stunted	BMI in 2002	Wasted	Not wasted
Underweight	0.25	0.08	Stunted	0.20	0.11	Wasted	0.08	0.11
Not underweight	0.19	0.48	Not stunted	0.16	0.53	Not wasted	0.11	0.70
Weight for age in 2009			Height For Age in 2009			BMI in 2009		
Weight for age in 2006	Underweight	Not underweight	Height For Age in 2006	Stunted	Not stunted	BMI in 2006	Wasted	Not wasted
Underweight	0.37	0.08	Stunted	0.25	0.11	Wasted	0.12	0.06
Not underweight	0.09	0.47	Not stunted	0.04	0.60	Not wasted	0.16	0.66

Note: Detailed table in annexure

From our nutrition mobility matrices, various observations have been made. For underweight and stunting, more transitions are made in the younger age bracket than in the older age bracket while for wasting; the transitions made are similar in both age brackets. It reinforces the fact that stunting occurs in the early years while weight remains stable, as demonstrated by wasting, which shows similar transitions between the two age brackets. It is also observed that about 70% of the children show persistence in their nutritional status.

A World Bank study (2011) in India has shown that growth has not been equitable. Scheduled Tribes appear to have done more poorly than other groups and show the slowest pace of improvements in a range of areas. In our study, we observe other castes do better than backward classes, scheduled castes and scheduled tribes in terms of the malnutrition indicators. Prevalence of stunting is highest amongst the scheduled tribes. Females are found to do better than males. Twenty eight percent make transitions for underweight and stunting while 23% make transitions in wasting for the younger bracket for both males and females.

[5] This concept is borrowed from intergenerational mobility in employment (Hnatkovska et al., 2011) which is based on the conditional probability of the child choosing the same profession as the father.

Location wise, urban sector does better than rural sector in terms of malnutrition indicators. This urban-rural differential has been observed at the aggregate level too (NFHS-3); with rural sector (50%) having higher prevalence of underweight than urban areas (38%). Twenty two to twenty four percent of children in urban while 30% in rural areas show transitions in the younger age bracket while 12-15% and 17% show transitions in older age bracket for urban and rural areas respectively.

As we move to higher wealth quartiles, fewer percentage of children malnourished. For the first and second quartile, thirty percent children make transitions for underweight and stunting in the younger age bracket while 20% do so in wasting. Eighteen percent and 14% make transitions for underweight and stunting respectively while 20% make transitions in wasting for the older bracket. For the third age quartile, twenty five percent make transitions for underweight and stunting in the younger bracket while 15% do so in the upper bracket. In the fourth quartile, 15% make transitions for the younger bracket while ten percent do so in the older bracket.

6. Concluding Remarks

The results indicate at the aggregate level, our data from the three rounds fits the conceptual framework set by the nutritionists. Once the window of opportunity is lost, it is very difficult for a child to catch up to a normal growth path and persistence in the nutritional status is observed. For underweight and stunting, more transitions are made in the younger age bracket than in the older age bracket while for wasting; the transitions made are similar in both age brackets. About 70% of the children show persistence in the nutritional status in the first transition while 85% show persistence in the second transition for both stunting and underweight. Differences in transitions are observed across gender, location, wealth quartiles and social groups. Thus in the subsequent analysis, we plan to investigate the relationship between socioeconomic characteristics and dynamics of nutritional status of children in detail by building a theoretical model and validating it with the longitudinal data.

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8. Annexure

Table 6: Z scores for Weight for age (Underweight), Height for Age (Stunting) and BMI for age (Wasting)

	Number	Underweight			Stunting			Wasting		
		2002	2006	2009	2002	2006	2009	2002	2006	2009
Ethnic group										
SC	343	-1.54 (1.17)	-1.94 (0.87)	-2.02 (0.99)	-1.15 (1.73)	-1.75 (0.98)	-1.51 (1.35)	-1.19 (1.24)	-1.17 (0.88)	-1.54 (1.28)
t value		-5.76***	-5.21***	-7.36***	-3.78***	-5.55***	-4.86***	-3.26***	-1.05	-4.29***
ST	244	-1.77 (1.07)	-2.03 (-0.98)	-2.11 (-2.23)	-1.64 (1.53)	-1.80 (1.42)	-1.79 (1.25)	-1.09 (1.15)	-1.24 (1.18)	-1.35 (1.22)
t value		-7.95***	-5.71***	-7.71***	-7.68***	-4.81***	-7.89***	-2.02*	-1.7	-2.09*
BC	919	-1.44 (1.11)	-1.91 (0.89)	-1.93 (1.03)	-1.10 (1.65)	-1.70(1.03)	-1.45 (1.13)	-1.08 (1.12)	-1.19 (0.96)	-1.50 (1.15)
t value		-5.72***	-6.31***	-7.73***	-4.20***	-6.06***	-5.49***	-2.69**	-1.83	-5.09***
OC	399	-1.06 (1.11)	-1.57 (0.99)	-1.45 (1.09)	-0.70 (1.49)	-1.30 (1.13)	-1.08 (1.00)	-0.89 (1.20)	-1.08 (09.96)	-1.15 (1.16)
Wealthquartiles										
First	266	-1.72 (1.11)	-2.11 (0.89)	-2.24 (0.91)	-1.52 (1.62)	-2.04 (0.95)	-1.83 (1.24)	-1.13 (1.20)	-1.14 (1.02)	-1.53 (1.12)
Second	877	-1.55 (1.13)	-1.98 (0.87)	-2.07 (0.95)	-1.17 (1.76)	-1.75 (1.19)	-1.59 (1.18)	-1.17 (1.21)	-1.24 (1.02)	-1.52 (1.16)
t value		-2.24**	-2.04**	-2.71**	-2.92**	-3.59***	-2.85**	0.57	1.41	-0.07
Third	590	-1.25 (1.07)	-1.70 (0.95)	-1.67 (1.05)	-0.95 (1.48)	-1.46 (0.99)	-1.21 (1.06)	-0.96 (1.08)	-1.12 (0.99)	-1.36 (1.21)
t value		-5.83***	-6.04***	-7.71***	-5.11***	-7.97***	-7.48***	-1.97*	-0.21	-1.97*
Fourth	172	-0.88 (1.06)	-1.38 (1.04)	-1.01(0.88)	-0.59 (1.33)	-1.06 (1.01)	-0.72 (1.00)	-0.75 (1.07)	-1.08 (1.14)	-0.87 (1.25)
t value		-7.89***	-7.73***	-12.46***	-6.30***	-10.23***	-9.84***	-3.40***	-0.49	-5.75***
Gender										
Male	1016	-1.52 (1.18)	-1.88 (0.98)	-1.95 (1.09)	-1.18 (1.73)	-1.69 (1.08)	-1.49 (1.03)	-1.13 (1.20)	-1.17 (1.03)	-1.48 (1.16)
Female	889	-1.32 (1.08)	-1.84 (0.93)	-1.78 (1.01)	-1.00 (1.53)	-1.58 (1.14)	-1.37 (1.32)	-0.99 (1.11)	-1.18 (1.01)	-1.35(1.23)
t value		-3.84***	-1.11	-3.78***	-2.42*	-2.51*	-2.14*	-2.60**	0.06	-2.32*
Location										
Urban	485	-1.10 (1.11)	-1.60 (1.00)	-1.39 (1.18)	-0.81 (1.44)	-1.33 (1.00)	-1.01 (1.07)	-0.89 (1.45)	-1.11 (1.02)	-1.16(1.32)
Rural	1420	-1.53 (1.12)	-1.95 (0.89)	-2.04 (0.96)	-1.19 (1.69)	-1.75 (1.13)	-1.58 (1.18)	-1.13 (1.16)	-1.19 (1.02)	-1.50 (1.13)
t value		7.28***	7.31***	12.12***	4.55***	7.26***	9.38***	4.29***	1.46	5.63***

Notes: Andhra Pradesh is home to people belonging to different social castes. The social classes are divided into four categories: Scheduled castes (SC), Scheduled tribes (ST), backward classes (BC) and other castes (OC). The Scheduled Castes (SCs) and the Scheduled Tribes (STs) are two groupings of historically disadvantaged people that are given express recognition in the Constitution of India. The Backward classes (BCs) include people belonging to aboriginal tribes, Vimukhti Jatis and Vocational groups. They also include SCs converted to Christianity. The erstwhile upper classes belong to the category of other classes (OCs). The wealth index is intended to be the primary instrument to measure the socioeconomic status of a household in the survey which can take a value between 0 and 1, whereby a higher wealth index value indicates a higher socioeconomic status. The first wealth quartile denotes the lowest wealth quartile and the fourth denotes the highest in our sample. Gender wise and location wise differences are also recorded. T-values are recorded to check for significance. * denotes significance at 5%, **denotes significance at 1% and *** denotes significance at 0.1%.

Table 7: Transition matrices for Underweight, Stunting and Wasting between 2002 and 2006

	Underweight				**Stunting**				**Wasting**			
	Persistence	**Catch-up**	**Faltering**	**Persistence**	**Persistence**	**Catch-up**	**Faltering**	**Persistence**	**Persistence**	**Catch-up**	**Faltering**	**Persistence**
	0 0	0 1	1 0	1 1	0 0	0 1	1 0	1 1	0 0	0 1	1 0	1 1
Gender												
male	0.25	0.07	0.21	0.47	0.19	0.08	0.18	0.54	0.10	0.14	0.10	0.67
Z-stat		-18.14***		-26.21***		-16.82***		-27.07***		-15.39***		-27.91***
female	0.20	0.05	0.22	0.52	0.15	0.08	0.18	0.58	0.07	0.09	0.11	0.73
Z-stat		-15.09***		-25.71***		-14.35***		-26.13***		-11.83***		-27.36***
Location												
urban	0.15	0.06	0.19	0.60	0.09	0.08	0.14	0.69	0.07	0.09	0.12	0.72
Z-stat		-10.00***		-19.62***		-9.00***		-20.09***		-8.94***		-20.12***
rural	0.26	0.07	0.22	0.46	0.20	0.08	0.20	0.52	0.09	0.12	0.10	0.69
Z-stat		-21.37***		-31.03***		-20.20***		-31.81***		-17.23***		-33.51***
Wealth Quartile												
First	0.31	0.06	0.26	0.36	0.26	0.08	0.23	0.43	0.06	0.14	0.11	0.69
Z-stat		-10.00***		-12.88***		-9.53***		-13.22***		-7.41***		-14.52***

second	0.26	0.07	0.23	0.44	0.21	0.09	0.20	0.50	0.10	0.13	0.10	0.67
Z-stat		-17.00***		-24.25***		-16.09***		-24.85***		-14.11***		-26.04***
third	0.17	0.06	0.19	0.57	0.12	0.08	0.15	0.64	0.07	0.09	0.10	0.74
Z-stat		-11.78***		-21.24***		-10.90***		-21.70***		-9.69***		-22.27***
fourth	0.10	0.06	0.16	0.67	0.06	0.06	0.09	0.79	0.09	0.08	0.13	0.70
Z-stat		-5.38***		-11.95***		-4.47***		-12.32***		-5.38***		-11.95***
Ethnic group												
SC	0.26	0.07	0.19	0.48	0.19	0.09	0.20	0.52	0.08	0.15	0.08	0.70
Z-stat		-10.58***		-13.71***		-9.79***		-15.71***		-8.83***		-16.27***
ST	0.32	0.11	0.18	0.39	0.26	0.15	0.15	0.44	0.07	0.13	0.13	0.67
Z-stat		-10.19***		-11.00***		-10.00***		-12.00***		-7.07***		-13.93***
BC	0.23	0.06	0.23	0.48	0.18	0.07	0.20	0.55	0.09	0.11	0.11	0.70
Z-stat		-16.27***		-22.24***		-15.20***		-26.22***		-13.38***		-27.20***
OC	0.14	0.06	0.22	0.59	0.11	0.05	0.13	0.71	0.08	0.09	0.11	0.71
Z-stat		-8.71***		-16.09***		-7.87***		-18.35***		-8.37***		-18.13***

Notes: Persistence (0 0) refers to children who were malnourished (in terms of stunting, wasting and underweight) in the year 2002 and 2006. Catch-up (0 1) refers to children who were malnourished in 2002 but not malnourished in 2006. Faltering (1 0) refers to children who were not malnourished in 2002 but malnourished in 2006. Persistence (1 1) refers to children who were not malnourished in both the years. Reported values are the proportion of children who show persistence, catch-up and faltering over the two years. Z-statistic is calculated to check for significance between Persistence (0 0) and Catch up (0 1). It is also calculated between Faltering (1 0) and Persistence (1 1).

Table 8: Transition matrices for Underweight, Stunting and Wasting between 2006 and 2009

	Underweight				**Stunting**				**Wasting**			
	Persistence	**Catch-up**	**Faltering**	**Persistence**	**Persistence**	**Catch-up**	**Faltering**	**Persistence**	**Persistence**	**Catch-up**	**Faltering**	**Persistence**
	0 0	0 1	1 0	1 1	0 0	0 1	1 0	1 1	0 0	0 1	1 0	1 1
Gender												
male	0.38	0.07	0.11	0.44	0.27	0.11	0.04	0.58	0.13	0.06	0.17	0.64
Z-stat		-21.49***		-23.54***		-19.54***		-25.18***		-14.14***		-28.57***
female	0.35	0.08	0.07	0.50	0.23	0.11	0.04	0.62	0.11	0.06	0.14	0.68
Z-stat		-19.49***		-22.56***		-17.29***		-24.29***		-12.56***		-27.04***

Location												
urban	0.22	0.12	0.06	0.60	0.13	0.10	0.02	0.74	0.10	0.09	0.13	0.68
Z-stat		-12.81***		-17.92***		-10.68***		-19.26***		-9.59***		-19.82***
rural	0.42	0.06	0.10	0.42	0.29	0.11	0.05	0.55	0.13	0.06	0.16	0.65
Z-stat		-26.03***		-27.24***		-23.81***		-29.21***		-16.31***		-33.97***
Wealth Quartile												
First	0.51	0.06	0.10	0.33	0.37	0.12	0.08	0.43	0.13	0.04	0.19	0.64
Z-stat		-12.33***		-10.68***		-11.44***		-11.62***		-6.71***		-14.87***
second	0.43	0.06	0.10	0.41	0.30	0.11	0.04	0.55	0.14	0.06	0.17	0.64
Z-stat		-20.71***		-21.17***		-19.00***		-22.72***		-13.11***		-26.55***
third	0.28	0.08	0.09	0.54	0.17	0.11	0.03	0.69	0.11	0.06	0.15	0.67
Z-stat		-14.70***		-19.34***		-12.77***		-20.66***		-10.20***		-22.05***
fourth	0.13	0.13	0.03	0.71	0.08	0.07	0.02	0.83	0.10	0.12	0.05	0.73
Z-stat		-6.71***		-11.27***		-5.09***		-12.08***		-6.08***		-11.62***
Ethnic group												
SC	0.40	0.06	0.11	0.44	0.28	0.11	0.04	0.57	0.13	0.03	0.17	0.67
Z-stat		-12.45***		-13.71***		-11.57***		-14.46***		-7.35***		-17.00***
ST	0.41	0.09	0.12	0.38	0.34	0.07	0.09	0.50	0.11	0.09	0.11	0.68
Z-stat		-11.09***		-11.00***		-10.05***		-11.96***		-7.00***		-13.96***
BC	0.39	0.07	0.10	0.44	0.26	0.13	0.03	0.59	0.14	0.06	0.18	0.63
Z-stat		-20.59***		-22.24***		-18.74***		-23.83***		-13.30***		-27.24***
OC	0.25	0.10	0.06	0.59	0.16	0.08	0.03	0.73	0.10	0.10	0.12	0.68
Z-stat		-11.83***		-16.09***		-9.75***		-17.44***		-8.83***		-17.92***

Notes: Notes: Persistence (0 0) refers to children who were malnourished (in terms of stunting, wasting and underweight) in the year 2006 and 2009. Catch-up (0 1) refers to children who were malnourished in 2006 but not malnourished in 2009. Faltering (1 0) refers to children who were not malnourished in 2006 but malnourished in 2009. Persistence (1 1) refers to children who were not malnourished in both the years. Reported values are the proportion of children who show persistence, catch-up and faltering over the two years. Z-statistic is calculated to check for significance between Persistence (0 0) and Catch up (0 1). It is also calculated between Faltering (1 0) and Persistence (1 1).

Dynamics of Changing Nutritional Status of Children in Andhra Pradesh

This paper examines the dynamics of nutritional status of children in the state of Andhra Pradesh in India in the years of 2002, 2006 and 2009 based on a sample of a cohort of 2000 children born in the year 2001-02. It observes whether a child who was malnourished (in terms of stunting, wasting and underweight) during early childhood (infancy) switches to a healthy status (catches-up) as he grows up, or whether a child who was not malnourished during early childhood grows up to be a malnourished (falters). Results suggest persistence in the nutritional status of children over the data points. The analysis is done separately for region, ethnic group, religion, location, wealth quartile and gender using nutrition mobility matrices.

Young Lives
An International Study of Childhood Poverty

About Young Lives

Young Lives is an international study of childhood poverty, involving 12,000 children in 4 countries over 15 years. It is led by a team in the Department of International Development at the University of Oxford in association with research and policy partners in the 4 study countries: Ethiopia, India, Peru and Vietnam.

Through researching different aspects of children's lives, we seek to improve policies and programmes for children.

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