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## Background

- Growth monitoring identifies HIV-infected children eligible for HAART, helps to assess their response to HAART as well as their general nutritional status.
- However, there is little knowledge how children in resource-limited settings respond to HAART.
- We examined anthropometric status and response to HAART in children treated at a large public-sector clinic in Malawi.

## Objectives

- To describe to ART. growth [age and sex adjusted z-scores for weight-for-age (WAZ), height-for-age (HAZ)] responses
- To examine associations between baseline characteristics and growth response
- To compare baseline anthropometric status with anthropometric status in the general population.

## Methods

### Study Population and Inclusion Criteria

- Children from the tertiary health facility 'Lighthouse' in Lilongwe, Malawi were included.
- children with WHO stages 3 and 4 or absolute or relative CD4 count below the age-dependent threshold for severe immunosuppression are started on ART as soon as caregivers have attended a group education session.

▪ Clinic aids measured weight and height at every visit with a weekly calibrated mechanical weighing scale and a height scale. Children with acute malnutrition received a peanut butter based, enriched ready-to-use food (plumpy nut).

- Inclusion criteria:
  - 15 years or younger at initiation of highly antiretroviral therapy (HAART)
  - ART-naïve
  - Started HAART between January 2001 and December 2008

### Statistical Analysis

- Weight and height measurements were converted into age- and sex-adjusted z-scores using data of the NCHS/CDC/WHO international reference population.
- We used multivariable mixed models with WAZ and HAZ as outcomes. A random effect per child was included to account for the correlation of repeated measurements within the same child. To model the trajectories of the anthropometric measurements on ART over time, the best fitting fractional polynomial was chosen.
- We compared the nutritional status of children aged 0 to 5 years starting ART with a reference population from Lilongwe city of the same age. The reference population comes from the 2004 Demographic and Health Survey (DHS 2004).

## Results

### Characteristics of Study Population

Overall a total of 1,021 HIV-infected children aged <15 years had at least one visit and 497 children started HAART. Among those who have not started HAART, 93% are lost to follow-up. Median follow-up duration on HAART was 23 months (IQR 10.7-33.6). Patients characteristics at start of HAART are shown in table 1.

Table 1: Patients characteristics of 497 children starting HAART

General/ Demographic		Disease status	
Girls (%)	49%	Degree of immunodeficiency None/ moderate	23%
		Severe	77%
Age (years)	8 (4-11)	Median (IQR) Z scores Weight-for-age	-1.8 (-2.5 to -0.9)
		Height-for-age	-2.2 (-3.1 to -1.3)
Year of ART start 2001-2004	40%	WHO stage I + II	6%
2005-2007	60%	III + IV	94%

### Comparison with Malawian children

At start of HAART the median Z score for both weight and height was substantially lower than in general Malawian children (Table 2)

Table 2: Comparison of the nutritional status of HIV-infected children starting antiretroviral treatment at the Lighthouse clinic with children of unknown HIV-status examined during the Demographic and Health Survey 2004.

	Lighthouse clinic	Demographic Health Survey	P value
<b>Weight-for-age</b>			
N	92	102	
Median z (IQR)	-1.8 (-2.8 to -0.3)	-1.2 (-1.8 to -0.6)	< 0.001
Median age (months)	36 (30-45)	34 (26-46)	0.44
Girls (%)	48%	50%	0.7
<b>Height-for-age</b>			
N	69	102	
Median z (IQR)	-2.0 (-3.5 to -0.8)	-1.4 (-2.8 to -0.5)	< 0.001
Median age (months)	37 (32-45)	34 (26-46)	0.2
Girls (%)	37%	50%	0.6

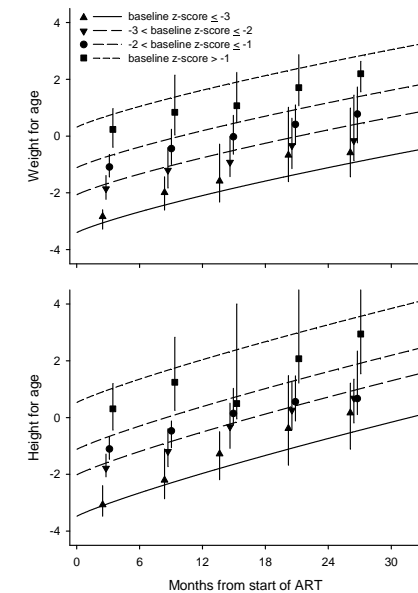
### Predictors of growth response

Low z-scores at the start of HAART, starting HAART before June 2004 and older age were associated with poor responses in WAZ and HAZ.

Conversely, sex, degree of immunodeficiency and clinical stage were not associated with the evolution of WAZ or HAZ after starting HAART.

Figure 1 shows the predicted growth response by WAZ and HAZ scores at HAART initiation together with the (observed) median values. Children who start HAART with a high degree of stunting or who were severely underweight did not catch-up within the 2-year period.

Figure 1: Evolution of z-scores for weight-for-age and height-for-age from start of antiretroviral therapy up to 27 months after start of ART. Lines represent fit of model. Dots represent medians with interquartile ranges (IQR).



## Discussion & Conclusions

- About half of the children were underweight and stunted at HAART start.
- HIV infected children were lighter and shorter than children of unknown HIV status from the same area – this indicates that low z-scores are mainly related to HIV and opportunistic infections
- Median WAZ and HAZ increased with HAART, reaching normal values after about 18 months of therapy.
- However, in the subset of children who started with WAZ scores of less than -2, normal values were not reached even after two years of HAART