Child Anthropometry in Côte d'Ivoire

Estimates from Two Surveys, 1985 and 1986
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Child Anthropometry in Côte d'Ivoire

Estimates from Two Surveys, 1985 and 1986
The Living Standards Measurement Study

The Living Standards Measurement Study (LSMS) was established by the World Bank in 1980 to explore ways of improving the type and quality of household data collected by statistical offices in developing countries. Its goal is to foster increased use of household data as a basis for policy decisionmaking. Specifically, the LSMS is working to develop new methods to monitor progress in raising levels of living, to identify the consequences for households of past and proposed government policies, and to improve communications between survey statisticians, analysts, and policymakers.

The LSMS Working Paper series was started to disseminate intermediate products from the LSMS. Publications in the series include critical surveys covering different aspects of the LSMS data collection program and reports on improved methodologies for using Living Standards Survey (LSS) data. More recent publications recommend specific survey, questionnaire, and data processing designs, and demonstrate the breadth of policy analysis that can be carried out using LSS data.
Child Anthropometry in Côte d'Ivoire

Estimates from Two Surveys, 1985 and 1986

John Strauss
Kalpana Mehra

The World Bank
Washington, D.C.
ABSTRACT

Child heights, weights and weights given height are tabulated for the Côte d'Ivoire using the Living Standards Survey data for 1985 and 1986. The major finding is the low incidence of stunting (low height for age) relative to other West African nations. Important regional variation exists, but in the poorer Savanna region levels of stunting are still somewhat lower than in other rural areas of West Africa. Wasting (low weight given height) is more in line with other West African countries, but is far lower than found in South Asia.

Several patterns appear in bivariate relationships between certain household and community factors and the incidence of low height or weight. Parental education and height, and relationship of the child to the household head seem especially important.
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INTRODUCTION

Anthropometric measurements on children have been widely used as one indicator of health (for example, Martorell, 1982; Falkner and Tanner eds., 1986). In particular, height standardized for age is used as an indicator of longer run nutritional status, reflecting past outcomes; while weight given height is used as one indicator of shorter run status, (Waterlow et al., 1977). This report presents estimates of height-for-age, weight-for-height and weight-for-age for children under 10 years of age from the data for the Living Standards Surveys in 1985 and 1986 in Côte d'Ivoire. Weight-for-age, while it is a hybrid measure reflecting both past and current outcomes, it is nevertheless included to compare to other surveys. Height and weight measurements were taken in the Côte d'Ivoire Living Standards Survey (CILSS), conducted by the the Direction de la Statistique, Côte d'Ivoire, with assistance from the Living Standards Unit of the World Bank; (to date the survey has been conducted in three years, 1985, 1986 and 1987).

The report is organized into two parts: part one provides breakdowns by age, sex and region, of standardized height, weight and weight-for-height. Part two provides cross-tabulations with a variety of factors thought in the literature to influence these child anthropometric outcomes: such as parental education, parental height, household income, source of drinking water and mother's relationship to the child in the often extended household. These cross-tabulations have to be interpreted quite carefully since they represent bivariate relationships only. (A multivariate analysis is provided in Strauss, 1988).
In the analysis presented herein, heights and weights are standardized for age and sex, and weight-for-height is measured as weight standardized for height and sex; in all cases using National Center for Health Statistics (NCHS) standards (1976). The U.S. standards provide comparability with many other surveys, while not requiring that normative conclusions be reached regarding the severity of any shortfalls. The use of the NCHS standards is also motivated by evidence from a number of surveys (of non-East Asian populations) that pre-adolescent children from well nourished households have heights and weights close to the U.S. median, while substantial shortfalls exist for children from more poorly nourished households, (Habicht et al., 1974, Martorell and Habicht, 1986). The results of the analysis are presented in the Appendix with tables containing means and standard deviations, while frequency distributions are illustrated in figures in the main text. Cut-off points used in these figures correspond to World Health Organisation standards of stunting (90% of U.S. median height-for-age) and wasting (80% of U.S. median weight-for-height). The weight-for-age cutoffs correspond to the Gomez scale (less than 60%, 60-75%, 75-90% and greater than 90%). With a cut-off point based on so-called Z-scores\(^1\), using less than two Z-scores under NCHS standards results in somewhat higher incidences of stunting and wasting (Sahn, 1988). This reflects the fact that much of the distribution of standardized measurements falls in this range.

\(^1\) A Z-score is derived by subtracting the mean height (or weight) from the NCHS standards and dividing by the standard deviation of the NCHS distribution for that particular age-sex group.
The data are taken from a national probability sample of 1600 households each year, out of which 800 were reinterviewed in the second year, with 800 new households being added (see Ainsworth and Muñoz, 1986). The anthropometric measurements did not commence until past mid-way in 1985, resulting in only 636 households having measurements taken in 1985, although the full 1600 households were covered in 1986.

In Abidjan, low income households were underrepresented in the first two survey years, even though the sample was designed to be self-weighting. In order to correct for this, household weights for each of the two years were derived and used for the Abidjan calculations. However, these weighted averages were fairly close to the unweighted sample averages; the latter (unweighted) being the one which are reported in this paper.
RESULTS

Figures 1, 2 and 3 show the empirical frequency distributions in 1985 and 1986 for standardized height, weight and weight-for-height, respectively, broken down by age and rural or urban place of residence. Means and standard deviations are provided in Appendix, Table 1. The major finding is the remarkably low percentage of children with heights less than 90% of U.S. standards. Surveys in other sub-Saharan countries show stunting levels of 20 percent among pre-school children (Kumar, 1986; Svedberg, 1987), considerably higher than is found in the CILSS. On the other hand, the Côte d'Ivoire data show much greater stunting than in the reference U.S. population, where only 0.5 percent of two year old boys fall below 90% of median (Waterlow et al., 1977).

In weight-for-height, the proportion of children under 80 percent of the U.S. median (wasting) is more on par with what has been found in sub-Saharan Africa, which in general is low when compared to South Asia (Kumar, 1986).

Age

Despite the average findings, considerable variation in outcomes exists within the Côte d'Ivoire. In the figures, one can examine differences by age of child, by rural or urban residence, and by the survey year. As children grow older a general pattern exists of increases in the proportion in the lower tail of the distribution. The proportion below 90% of U.S. median height increases dramatically between one and two years, and increases further between two and four years, while declining at higher ages. For weight-for-height the proportion under 80% rises precipitously between one and two years, falling drastically as children age further.
Figure 1A

Distribution of NCHS Height-for-Age Standards by Age (Urban) 1985

Legend:
- LOW-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-HIGH

Distribution of NCHS Height-for-Age Standards by Age (Rural) 1985

Legend:
- LOW-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-HIGH
Figure 1B

Distribution of NCHS Height-for-Age Standards by Age (Urban)
1986

Legend
- LOW-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-HIGH

Distribution of NCHS Height-for-Age Standards by Age (Rural)
1986

Legend
- LOW-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-HIGH
Figure 2A

Distribution of NCHS Weight-for-Age Standards by Age
(Urban)

1985

Distribution of NCHS Weight-for-Age Standards by Age
(Rural)

1985
Figure 2B

Distribution of NCHS Weight-for-Age Standards by Age
(Urban)
1986

Legend
- Low-50%
- 60-75%
- 75-90%
- 90-105%
- 105-120%
- 120%-High

Distribution of NCHS Weight-for-Age Standards by Age
(Rural)
1986

Legend
- Low-50%
- 60-75%
- 75-90%
- 90-105%
- 105-120%
- 120%-High
Figure 3A

Distribution of NCHS Weight-for-Height Standards by Age (Urban)

1985

Legend
- LOW-50%
- 50-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-HIGH

Distribution of NCHS Weight-for-Height Standards by Age (Rural)

1985

Legend
- LOW-50%
- 50-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-HIGH
Figure 3B

Distribution of NCHS Weight-for-Height Standards by Age (Urban) 1986

Legend
- LOW-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-HIGH

Age Group
0-11 12-23 24-47 48-71 72-119

Distribution of NCHS Weight-for-Height Standards by Age (Rural) 1986

Legend
- LOW-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-HIGH

Age Group
0-11 12-23 24-47 48-71 72-119
These findings conform to a general pattern found in developing countries (see, for example, Martorell and Habicht, 1986) which may result from factors leading to nutritional stress around the time of weaning and/or the introduction of solid foods.

Comparison of 1985 and 1986

Comparing the two years data is complicated. The first year measurements were only taken in some of the sampling clusters resulting in a smaller sample size. The clusters were in principle assigned randomly for interviewing in different months of the year. Hence, the clusters covered by anthropometric measurements in the last five months of the 1985 should be a random subsample of the entire set. However, a random subset could give rise to differences if an unusual draw were obtained. To control for this, results were also obtained restricting households in 1986 to those residing in the 1985 clusters. These results are largely consistent with what is presented and are available upon request.

In Appendix Tables 1 and 2 it is apparent that mean values are close in the two survey years but the standard deviations are substantially higher in 1986. This increase in the measured spread of the distributions for height and weight-for-height is also apparent when comparing the Figures. Both sides of the distribution, not just the lower tails, are affected. However, examining the data by region (Figures 4-6) reveals that the increase has occurred primarily in Abidjan and in the East Forest. It is possible that the changes are real, but one should be quite cautious in drawing such an inference. It is also possible that the difference could result from random chance, the larger sample size in 1986 resulting in more extreme observations,
Figure 4

Distribution of NCHS Height-for-Age Standards by Region
1985

Legend
- Low-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-High

Distribution of NCHS Height-for-Age Standards by Region
1986

Legend
- Low-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-High
Figure 5

Distribution of NCHS Weight-for-Age Standards by Region
1985

Legend
- LOW-60%
- 60-75%
- 75-90%
- 90-105%
- 105-120%
- 120%-High

Distribution of NCHS Weight-for-Age Standards by Region
1986

Legend
- LOW-60%
- 60-75%
- 75-90%
- 90-105%
- 105-120%
- 120%-High
Figure 6

Distribution of NCHS Weight-for-Height Standards by Region
1985

Legend
- Low-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-High

Distribution of NCHS Weight-for-Height Standards by Region
1986

Legend
- Low-80%
- 80-90%
- 90-100%
- 100-110%
- 110-120%
- 120%-High
or it could be that in these two areas the anthropometrists were making more error ridden measurements in 1986.2/

**Urban-Rural Differences**

Children residing in rural areas tend to be smaller and lighter than those in urban areas. The differences in height persist, and even grow, as children age. This is consistent with height reflecting past outcomes. For weight-for-height, the differences are greatest for children under two years, narrowing after that age. In Figures 4-6, standardized measurements are further broken down by region. Urban Côte d'Ivoire is divided into Abidjan and the rest, while rural households are divided into the East Forest, West Forest or Savanna. A ranking of rural regions emerges: children living in the East Forest having the lowest incidence of stunting and wasting; followed by children in the West Forest and finally children in the Savanna. This regional ranking coincides with rankings in terms of income (see Glewwe, 1987).3/

---

2/ For a subsample of household members, measurements were taken twice, two weeks apart. For height, and to a somewhat lesser extent for weight, comparing these two measurements should give an indication of errors in measurement. An analysis of variance was estimated using individual level dummy variables. The standard error from that equation provides an estimate of measurement errors. These ANOVA's were run separately for 1985 and 1986 data, splitting the sample by different age groups of individuals and by different anthropometrists. The estimated standard errors are in general smaller for 1986 than for 1985. However, it is possible that contrary to instructions the anthropometrists were more frequently looking up the first measurements before they took the second, in 1986, thus destroying any independence between the two measurements, and resulting in a smaller estimated standard error in 1986.

3/ The regional differences in anthropometric outcomes are well explained by a combination of household level factors such as parental education and height, and by community level factors such as wage rates, quality of medical services and incidence of disease (see Strauss, 1988).
In Appendix Table 2, means and standard deviations of standardized measurements are provided. These are broken down by sex in addition to region. It is interesting to note that there is an absence of explicit signs of sex preference. This conforms with Deaton's (1988) finding for the effect of male and female children on the consumption of "adult" goods, and more generally with other anthropometric evidence from sub-Saharan Africa (Svedberg, 1987).

Cross-Tabulations

The following sections report a series of two-way classifications. These are designed to provide the underlying factors of variation in child anthropometric outcomes. Because they are only bivariate relationships, one must be quite cautious in drawing inferences. Strauss (1988) reports a multivariate analysis of the 1985 rural data, focusing on household and community determinants, which largely supports the conclusions below.4/

The factors considered are maternal and paternal education, decile of per capita household expenditure, relationship to household head, mother's height, and source of household drinking water. Parental education are natural variables to consider given their importance in generating income and in making choices which affect health and nutrition. This importance has been surveyed by Cochrane, Leslie and O'Hara (1982). Per capita household expenditure is a useful measure of long run income. Relationship to the head of household may be important in extended households, as found in Côte d'Ivoire, where polygyny and child fosterage are relatively common. Source of

household drinking water is also of interest. As mentioned, all these variables are correlated with each other and with other explanatory factors making inference somewhat hazardous, yet the results are still of interest.

Mother's Education (Figures 7 to 9)

The education variables have been divided into three categories for urban areas; none, some primary, and completed primary. In rural areas, the two positive schooling categories have been combined because so few mothers had completed primary school. In 1985, the expected negative relationship shows up between greater maternal education and standardized height, for both urban and rural areas (Figure 7). For weight-for-height the urban relationships are not so clear cut. For rural children in 1986 data, a negative relationship exists between mother's education and the proportion of children stunted or wasted which is similar to 1985, but for urban children this does not seem to be the case. Whether the lack of a negative relationship in urban areas is a result of better health infrastructure making maternal education less important, or stems from other facts, will have to be examined more carefully by multivariate analysis.

Father's Education (Figures 10 to 12)

The relationships appear to be different between the two years for father's education. In 1985, a monotonic negative relationship appears for both rural and urban areas, for both standardized height and weight-for-height. In the 1986 data, this relationship seems to break down for standardized height. No clear differences between rural and urban areas are apparent for either year, in contrast to maternal education.
Figure 7

Distribution of NCHS Height-for-Age Standards by Mother's Education

1985

Urban - None

Urban - Any Primary

Urban - Primary+

Rural - None

Rural - Some

1986

Urban - None

Urban - Any Primary

Urban - Primary+

Rural - None

Rural - Some
Figure 8

Distribution of NCHS Weight-for-Age Standards by Mother's Education

1985

Urban - None

Urban - Any Primary

Urban - Primary+

Rural - None

Rural - Some

Distribution of NCHS Weight-for-Age Standards by Mother's Education

1986

Urban - None

Urban - Any Primary

Urban - Primary+

Rural - None

Rural - Some
Figure 9

Distribution of NCHS Weight-for-Height Standards by Mother's Education

- 1985 - Urban - None
- 1985 - Urban - Any Primary
- 1985 - Urban - Primary+
- 1986 - Rural - None
- 1986 - Rural - Some

[Pie charts showing distribution by urban and rural areas, with education levels specified.

Legend:
- Low-80%
- 100-110%
- 80-90%
- 110-120%
- 90-100%
- 120%-High]
Figure 10

Distribution of NCHS Height-for-Age Standards by Father's Education

1985

1986

Urban - None

Urban - Any Primary

Urban - Primary+

Rural - None

Rural - Some
Figure 12

Distribution of NCHS Weight–for–Height Standards by Father's Education

Urban – None 1985

Urban – Any Primary

Urban – Primary+

Rural – None

Rural – Some

Distribution of NCHS Weight–for–Height Standards by Father's Education 1986

Urban – None

Urban – Any Primary

Urban – Primary+

Rural – None

Rural – Some
Per Capita Expenditure Decile

The 1985 per capita expenditure of each household was computed using imputations for housing in urban areas but not for rural households (see Glewwe, 1987). Deciles were created separately for urban and rural Côte d'Ivoire. Any relationships transparent in Figures 13A, 13B or 13C would seem to be at the extremes. For the top urban deciles height and weight-for-height are near U.S. median levels, consistent with evidence from a variety of anthropometric surveys (Martorell and Habicht, 1986). Likewise children from the lowest decile have significantly lower weights-for-heights (though not heights), than to other children. No patterns emerge in between the top and bottom deciles.
Figure 13A

Average Height-for-Age by Per Capita Expenditure Deciles and Residence

1985

Legend

Urban
Rural
Average Weight-for-Age by Per Capita Expenditure Deciles and Residence

1985

Legend

Urban
Rural
Figure 13C

Average Weight-for-Height by Per Capita Expenditure Deciles and Residence

1985

Legend

Urban
Rural
Relationship to Head of Household

Four categories are distinguished for this variable: (1) children whose mother's are the household head or senior wife of the head (this category will include children whose fathers are heads and have only one wife); (2) children whose mothers are junior wives of the household head; (3) children not of the head but whose parents reside in the household, and (4) children not having any parents in the household (foster children). Figures 14, 15 and 16 provide the results, which are broadly consistent over both years. Children whose parents include the household head have a lower incidence of stunting and wasting than children not of the head of household whose parents reside in the household. There is some tendency for children whose mothers are junior wives to fare worse than children of senior wives or of female household heads. Finally, and quite interestingly, foster children have lower incidences of both stunting and wasting than even the children of the head. This may be because healthier children are selected to be fostered out (and in) of households, but future analysis will have to find the exact reasons. This finding for Côte d'Ivoire is in contrast with more limited surveys in countries such as Sierra Leone (Bledsoe and Ewbank, 1987).
Figure 14A

Distribution of NCHS Height-for-Age Standards by Status of Child in the Household — Urban

1985

Distribution of NCHS Height-for-Age Standards by Status of Child in the Household — Rural

1985
Figure 14B

Distribution of NCHS Height-for-Age Standards by Status of Child in the Household - Urban

1986

- Child of Female Head or Senior Wife of Head
- Child of Junior Wife of Head
- Not of Head - Parents in Household
- Not of Head - Parents not in Household

Distribution of NCHS Height-for-Age Standards by Status of Child in the Household - Rural

1986

- Child of Female Head or Senior Wife of Head
- Child of Junior Wife of Head
- Not of Head - Parents in Household
- Not of Head - Parents not in Household
Figure 15A

Distribution of NCHS Weight-for-Age Standards by Status of Child in the Household - Urban 1985

Child of Female Head or Senior Wife of Head

<table>
<thead>
<tr>
<th>Status</th>
<th>Low-60%</th>
<th>90-105%</th>
<th>60-75%</th>
<th>105-120%</th>
<th>75-90%</th>
<th>120%-High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child of Female Head</td>
<td>35.9</td>
<td>4.3</td>
<td>21.6</td>
<td>2.6</td>
<td>0.6</td>
<td>3.7</td>
</tr>
<tr>
<td>Child of Junior Wife</td>
<td>37.7</td>
<td>18.9</td>
<td>19.8</td>
<td>5.0</td>
<td>3.4</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Child of Female Head or Senior Wife of Head

<table>
<thead>
<tr>
<th>Status</th>
<th>Low-60%</th>
<th>90-105%</th>
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</tr>
</tbody>
</table>

Child of Female Head or Senior Wife of Head

<table>
<thead>
<tr>
<th>Status</th>
<th>Low-60%</th>
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</table>

Child of Female Head or Senior Wife of Head

<table>
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<tr>
<th>Status</th>
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</table>

Child of Female Head or Senior Wife of Head

<table>
<thead>
<tr>
<th>Status</th>
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<td>1.6</td>
</tr>
</tbody>
</table>

Distribution of NCHS Weight-for-Age Standards by Status of Child in the Household - Rural 1985

Child of Female Head or Senior Wife of Head

<table>
<thead>
<tr>
<th>Status</th>
<th>Low-60%</th>
<th>90-105%</th>
<th>60-75%</th>
<th>105-120%</th>
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<td>1.6</td>
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</table>

Child of Female Head or Senior Wife of Head

<table>
<thead>
<tr>
<th>Status</th>
<th>Low-60%</th>
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</table>

Child of Female Head or Senior Wife of Head

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<td>3.4</td>
<td>1.6</td>
</tr>
</tbody>
</table>
**Figure 15B**

Distribution of NCHS Weight-for-Age Standards by Status of Child in the Household – Urban

1986

- Child of Female Head or Senior Wife of Head
- Child of Junior Wife of Head
- Not of Head – Parents in Household
- Not of Head – Parents not in Household

Distribution of NCHS Weight-for-Age Standards by Status of Child in the Household – Rural

1986

- Child of Female Head or Senior Wife of Head
- Child of Junior Wife of Head
- Not of Head – Parents in Household
- Not of Head – Parents not in Household
Figure 16A

Distribution of NCHS Weight-for-Height Standards by Status of Child in the Household — Urban 1985

Child of Female Head or Senior Wife of Head

Child of Junior Wife of Head

Not of Head – Parents in Household

Not of Head – Parents not in Household

Distribution of NCHS Weight-for-Height Standards by Status of Child in the Household — Rural 1985

Child of Female Head or Senior Wife of Head

Child of Junior Wife of Head

Not of Head – Parents in Household

Not of Head – Parents not in Household
Figure 16B
Distribution of NCHS Weight-for-Height Standards by Status of Child in the Household - Urban 1986
Child of Female Head or Senior Wife of Head

Not of Head - Parents in Household

Child of Junior Wife of Head

Not of Head - Parents not in Household

---

Distribution of NCHS Weight-for-Height Standards by Status of Child in the Household - Rural 1986
Child of Female Head or Senior Wife of Head

Not of Head - Parents in Household

Child of Junior Wife of Head

Not of Head - Parents not in Household
**Mother's Height** (Figures 17 to 19)

Height of a child's parents will certainly affect that of the child. This is borne out in Figure 17, where mothers' heights are categorized according to whether they are above median U.S. heights for 18 years old (greater than 164 cms) or whether they are less than one standard deviation (158-164 cms calculated using NCHS data), between one and two standard deviations (152-158 cms) or less than two standard deviations (152 cms) under U.S. adult median height. Some of the smallest mothers will include those as young as 13 or 14 years. As is clear from Figure 17, there is a strong bivariate relationship between maternal and child height. This is not purely genetic as shorter mothers may be very young, have less education and other unobservable human capital. For weight-for-height (Figure 19) no clear-cut relationship exists. This may indicate that the non-genetic effect of height is small.

**Source of Drinking Water** (Figures 20 to 22)

Five (rainy season) sources are distinguished: piped water, well with a pump, well without a pump, outside (rain, rivers, lakes, etc.) and other. In rural areas a clear distinction in the 1985 data between sources exists. Children in households having piped water are less likely to be stunted or wasted than others. The differences between non-piped water sources is less dramatic. In the 1986 data even the difference between piped and non-piped sources in rural areas is diminished. In urban areas having piped water does not seem to be associated with any advantages. Of course, having access to piped water in rural areas probably means residence in a larger town having consequently better health and educational facilities, and, quite possibly, parents with more education and income.
Figure 17A

Distribution of NCHS Height-for-Age Standards by Height of Mother – Urban

138-152 cms

152-158 cms

158-164 cms

164-178 cms

1985

Distribution of NCHS Height-for-Age Standards by Height of Mother – Rural

138-152 cms

152-158 cms

158-164 cms

164-178 cms

1985
Figure 17B

Distribution of NCHS Height-for-Age Standards by Height of Mother - Urban

1986

- 37 -

Distribution of NCHS Height-for-Age Standards by Height of Mother - Rural

1986
Figure 18A

Distribution of NCHS Weight-for-Age Standards by Height of Mother - Urban

1985

- 138-152 cms
- 158-164 cms
- 164-178 cms

Distribution of NCHS Weight-for-Age Standards by Height of Mother - Rural

1985

- 138-152 cms
- 158-164 cms
- 164-178 cms
Figure 19A

Distribution of NCHS Weight-for-Height Standards by Height of Mother - Urban

<table>
<thead>
<tr>
<th>Height Range</th>
<th>1985</th>
</tr>
</thead>
<tbody>
<tr>
<td>138-152 cms</td>
<td>11.2</td>
</tr>
<tr>
<td>152-158 cms</td>
<td>12.2</td>
</tr>
<tr>
<td>158-164 cms</td>
<td>21.2</td>
</tr>
<tr>
<td>164-178 cms</td>
<td>37.3</td>
</tr>
</tbody>
</table>

Distribution of NCHS Weight-for-Height Standards by Height of Mother - Rural

<table>
<thead>
<tr>
<th>Height Range</th>
<th>1985</th>
</tr>
</thead>
<tbody>
<tr>
<td>138-152 cms</td>
<td>21.2</td>
</tr>
<tr>
<td>152-158 cms</td>
<td>17.3</td>
</tr>
<tr>
<td>158-164 cms</td>
<td>4.7</td>
</tr>
<tr>
<td>164-178 cms</td>
<td>33.2</td>
</tr>
</tbody>
</table>
Figure 19B

Distribution of NCHS Weight-for-Height Standards by Height of Mother - Urban

138-152 cms

152-158 cms

158-164 cms

164-178 cms

1986

Distribution of NCHS Weight-for-Height Standards by Height of Mother - Rural

138-152 cms

152-158 cms

158-164 cms

164-178 cms

1986
Figure 20A

Distribution of NCHS Height-for-Age Standards by Source of Drinking Water – Urban

1985

Distribution of NCHS Height-for-Age Standards by Source of Drinking Water – Rural

1985
Figure 20B

Distribution of NCHS Height-for-Age Standards by Source of Drinking Water - Urban

1986

Distribution of NCHS Height-for-Age Standards by Source of Drinking Water - Rural
Figure 21A

Distribution of NCHS Weight-for-Age Standards by Source of Drinking Water – Urban

1985

Distribution of NCHS Weight-for-Age Standards by Source of Drinking Water – Rural

1985
Figure 21B

Distribution of NCHS Weight-for-Age Standards by Source of Drinking Water - Urban

1986

Distribution of NCHS Weight-for-Age Standards by Source of Drinking Water - Rural

1986
Figure 22A

Distribution of NCHS Weight-for-Height Standards by Source of Drinking Water - Urban

1985

- Piped
- Well with no Pump
- Outside

Distribution of NCHS Weight-for-Height Standards by Source of Drinking Water - Rural

1985

- Piped
- Well with Pump
- Well with no Pump
- Outside
- Other
Figure 22B

Distribution of NCHS Weight-for-Height Standards by Source of Drinking Water - Urban

1986

Distribution of NCHS Weight-for-Height Standards by Source of Drinking Water - Rural

1986
CONCLUSIONS

The major finding from the CILSS in both years is the very low incidence (for Sub-Saharan Africa) of stunting (low height-for-age). The prevalence of low weight given height (wasting) is more in line with other African nations, but is substantially below the levels found in South Asia. Rural areas have a greater prevalence of both stunting and wasting than do urban areas, and the northern Savanna area has the highest incidence of low height and weight-for-height.

Several patterns appear in bivariate relationships between certain household and community factors and the incidence of low height or weight. Parental education and height, and relationship of the child to the household head seem especially important. Since these are bivariate relationships one must take care not to over interpret these results. A full multivariate analysis of the rural data from 1985 can be found in Strauss, 1988.
REFERENCES


APPENDIX: MEAN ANTHROPOMETRIC MEASUREMENTS
### Table 1: Mean Anthropometric Measurements by Sex and Age Group, 1985

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Sex</th>
<th>N</th>
<th>Height (cms)</th>
<th>Standardized Height-for-Age</th>
<th>Weight (kgs)</th>
<th>Standardized Weight-for-Age</th>
<th>Standardized Weight-for-Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>All</td>
<td>1667</td>
<td>102.0</td>
<td>98.8</td>
<td>16.7</td>
<td>95.9</td>
<td>97.5</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>823</td>
<td>101.7</td>
<td>98.5</td>
<td>16.7</td>
<td>95.0</td>
<td>97.3</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>844</td>
<td>102.4</td>
<td>99.1</td>
<td>16.7</td>
<td>96.0</td>
<td>97.6</td>
</tr>
<tr>
<td>0 - 11</td>
<td>All</td>
<td>170</td>
<td>64.4</td>
<td>100.7</td>
<td>6.7</td>
<td>100.6</td>
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<tr>
<td></td>
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<td>7.0</td>
<td>100.8</td>
<td>98.9</td>
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<tr>
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<td>Female</td>
<td>78</td>
<td>63.1</td>
<td>100.6</td>
<td>6.3</td>
<td>100.4</td>
<td>97.8</td>
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<tr>
<td>12 - 23</td>
<td>All</td>
<td>146</td>
<td>78.3</td>
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<td>9.8</td>
<td>91.3</td>
<td>94.1</td>
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<td>10.1</td>
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<td>92.7</td>
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<td>353</td>
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<td>93.2</td>
<td>97.5</td>
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<td>172</td>
<td>89.8</td>
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<td>12.8</td>
<td>92.0</td>
<td>97.1</td>
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<tr>
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<td>Female</td>
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<td>97.9</td>
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<td>48 - 71</td>
<td>All</td>
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<td>16.5</td>
<td>94.5</td>
<td>96.9</td>
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<tr>
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<td>170</td>
<td>105.7</td>
<td>98.2</td>
<td>16.9</td>
<td>93.9</td>
<td>96.8</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>172</td>
<td>103.8</td>
<td>98.4</td>
<td>16.1</td>
<td>95.0</td>
<td>97.1</td>
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<td>23.1</td>
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<td>23.1</td>
<td>96.5</td>
<td>97.9</td>
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<tr>
<td></td>
<td>Female</td>
<td>344</td>
<td>122.3</td>
<td>99.5</td>
<td>23.1</td>
<td>99.0</td>
<td>98.7</td>
</tr>
</tbody>
</table>

Note: The number in parenthesis is the standard deviation. Standards used are from NCHS (1976).
Table 1: (Continued)

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Sex</th>
<th>N</th>
<th>Height (cms)</th>
<th>Standardized Height-for-Age</th>
<th>Weight (kgs)</th>
<th>Standardized Weight-for-Age</th>
<th>Standardized Weight-for-Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>All</td>
<td>3892</td>
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<td>97.1</td>
<td>98.6</td>
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<tr>
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<td>Male</td>
<td>1994</td>
<td>103.0</td>
<td>(21.6)</td>
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<td>98.5</td>
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<td>Female</td>
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<td>101.7</td>
<td>(22.6)</td>
<td>16.8</td>
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<td>98.7</td>
</tr>
<tr>
<td>0 - 11</td>
<td>All</td>
<td>435</td>
<td>64.6</td>
<td>(8.1)</td>
<td>6.7</td>
<td>100.6</td>
<td>100.6</td>
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<tr>
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<td>Male</td>
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<td>(8.3)</td>
<td>6.8</td>
<td>100.0</td>
<td>97.2</td>
</tr>
<tr>
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<td>Female</td>
<td>215</td>
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<td>(7.8)</td>
<td>6.5</td>
<td>101.2</td>
<td>99.1</td>
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<tr>
<td>12 - 23</td>
<td>All</td>
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<td>77.7</td>
<td>(6.2)</td>
<td>9.7</td>
<td>90.6</td>
<td>95.1</td>
</tr>
<tr>
<td></td>
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<td>154</td>
<td>78.5</td>
<td>(6.4)</td>
<td>10.0</td>
<td>89.8</td>
<td>95.3</td>
</tr>
<tr>
<td></td>
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<td>179</td>
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<td>(7.8)</td>
<td>9.4</td>
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<td>768</td>
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<td>(8.3)</td>
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<td>16.7</td>
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<td>23.6</td>
<td>97.5</td>
<td>98.8</td>
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<td>(9.9)</td>
<td>23.5</td>
<td>99.9</td>
<td>98.5</td>
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Note: The number parenthesis is the standard deviation.
Table 2: Mean Anthropometric Measurements of Children Under 10 Years of Age by Region and Sex, 1985

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<th>Region</th>
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<th>N</th>
<th>Height (cms)</th>
<th>Standardized Height-for-Age</th>
<th>Weight (kgs)</th>
<th>Standardized Weight-for-Age</th>
<th>Standardized Weight-for-Height</th>
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<tbody>
<tr>
<td>Urban</td>
<td>All</td>
<td>679</td>
<td>102.8</td>
<td>99.2 (5.5)</td>
<td>16.9 (6.7)</td>
<td>97.0 (15.1)</td>
<td>97.7 (9.2)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>317</td>
<td>102.2</td>
<td>98.8 (5.7)</td>
<td>16.8 (6.6)</td>
<td>95.8 (14.3)</td>
<td>97.4 (8.2)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>362</td>
<td>103.2</td>
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<td>17.0 (6.9)</td>
<td>98.0 (15.1)</td>
<td>97.9 (10.0)</td>
</tr>
<tr>
<td>Abidjan</td>
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<td>103.1</td>
<td>99.7 (5.3)</td>
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<td>97.7 (15.4)</td>
<td>97.4 (9.4)</td>
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<td>151</td>
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<td>97.7 (10.4)</td>
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<td>98.1 (9.7)</td>
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<td></td>
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<td>95.8 (16.0)</td>
<td>97.3 (9.5)</td>
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<tr>
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<td>99.2 (7.1)</td>
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Note: The number in parenthesis is the standard deviation. Standards used are from NCHS (1976).
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<th>Height (cms)</th>
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<th>Weight (kgs)</th>
<th>Standardized Weight-for-Age</th>
<th>Standardized Weight-for-Height</th>
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<td>95.9</td>
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Note: The number in parenthesis is the standard deviation.
Table 3: Mean Anthropometric Measurements by Region and Mother's Education (Children Under 10 years of Age), 1985

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<tr>
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<td>None (N)</td>
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<td>Weight-for-Age</td>
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<td>95.3 (14.3)</td>
</tr>
<tr>
<td>Height-for-Age</td>
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<td>98.6 (5.3)</td>
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<tr>
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1986

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<td>Primary (N)</td>
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Note: The number in parenthesis is the standard deviation.
Table 4: Mean Anthropometric Measurements by Region and Fathers' Education (Children Under 10 Years of Age), 1985

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1986

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<td>97.3  96.7</td>
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Note: The number in parenthesis is the standard deviation.
Table 5: Mean Anthropometric Measurements by Region and Status in the Household (Children Under 10 Years of Age), 1985

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</tr>
<tr>
<td></td>
<td>Female Head  Female Head</td>
<td>Parents Parents</td>
</tr>
<tr>
<td></td>
<td>or Senior Wife of Male Head</td>
<td>or Senior Wife of Male Head</td>
</tr>
<tr>
<td></td>
<td>Wife of Male Head</td>
<td>Parents in Household</td>
</tr>
<tr>
<td>Weight-for-Age</td>
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<td>95.7 (16.3)</td>
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<td>95.9 (13.9)</td>
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1986

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<td>Female Head  Female Head</td>
<td>Parents Parents</td>
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<td>or Senior Wife of Male Head</td>
<td>or Senior Wife of Male Head</td>
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<td>Parents in Household</td>
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Note: The number in parenthesis is the standard deviation.
### Table 6: Mean Anthropometric Measurement by Region and Mother's Height (Children Under 10 Years of Age), 1985

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Note: The number in parenthesis is the standard deviation.
Table 7: Mean Anthropometric Measurements by Region and Father's Height (Children Under 10 Years of Age), 1985

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Note: The number in parenthesis is the standard deviation.
Table 8: Mean Anthropometric Measurements by Region and Mother's Body Mass Index (Children Under 10 Years of Age), 1985

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1986

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Note: The number in parenthesis is the standard deviation.
Table 9: Mean Anthropomorphic Measurements by Region and Source of Drinking Water (Children of 10 Years of Age), 1985

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1986

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