

ASSESSMENT OF CHILD NUTRITION IN THE GREATER HORN OF AFRICA¹: RECENT TRENDS AND FUTURE DEVELOPMENTS

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SUMMARY OF FINDINGS AND IMPLICATIONS

Trends in child nutrition and food security.

Long-term trends in malnutrition were explored in countries where repeated national surveys were carried out, i.e. Ethiopia, Eritrea, Kenya and Uganda. In all four countries, national trends in child underweight showed a slight improvement over the last ten years, at a rate of around 0.1-0.6 percentage points (ppts)/yr reduction in child underweight. The overall average, of about 0.4 ppts/year reduction, is slightly better than for Sub-Saharan Africa as a whole, estimated as almost static over this period³. Prevalences of child malnutrition are about twice as high in Eritrea and Ethiopia (around 40% underweight) as in Kenya and Uganda (around 20%), and this should direct attention and resources to Eritrea and Ethiopia (stunting is the major component). Progress was slowed by drought, which occurred through much of this time. The improving trend between 2000 and 2004 in Kenya and Ethiopia was associated with progressively milder drought up to 2003.

At sub-national level, trends in stunting, underweight and wasting varied significantly, with some areas, particularly those more arid (NE Kenya, N Uganda, lowland Ethiopia) showing notable deterioration. This was confirmed by data from the small-scale surveys, which identified the following areas as much worse off: Somali region in Ethiopia, North Eastern province in Kenya, Gedo in Somalia, Jonglei in Southern Sudan and North East region in Uganda. This was most likely primarily a result of drought, which was especially serious in 2000-2 and 2004-5.

The relative price of food (FPI/CPI, as an indicator of food insecurity) responded to drought and economic stress, falling (for Ethiopia, Kenya and Uganda) after 1999, then rising again in 2003-4. Trends in relative food prices tended to be consistent with changes in malnutrition at national level in Ethiopia, Uganda and Kenya. Indeed, improving access to food as reflected by the FPI/CPI ratio was usually accompanied by decreasing malnutrition (in Uganda and Ethiopia) and vice versa (in Kenya from 2002).

More effective intervention to mitigate drought effects on food security and nutrition is needed. In addition, more timely, disaggregated, and cause-related analyses are warranted from national surveys.

Growth patterns, choice and interpretation of indicators.

Growth patterns of children in different parts of the Horn of Africa vary considerably, much more than in Southern Africa for example. Overall, national averages in Uganda and Kenya show low levels of wasting but significant stunting, similar to Southern Africa; while Somalia has about twice as much wasting and about half as much stunting. Sudan and Eritrea show

³ Mason J, Rivers J, & Helwig, C. (2005). *Recent trends in malnutrition in developing regions: Vitamin A deficiency, anemia, iodine deficiency, and child underweight*. Food Nutr Bull, vol 26, number 1, March 2005.; 57-163; also as Special Issue. 1-110. See table 22.

relatively similar patterns of malnutrition with both high stunting and wasting, so does Ethiopia, but with an even higher wasting prevalence.

Comparison of wasting and stunting prevalences within countries revealed that areas with high levels of wasting - and relatively low stunting - are mainly populated by pastoralists while low-wasting, high-stunting areas tend to be predominantly agricultural. More consensus on nutritional indicators and their interpretation should be sought. First, there is a tendency to prefer wasting (wt/ht), both because it is easier to measure, not requiring age determination, and second because it is sometimes considered more relevant to acute problems. However, as seen in southern Africa, wasting is relatively rare except in arid areas, and underweight is more responsive both to causes, and to changes through time.

Of considerable importance in the Horn countries, it is not clear that wasting prevalences are comparable between different populations, in terms of indicating degree of need and its urgency. These analyses show how pastoralists are taller and thinner and these divergences start in the first year of life; but pastoralists are not necessarily chronically more deprived, because it is unlikely then that they would be taller than other groups. This does not badly affect interpretation of trends *within* population groups; but it does mean that (say) 10% wasting in central Uganda or Kenya (or Malawi) may be equivalent in terms of need to 20% wasting in NE Kenya or the Ethiopian lowlands. On the other hand, for example stunting is extremely high in highland Ethiopia (40-50%), and *this* could represent a more extensive need than high wasting prevalences. Better agreement on these interpretations needs to be brokered.

Results of small-scale surveys of vulnerable populations.

Nearly 500 small-scale surveys mainly from populations affected by drought and displacement were compiled and analysed, mainly using wasting as the outcome (GAM). An analysis of the reports and sample raw datasets showed that almost all of the surveys abided by international standards. Most of the sub-national surveys conducted in the region were judged likely to provide reliable estimates of wasting; however, the validity of age assessment, hence of underweight and stunting, and of mortality estimates is questionable.

Within countries, the analytical procedures adopted mitigated the problem of surveys being done in different regions and times, which otherwise reduces comparability and trend estimation. In particular the extent of seasonal effects was estimated, as adding about 2 - 4 ppts to the best season – this was usually but not always in the hungry season. Within countries, the analysis also pointed to significant differences in ‘global acute malnutrition’ (GAM: wasting plus oedema) prevalence between years (between 7 and 9 ppts between the worst and best year). The above-mentioned findings were consistent with national drought patterns for some years (i.e. years with peaks in GAM had more severe drought) but not all years⁴. Across countries (i.e. in a merged dataset), taking out the effects of seasonality and livelihood, the expected average increase in GAM prevalence due to drought was 3.6 ppts.

⁴ This can be partly explained by the fact that small-scale surveys tend to be conducted in the most vulnerable areas where drought and malnutrition patterns don't necessarily coincide with overall national patterns.

Furthermore, wasting among pastoralists was significantly greater by 5-15 ppts than among non-pastoralists, depending on the country. Displaced populations also had somewhat higher wasting prevalences, although the differences observed between IDPs/non-IDPs were smaller than between livelihood groups.

Trigger levels of wasting in pastoralist and non-pastoralist populations.

The smoothed trends suggest levels of wasting and changes in these that indicate unusual problems, and this may be useful for interpretation of future survey results. In Kenya, Somalia, and S Sudan – in the arid, pastoralist areas – prevalences of wasting in non-drought years may be around 12-17% (say, 15% on average), and this rises to 20-25% in drought. This suggests that 20% wasting in these populations is a ‘yellow light’ warning, and 25% a sign of serious crisis. In Ethiopia the highlands and lowlands need to be distinguished, but the trigger levels that suggest themselves are probably lower, at perhaps 15% warning, 20% crisis (but the population in the Somali region of Ethiopia is probably similar to the 20%-25% levels in the other countries).

The implications of comparing wasting levels between pastoralist and non-pastoralist groups was examined using Kenya DHS data, which recorded ethnicity. The same groups in different conditions, and different groups in similar conditions, could be compared. The tentative conclusions were, in sum, as follows. In pastoralists tallness seems inherent and not much changed by environment, whereas thinness is much reduced outside the traditional areas or lifestyle. But not all thinness is likely to be due to chronic deprivation, otherwise there should be more stunting. Interpretation of wasting among pastoralists should concentrate on *changes* in prevalences – first when rapid increases are seen, and second from a baseline that is higher for pastoralist (say 15%) than non-pastoralists (say 5%). Underweight would average out the tallness-thinness with shortness-less thinness, to give an indicator more comparable across groups; here again changes in prevalence would provide the more useful indicator.

Can arm circumference replace weight-for-height?

The possibility of arm circumference (AC) measurements and wt/ht being interchangeable was investigated from selected small-scale surveys containing both measurements. While AC cut-points of 12.5 or 13.0 cms (depending on the survey) can yield prevalences similar to wt/ht <-2SDs, the problems are that these prevalences are not sufficiently close, nor do the two indicators reliably select the same areas. Thus trends cannot be assessed from comparing arm circumference measures in one survey and wt/ht in another, even with matched cut-points. Nor can areas be comparably selected. Nor in fact (as a side issue here) are the same individual children normally selected from low AC or low wt/ht, either as moderate or severe cases – thus the screening methods are by no means equivalent. This stems from the limited association between the two indices – typically sensitivity plus specificity (as a conventional measure of association) are about 1.3-1.4, meaning the selection is only 30-40% better than random.

Nutritional status of orphans.

Orphans are an emerging vulnerable group in the region. Previous work had shown however that orphans were not worse off nutritionally, at least as could be judged from re-analysis of existing surveys. This was confirmed for the six countries in GHA. However, new questions are coming up. One concerns counter-intuitive results, such as that paternal orphans, or even non-orphans, living with neither parent, or father only (for non-orphans), seem to do better. Another is that households with multiple orphans (but not one only) do indeed show increased signs of food insecurity. A next step is to better identify these households, and find out what the story really is. Child-headed households are not captured in most surveys, and specific efforts to identify these and assess their situation are also important.

Estimating mortality in small-scale surveys.

Mortality estimates are included in many of the small-scale surveys, and results used to indicate populations affected by drought, displacement, etc. There are concerns that the sample sizes are too low to give useful mortality estimates, moreover the confidence bands are almost never given. In the meanwhile, uncertainty in South Sudan, where surveys had shown surprisingly low child mortality rates recently, was investigated by a field visit (by Catherine Ampagoomian). Findings from the visit are summarized in section 4 D and the full report is available in annex 11. The field visit did seem to confirm that the crises resulting from displacement and conflict, drought, and the associated ill-health, food insecurity, and malnutrition indeed were causing child deaths in excess of normal, probably to a greater extent than indicated by the survey results. Reasons probably included small survey sample sizes, questionnaire design, training, etc. In light of the above, in the short term, we recommend that agencies calculate and report on confidence intervals for mortality estimates. In the longer run, the question of whether to continue to include mortality questions in such surveys should be given further consideration; and the use of mortality as an indicator of food security (e.g. as in the Somalia phase classification system) may also require review.

Capacity for nutritional surveillance.

An assessment of capacities in the region for continuing investigations such as this, and how this capacity could be enhanced, was included in the study. Overall, there is a lack of both human resources and technical capacity to carry out nutrition surveillance and analysis in the region. Based on this conclusion, we suggest the following next steps: (i) addressing the issue of the overall lack of staffing, (ii) building the capacity of agencies' staff through in-country training and (iii) strengthening the capacity of local universities to deliver relevant coursework in the medium to long run (see sections 6 and 7).

Next steps.

Four activities are suggested for next steps (see section 7), as follows.

First a regional methodology workshop could make an important contribution in brokering agreement and resolving some long-standing issues in nutrition assessment and surveillance. This would need careful preparation, and should be linked with existing approaches, e.g.

‘SMART’ methods, FSAU/Somalia, etc. Issues such as indicator choice and interpretation, survey methods, analyses, and screening methods, would be included. The results should include manuals and training materials, and arrangements to build capacity for application.

Second, training should be developed, both at higher-levels to enhance key institutions in the region, and for in-country/on-site training. Collaboration between Tulane and University of Western Cape is proposed as one way ahead, building on proposals made in previous work in southern Africa (NIPSA).

Follow up research, to cover a number of issues identified at the October 2005 regional workshop in Nairobi that launched the current project and subsequently, is suggested. This would include using the data now assembled to study, for example, the impact of food aid, and linkages with HIV; and seeing how questions that could not be addressed for lack of data, such as the concern for destitute pastoralists, could now be tackled.

Mobilizing resources for these activities itself constitutes a key step. Proposals have been developed in the context of southern Africa (see “Food and Nutrition Security in southern Africa: Developing Information and Response Systems, Concept note and outline proposal.” J.B. Mason, S. Gillespie. 20 July 2004) and these are applicable to Eastern and Southern Africa overall. We need to discuss with UNICEF how to now move these ahead.

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SECTION 1: INTRODUCTION

The Greater Horn of Africa has been facing a number of challenges, including drought, conflict and displacement, which have raised growing concerns. As a result, in recent years, a large number of nutrition surveys were carried out, in the same time, humanitarian assistance was provided to the most affected areas.

In 2003-2004, a UNICEF study relatively similar to this one - focusing on child malnutrition, drought and HIV/AIDS – was carried out in Southern Africa (six countries), in collaboration with Tulane University.⁵ UNICEF subsequently decided to expand the study to the Greater Horn of Africa.

There has been extensive nutrition assessment work over the last few years in the Greater Horn of Africa, with more than 500 surveys (national and sub-national) carried out between 2000 and 2005. This provides a good opportunity for results synthesis.

As a first step to this initiative, a regional meeting was held in Nairobi in October 2005, with participants from UNICEF country offices, governments (Ministry of Health), partners and Tulane University. By the end of the meeting, participants had identified research questions of interest and drafted a report outline to provide guidance for the study. This report is the end product.

This report is divided into two main parts, A and B. Part A is divided into seven sections and provides a regional synthesis of findings from the analysis of national and sub-national surveys, and from specific studies. First, for context, we looked at data from national surveys to identify broad trends in child malnutrition and related causes (see section 2). Second, we analyzed results from some 500 small-scale nutrition surveys carried out in five countries. The purpose was to understand better what the survey results meant in terms of the extent of malnutrition, and to contribute to future survey design and interpretation, by assessing the effect of seasonality and other factors on nutritional status (see section 3). Some of the methods used for the analysis covered in section 2 and 3 were similar to those used in the NIPSA study carried out in Southern Africa; others were introduced for this purpose as described in section 2 and 3.A. Third, specific issues originating in the regional workshop and/or emerging from the analysis were looked at; these included, (i) comparing weight-for-height and arm circumference for the identification of malnourished groups and individual children (section 4. A.); (ii) exploring and interpreting variations in wasting and stunting patterns among pastoralists and non-pastoralists (section 4. B); investigating associations between child malnutrition and orphanhood (section 4. C); and (iv) investigating mortality levels in South Sudan (section 4. D). Fourth, methodologies applied for sub-national surveys in all six countries were reviewed and lessons from the specific studies (such as the comparison of arm circumference and weight-for-height) were drawn in order to contribute to the overall objective of this study, i.e. make recommendations for future survey design and interpretation (section 5). Fifth, future capacity building needs in nutrition surveillance and analysis in the region were assessed and recommendations were made to improve local capacity to carry out this type of work (section 6 & 7).

⁵ This project was named Nutrition Information Project for Southern Africa (NIPSA).

Part B provides details on the analysis of the 500 or so small-scale surveys by country and is comprised of individual country reports; it relates to the regional synthesis included in section 3 of part A.

SECTION 2: ANALYSIS OF LONG-TERM NATIONAL AND REGIONAL TRENDS AND SELECTED CAUSES

Maps of the region and of individual countries are given in the Annex section (Annexes 6 and 7), showing the geography, administrative boundaries, and other features. These will be used also to indicate areas surveyed, populations, etc. The maps showing drought from the water requirement satisfaction indices (wrsi) are in Annex 1, displayed as one year per page (these are also summarized in figure 2.3 as discussed later).

The datasets used for the analyses described in this section – national survey results – are summarized in table 2.1.

The seasonal pattern of harvests and food shortages is illustrated in table 2.2. Several indicators of drought are compiled as described later in this section, and these are summarized broadly, to provide initial guidance, in table 2.3.

In this section trends in child malnutrition indicators are established from existing data, at national and sub-national (e.g. province) levels. The main factors likely to be causing changes that are examined are drought and related food insecurity, and HIV/AIDS (for Uganda).

A. CHILD UNDERWEIGHT

Estimates of prevalences of children underweight are derived from national surveys, carried out by government offices, often in association with DHS, or UNICEF/MICS. Data were accessed from the datasets themselves when available, from the published reports, or via WHO (www.who.int/nutgrowth/database/en/). Age groups were matched as far as possible, and seasonality considered, as in previous studies (UNICEF, Nipsa1, 2004).

National trends could be assessed for Uganda, Kenya, Ethiopia, and Eritrea – see figure 2.1. Each of these showed some improvement over the last ten years, at a rate of around 0.1-0.6 ppts/yr, which is typical for sub-Saharan Africa. Seasons are not strictly comparable across all the surveys. An example is concern is for the 2000-2005 comparison in Ethiopia (see N. Oliphant's report); on balance it was concluded that improvement did occur over this period, even if seasonality may be complicating the interpretation.

B. RELATIVE FOOD PRICES

Prices and drought are likely to influence these broad national trends. The ratio of the food price index to the general consumer price index (FPI/CPI) is frequently predictive of changes in malnutrition. The FPI and CPI values were extracted from the ILO database (<http://laborsta.ilo.org>) for Uganda, Kenya and Ethiopia (they were not available for Eritrea), and results shown in figure 2.2.a and b. These trends (figure 2.2.a) are consistent with overall improving access to food in Uganda and Ethiopia, but with possibly increased food insecurity in Kenya from 2002 – this coincides with rapid general price inflation as shown in figure 2.2.b. In contrast, rapid inflation in Ethiopia in 1995-6 was controlled thereafter, which is likely to have contributed to improving nutrition.

C. DROUGHT

Throughout the period 1997-2005 drought was reported as the norm, except in Kenya mid-1998 to mid-1999, and in Uganda in late 2001. An accessible source of such reports is from the FAO Global Information and Early Warning System (GIEWS) (<http://www.fao.org/giews/english/fs/index.htm>), which categorizes countries as ‘normal’, ‘unfavourable prospects for current crops’, ‘food supply shortfall in current marketing year requiring exceptional assistance’, and both of these. These reports are issued three to six times per year. Extracting from the 41 reports from 1997 through 2005 allows an estimate (from the unfavourable crop prospects category) of timing of drought. These reported Kenya as clearly affected by drought in 1999, 2000, 2004 and 2005; Ethiopia in 1999 and 2000; Somalia in 2000 and 2001; Eritrea in 2000 and 2001; and Sudan in 2001-02 and 2004. Uganda was only occasionally reported as having unfavourable crop conditions in this period.

A second source of information on drought, available for 2000 through 2005, is from calculations from rainfall data of the ‘Water Requirement Satisfaction Index’, kindly provided through FEWS NET by the USGS⁶. The maps are reproduced on a single page in figure 2.3, and given enlarged (one per page) in Annex 1. These are also useful for assessing drought effects particularly by sub-national area. At national level, for Kenya these observations appear to roughly match the extracted FAO/GIEWS reports, of drought in 2000, 2004, and 2005, and suggest drought in 2001 also; the West of Kenya is much less affected, and the Coast and E/NE are the most. Ethiopia appears most drought-affected in 2000 and 2001, although only data for the highlands are available in the maps. Somalia appears less affected in 2000, but badly in 2001, 2004 and 2005. Eritrea is not included in these maps. South Sudan can be seen separately here from the national (GIEWS) reports, and appears somewhat drought-affected in 2001, 2002, and 2004. Uganda had some drought, from the WRSI, in 2002-04.

The estimates of crop production, again as provided by FAO, give a further estimate of drought effects. These were taken from FAOSTAT, available up to 2004, (<http://faostat.fao.org/faostat/collections?version=ext&hasbulk=0>) using the agricultural production indices for cereals; however, since these production estimates were standardized

⁶ <http://igskmncnwb015.cr.usgs.gov/adds/index.php>

with reference to the average of 1999-2001, which included drought years, the indices were recalibrated to non-drought (or anyway high production) years, as follows: Kenya, 1994, index 124.9; Ethiopia, 1996, index 106.8; Sudan, 1994, index 136.6. This was so that the indices shown approximated to production as a % of a non-drought year.

These results are plotted, together with the GIEWS and WRSI drought estimates, in figure 2.4. Crop (cereal) production was down in Kenya throughout the period, compared to 1994, most notably in 2000, 2002, and 2004. In Ethiopia, in 2000 production was low by almost 20% compared to 1996, and again in 2003. Uganda was relatively stable and less affected. Sudan – only national cereal production indices are available – showed large variations, with low production in 2000, 2002, and 2004.

Finally, shipments of food aid provide some guidance on the needs as perceived at the time, and these were taken also from FAOSTAT, expressed as kg cereals/caput/year (data available only through 2003) in figure 2.4. In Ethiopia and Kenya food aid shipments were increased in 2000, and in Ethiopia again in 2002-3 and Kenya in 2004, presumably responding to food shortages caused at least in part by drought.

These assessments of drought – summarized in table 2.3 are first considered in relation to national trends in child nutrition, then with sub-national trends. In section 2 results from smaller scale surveys and short-term trends in wasting are described.

D. PATTERNS OF CHILD MALNUTRITION

For interpretation across the region, the varying patterns of child malnutrition, particularly the differences in wasting and stunting, need initial consideration. For example, the prevalences of underweight children are about twice as high in Ethiopia and Eritrea as in Kenya and Uganda, and understanding these differences is important in interpreting both levels and trends. As discussed shortly, Sudan has higher underweight levels, similar to Ethiopia, whereas in Somalia they may be lower. (The observation that Somalis are more wasted – chronically – has been ascribed to persistent food insecurity and deprivation; however this would not account for why they are taller and less stunted.)

It is useful to separate the components of underweight into stunting and wasting. The growth pattern of children in different parts of the Horn of Africa varies considerably, much more than, for example, in Southern Africa. The determinants of growth start with genetic potential and growth *in utero*, which depends in part on the mother's previous growth and current health and nutrition. Birth weight and size are usually the largest determinant of subsequent growth. Low birth weight is relatively uncommon in Kenya and Uganda, at 11-12% corresponding with low prevalences of thinness (low BMI) in women (see table 2.4.). Low birth weight is more common in the other countries in the Horn; Somali rates are probably underestimated. These correspond to higher prevalences of thinness in women (BMI <18.5). In fact the pattern in Eritrea, and probably in Somalia, is more like Asia (India is also shown in the table) than further south in Africa. Maternal mortality ratios are also shown, as an indicator of maternal health and access to health care.

Breastfeeding practices, and early child nutrition and health, then determine growth, but against the background of programming at birth. Linear growth and soft tissue growth (muscle, fat, organs) will differentiate in part depending on *in utero* and birth characteristics, and subsequent health and nutrition – the relative variation relates to the pattern of inhibitors to growth (e.g. food, health, care). Many children grow up thin, so wasting is not exactly the right expression – ‘thinness’ is more appropriate – and it can be persistent (or ‘chronic’). It is expected that, with a short-duration infection or transient food shortage, soft tissue is first affected (fat and muscle will be used to supply nutrients), and linear growth slows soon after. Thus it is likely that increased thinness often precedes slower linear growth. However, it is a considerable oversimplification to equate thinness with acute malnutrition – since many children grow up thin, without experiencing acute food shortage; and repeated transient episodes of inadequate diet may slow linear growth, as do repeated infections.

The patterns of growth in the first five years of life differ substantially by population group and ecology; this is striking when comparing Somalia and Uganda, see figure 2.5, plotting data taken from recent surveys (MICS 2000 for Somalia; DHS 2001 for Uganda; via WHO). Somali babies have lower weight at birth (which may be thinness more than shortness). Ugandan babies are on average not thin at all by 6-12 months, building up muscle and fat, but falling rapidly behind the reference standards in terms of linear growth, so that by 12-24 months the stunting prevalence is 50%. In contrast, the average Somali child is thinner and taller, by 12-24 months, with half the stunting prevalence – compared to Uganda - and nearly 15% thinness (<2SDs wt/ht). These divergent patterns may be due to diet, care, intrauterine programming from maternal factors, or expressions of genetic potential (within the different ecologies). The issue here is that stunting and wasting are likely to have different causes between these populations, and thus different interpretations for programs. The likelihood is that the pastoralist populations have quite different child growth patterns which accounts for these observations. Pastoralists (see table 2.5.) are a majority of the population in Somalia and rural Sudan, and form significant minorities in Eritrea (33%) and Kenya (20%); the data do not give proportions for Uganda, however the North-East (e.g. Karamoja) has a substantial pastoralist population.

The national average patterns of stunting, wasting, and underweight for all six countries from recent surveys are given in figure 2.6. Uganda and Kenya have relatively low wasting but significant stunting, more than 30%; this is similar to patterns farther south in Africa, such as Malawi (shown in figure 2.6; see also UNICEF, 2004, 2005; Mason et al, 2005). Somalia in contrast has about half the stunting prevalence, around 15%, but twice the wasting. Ethiopia has very high stunting and wasting at nearly 10% on average. Sudan and Eritrea have high stunting and wasting. In fact, the pattern in Sudan and Eritrea, and to an extent in Ethiopia, has more parallels to that in Asian children (Indian results are given in figure 2.6 for comparison) than to e.g. Malawi. This raises crucial issues about the interpretation of wasting in different populations. [Note that, as discussed in a later section, environment plays an important role as illustrated by data showing that Somalis in urban Kenya have lower wasting prevalences, but are still taller.]

This diversity, illustrated between Uganda and Somalia in figure 2.5 and more broadly in figure 2.6, is also important *within* countries, here especially in Kenya, Uganda, and Ethiopia. The small-scale surveys analyzed as reported in section 2 are sub-national, mainly from the

high-wasting-prevalence areas. The contrasting patterns of stunting and wasting by area are seen within Kenya and Ethiopia, from disaggregating the national data (see figure 2.7). Here again it appears that the places with high wasting (and relatively low stunting) are the pastoralist areas; and in the low wasting high stunting areas (at least in Kenya and Ethiopia), livelihood is from settled farming.

In practical terms using underweight as the first indicator, pooling effects on linear growth and soft tissue, circumvents the issues concerning stunting vs. wasting, as a first approximation. However, in most of the data available from small-scale surveys age is so poorly measured that wasting is the only available indicator, and thus has to be interpreted. For the longer-term regional trends derived from national surveys, described next, underweight is used as the main indicator, using trends in stunting and wasting when these provide additional information.

E. REGIONAL TRENDS IN CHILD MALNUTRITION.

Kenya. Trends in child underweight, calculated by province from the 3 national surveys (DHS and MICS) for 1998-2003, are shown in figure 2.8. The improving trend in the west (W and Nyanza provinces) is consistent with a relative absence of drought in this part of the country (see WRSI maps, in figure 2.3 and Annex 1), despite the relatively high prevalences of HIV. Increases in underweight prevalence and wasting (see Annex 3) in the Northeast are likely to be due to drought in this semi-arid area (see WRSI maps); Eastern province may also have been affected, as may Rift Valley and Coast. The average disparities between provinces are as expected, with Nairobi and Central better off.

The increase in underweight in the North East was due to wasting, as seen in the regional trends, broken down into wasting, underweight, and stunting, in Annex 3. Here, the pattern is similar to that in other pastoralist populations, with high wasting and lower stunting; and it appears that the wasting increased as a result of drought that affected the North East throughout most of 2000-5 (see WRSI maps in Annex 1). (The relative patterns of stunting and wasting were illustrated earlier, in the discussion of figure 2.7).

Note that there are concerns regarding the comparability of the data between 2000 (MICS) and 2003 (DHS) for North Eastern Kenya as the increase in wasting (and underweight) prevalence between the two time periods is surprisingly large. One concern is that, for height measurements, while the DHS 2003 indicates whether children were measured lying or standing, the MICS does not specify. Another concern is the small sample size for North Eastern Kenya in the MICS 2000 (n=72), compared to a larger sample size in the DHS (n=285).

Ethiopia⁷. Estimates of trends by region in Ethiopia are based on national surveys carried out by the Central Statistical Authority (CSA; Welfare Monitoring Surveys, WMS) and two DHS surveys of 2000 and 2005 (for the latter only summary results are available). The

⁷ Map: <http://www.uneue.org/Maps/downloadables/ETH.GENERAL.pdf>

seasonal timing of these was only partly comparable. Results⁸ are shown in figure 2.9 for national patterns of underweight, stunting and wasting. These are taken from both the WMS and the DHS surveys, which generally agree on national trends. The main contrasts between the two survey types concerns the levels of stunting, probably due to measurement differences; rankings of regions by stunting are similar, and this difference is probably not too serious.

The national trends, overall, imply that in the period 1996-1998-2000 stunting decreased, wasting increased slightly, and underweight prevalences (as a result) were fairly static. The years 1998-2000 had lowered crop production, indicating effects of drought – the cereal crop production indices (using 99-01 = 100, FAOSTAT data) were: 1996, 106.8; 1997, 109.3; 1998, 81.9; 1999, 96.4; 2000, 92.4. Thus for example 1998 production was 27 ppts lower than 1997. The FPI/CPI ratio increased from 1997-9, indicating some food insecurity (see figures 2.2.a and 2.2.b). These indicators are at least in line with a static prevalence of malnutrition over 1996-2000.

Crop production recovered in 2001-4, the index being estimated as: 2001, 111.2; 2002, 104.4; 2003, 100.0; 2004, 107.5; and drought was less extensive during 2001-4. The FPI/CPI ratio broadly followed the degree of drought estimates, falling considerably in 2001-2, then climbing but not reaching the level of 2000. These indicators also match the trend in child malnutrition after 2000, which in sum was that stunting decreased, wasting fell slightly, and underweight decreased (as is common, in line with stunting).

The regional results need to take into account the patterns of malnutrition associated with pastoralism discussed earlier – here the populations in the east and northeast, Afar, Dire Dawa, and Somali, are substantially dependent on herding, with rainfall sparse and sporadic. These three regions have relatively high wasting (e.g. 10-16% cf 8% average by WMS 2005; 10-24% cf 11% average by DHS 2005), and somewhat lower-than-average stunting (e.g. 31-39% cf 49% average by WMS 2005; but 31-46% cf 40% by DHS 2005). Regional results are examined distinguishing lowlands – generally more pastoralist – and highlands.

Trends in wasting by region are shown in figures 2.10. The interpretation is made more complex because the WMS results do not coincide seasonally with those from the 2000 and 2005 DHS surveys (see table 2.1). Seasons are not comparable for 2000-5 either between WMS surveys, or DHS; but 2000 WMS was in June-July (moderate hungry season), and DHS 2005 April-August, which spanned the same period, and these two may be more comparable. This comparison is shown in figure 2.11. Looked at like this, in most regions the trends agree with those from WMS alone, except in Afar and Amhara. In Afar, it is unclear whether wasting increased, indicated by the WMS comparisons, or decreased, from the seasonally comparable WMS-DHS comparison. For Amhara, the opposite applies. But otherwise the different comparisons imply similar conclusions. Most striking is the apparent sharp increase in wasting in Somali, from about 12% to possibly more than 20%. This is similar to the increase in NE Kenya over 2000-2003, which is geographically contiguous with Somali region in Ethiopia. Tigray probably remains high in wasting prevalence, and Beshangul-Gumuzay have increased.

⁸ Data from Ethiopia was compiled by N Oliphant (2005), and the graphics are extracted from his report.

Stunting prevalences are strikingly high in Ethiopia – see figure 2.12 – but apparently improving substantially in the last five years; these results from the WMS are confirmed by the DHS surveys. The exceptions are in Amhara and Somali, where improvements seen in the WMS results were not confirmed by DHS – the results disagree in this case less probably due to seasonal non-comparability. But otherwise for stunting (as for wasting) the recent trends by region are similar from both survey types. Most of the regional stunting prevalences fall in 1996-1998, then rise in 1998-2000, following the pattern of food insecurity as indicated by the FPI/CPI ratio and crop production indices. The improvement in stunting 2000-5 is likely to have been in the earlier part of this period, judging by the drought and food price data.

Uganda. The small improvement in underweight prevalences at national level (see figure 2.1) showed some differentials by region, see figure 2.13. Malnutrition in the Northern region was estimated to have decreased substantially from 1988 to 2001, possibly with recovery of agricultural production after poor years in 1996-7 (cereal production index 72-75, compared to 100 in 1999-2001). With some drought in 2002-4 the prevalences may have increased again, but this can only be judged from the small-scale surveys discussed in section 2.

HIV/AIDS is likely to have affected nutrition – at least by analogy with findings in southern Africa – although this is hard to judge since data can only be matched at area level. Estimates of HIV prevalences from antenatal surveillance are shown in figure 2.14. These indicate a remarkable falling in prevalence from around 1990; they also show considerable differences between regions, with the North much the lowest, and Central and West regions reaching 30% at their peak in the early 1990's, with East intermediate. The changes however at this level of analysis show no obvious correlation with nutrition: reductions in HIV no doubt were beneficial to child welfare and nutrition, but this cannot be seen by comparing trends in the two.

Eritrea. Only two national estimates are available for Eritrea, from 1996 and 2002, as shown in Annex 5. Wasting is widespread, between 15 and 20% in three of the six provinces; but at relatively normal levels of 5% in Central, stressing that wasting is by no means inevitable. In terms of trends, stunting should be of concern – actually estimated to increase in three areas.

Somalia and S. Sudan. No representative data for assessing trends are available. In Somalia the situation has not allowed suitable survey work at large area level, although a number of local surveys have been carried out as described in section 2. In Sudan, the southern portion covered by this report was excluded from national surveys (e.g. DHS) due to the political situation. Again, local surveys may be used, see section 2.

F. SYNTHESIS ON WASTING TRENDS (2000-2005) FROM NATIONAL AND SUB-NATIONAL SURVEYS

This section brings together in summary form and at country level, the conclusions from national surveys as described above with results from sub-national surveys as given in the next section (section 3).

Ethiopia

Both analyses point to an improvement in wasting trends in Amhara region between 2000 and 2005. In Somali region, trends show different patterns. However, according to both sources, levels of wasting are very high (10-25%). Data from the small-scale surveys show higher levels of wasting compared to national survey data, which is expected since surveys tend to be conducted in areas of concern, that is, where malnutrition is more widespread. In Oromiya, both national and small-scale surveys show relatively low levels of wasting; nonetheless, while the analysis of national survey data points to relatively stable trends, small-scale surveys show an improvement. Note however that this only refers to one woreda (Gola Oda in East Haraghe) and is not representative of the whole region.

In conclusion, national and small-scale survey data point to somewhat different patterns in wasting trends, this can be mainly explained by the fact that small-scale survey data only covers, at best, a few areas in each region, usually the worst off, and is therefore not representative of the whole region. Note however that both sources point to much higher levels of wasting in the Somali region, compared to other provinces.

Kenya

Within provinces, national and sub-national data tend to show different patterns in wasting trends. In the North Eastern province, levels of wasting were high, compared to other regions, according to both sources (14-22% based on national surveys), although higher according to small-scale surveys. In Coast, Rift Valley and Eastern province, small-scale surveys reported much higher wasting prevalence than national surveys throughout. The above reflects the fact that sub-national surveys tend to be carried out in areas that are more vulnerable, and therefore have higher levels of wasting compared to other areas within the same region. Finally, note that areas that were selected in small-scale surveys in Rift Valley tended to have similar levels of wasting as areas surveyed in the North East.

Uganda

As noted above, data from small-scale surveys indicated much higher levels of GAM compared to national survey data, again reflecting that areas surveyed are usually worse off. However, both national and sub-national surveys pointed to higher levels of wasting in the North East, which corresponds to patterns observed in Southern Sudan, i.e. across the border.

SECTION 3: ANALYSIS OF SHORT-TERM SUB-NATIONAL TRENDS IN GLOBAL ACUTE MALNUTRITION IN RELATION TO SEASONALITY AND OTHER FACTORS

A. INTRODUCTION AND METHODS

The analysis of short-term sub-national trends in Global Acute Malnutrition was carried out in Ethiopia, Kenya, Somalia, Southern Sudan and Uganda. Although Eritrea was represented at the regional meeting, which preceded this exercise, the analysis could not be carried out due to lack of access to raw data and survey reports.

For each country, data are from small-scale surveys carried out where there was concern for acute malnutrition, either to gauge the need for external assistance or in areas that were already receiving assistance, including camps for IDPs. The surveys were conducted by government, NGO and/or, UN agencies between 2000 and 2005 and were compiled by area (province/region or district/county), year and season. These data were re-entered into SPSS to give a data file in which cases are defined as a survey (see list of datasets in Annex 8). Other variables recorded year, season, etc. The data consisted of Global Acute Malnutrition (GAM) prevalence (i.e. < -2 SDs weight-for-height and oedema) and indicators of possible causes. GAM was chosen as the first indicator since it was the single common indicator to all surveys across the region, also taking into account the difficulty to obtain accurate estimates of underweight and stunting given that age tends to be poorly measured in small scale surveys (see section 4). Indicators of possible causes included drought, floods, pest infestation, hailstorm (for Ethiopia only), IDP population, returnee population, displacement (i.e. IDP influx or out-migration), insecurity, disease outbreak (for Ethiopia only), and food aid (i.e. separate variables for General Food Distribution, Supplementary Feeding Program, Therapeutic Feeding Program and, for Kenya only, School Feeding).⁹ Variables for possible causes were all dummy variables (i.e. with 0/1 values corresponding to presence or absence of indicator during given year-season). The information for those variables was mainly derived from contextual information included in individual nutrition survey reports. We recognize that the list of possible causes is in no way exhaustive as there are many other factors that may influence nutritional status (e.g. morbidity, access to water, sanitation, health care, food prices etc.); however considering all those factors is beyond the scope of this study.

Each case corresponded to one cross-sectional survey and one prevalence for a given area and year-season. The numbers of cases (n) for each country are listed below:

- Ethiopia: 107
- Kenya: 64
- Somalia: 88
- Southern Sudan: 136
- Uganda: 51

⁹ Note that food aid indicators were not included for Southern Sudan and Somalia.

Although, for some countries, surveys conducted prior to 2000 were originally included in the country datasets, for the sake of consistency, the final analysis for each country only included data from 2000 onwards.

Prior to including data from every particular survey, a review of the methodology applied for the survey (i.e. information on sampling methodology and sample size, data collection techniques and analysis protocol contained in the survey report) was conducted. Only surveys that were estimated to provide relatively accurate and unbiased estimates were included for analysis.

The vast majority of small-scale surveys were conducted in high wasting prevalence areas, where, in most cases, there have been major humanitarian interventions. In some countries, such as Ethiopia and Kenya, data were collected in the same area, i.e. district or sub-district on a regular basis by the same organization; therefore providing a good picture of trends in those areas. In other countries, such as Somalia and Southern Sudan, the data are patchier – due to lack of capacity – as surveys tended to be conducted in response to specific concerns about a population group at a particular time. For this reason, the estimates presented in this section may not be typical of malnutrition levels for a given season and may instead be overestimated. This should be kept in mind especially when considering the effect of seasonality on malnutrition (see section D). In addition, contrary to national survey data, the small-scale survey data do not provide estimates that are representative at country or province level. Part B describes detailed findings from the analysis of small-scale surveys carried out within each country over the last five years; most of them were included in the analysis (provided adequate methodology; see part B, Annex 13 for list of sub-national surveys included in the analysis, by country).

For each country, the data were entered and analyzed by season, i.e. three seasons per year, namely, hunger gap, moderate and post-harvest. This terminology was applied across the region for the sake of consistency and convenience; however we recognize that those terms are not necessarily appropriate for all livelihoods (e.g. pastoralists). In most cases, seasons were defined at the area (i.e. sub-national) level and by livelihood, based on available information and consultation with country experts (see Annex 9 for seasonal calendar by country/area/livelihood).

The data were looked at by averaging the available data points, which introduces distortions when, for example, different seasons are included in different years. These distortions were reduced by fitting regression models to the data and using these to smooth the results. Therefore, at national level, adjusted trends were derived and represent the likely standard pattern of seasonal change in GAM prevalences, and an estimate of the actual levels of GAM prevalences. These are referred to as “smoothed” or “adjusted” GAM prevalence. At provincial/regional level, we analyzed crude (i.e. unadjusted) GAM means.

Multivariate analyses were conducted in order to identify which seasons and years were worse/better (with respect to GAM), controlling for other factors – such as IDP status and livelihood; and which indicators of possible causes were associated with acute malnutrition. Summary tables were extracted from the regression models.

Because individual cases in the country datasets represent prevalence at area level (i.e. each based on a sample size of approximately 900 children or more) as opposed to individuals, the level of significance is not expected to be as low as it would be if cases were individuals. We therefore estimate that a p-value between 0.1 and 0.15 is very likely to be significant.

B. OVERALL TRENDS

Average trends in prevalence of Global Acute Malnutrition were examined across the five countries in the Greater Horn of Africa. The findings from individual countries are summarized below and synthesized from individual country results described in Part B.

Overall, levels of malnutrition vary significantly from one country to another, with Southern Sudan experiencing very high levels throughout (i.e. adjusted yearly mean GAM prevalence was around 20% or more), and Ethiopia at the other end of the range (i.e. between 6% and 13%). Over the last five years, acute malnutrition trends in Southern Sudan remained fairly stable; other countries, however, experienced notable variations from year to year.

There is some, but not absolute consistency, between countries with regard to which year(s) showed higher or lower malnutrition rates in the areas surveyed. For instance, Ethiopia and Southern Sudan had their lowest level of GAM in 2004, while both Kenya and Somalia experienced peaks in acute malnutrition that same year (and 2003 for Kenya). Uganda also showed higher levels of GAM in 2003; so did Ethiopia with GAM peaks also in 2000. In Southern Sudan however, the highest levels of acute malnutrition were observed in 2002. Differences in mean crude GAM prevalence between peak and low years oscillated between 7 ppts (in Ethiopia) and 9 ppts (in Kenya). In all countries, the differences between peak and low years were significant or close to significant. In all countries except Sudan the differences in GAM prevalence between years were larger than the differences between seasons (see table 3.1 and table 3.2). Analysis across countries (in a merged dataset) confirmed that, controlling for livelihood and seasonality, levels of GAM in Kenya and Somalia were significantly elevated compared to Southern Sudan.

Small-scale survey data analyzed for Ethiopia covered the following areas: South Wollo zone in Amhara region, Fik, Jijiga and Shinille in Somali region, Wolyata in SNNPR and East Haraghe in Oromiya region (only Gola Oda woreda). In these areas, levels of acute malnutrition have been somewhat fluctuating. As shown in figure 3.1 for adjusted (“smoothed”) mean prevalence of GAM, there seemed to be an improvement in 2000-2001 followed by deterioration, with malnutrition reaching a peak in 2003 (11.7%).¹⁰ Although acute malnutrition rates seemed to have somewhat fallen the following year (2004), they may now be on the rise again (2005). If we take the GAM adjusted mean prevalence from 2000 and compare it with 2005 (same season), we observe a decrease of 0.7 ppts per year.

In Kenya, small-scale survey data for 2000-2005 were collected in the following areas: in Eastern province: Marsabit, Isiolo, Kitui, Moyale and Makueni districts; in North Eastern

¹⁰ Note that the peak is mainly explained by the significant surge in GAM in Somali region during the hunger gap of 2003 and by higher malnutrition in SNNPR.

province: Wajir, Mandera and Garissa districts; in Rift Valley province: Turkana, West Pokot, Likipia and Kajiado districts¹¹. Acute malnutrition rates in these areas tend to be much higher than in Ethiopia. Regarding trends, available data point to an improvement in the nutrition situation until 2002, i.e. down from 19.3% pooled mean GAM in 2000 to 13.7% in 2002; followed by a significant deterioration with peaks in GAM in 2003-2004 (overall above 20%) (See figure 3.2).

Small-scale survey data analyzed for Somalia covered a large number of areas yet did not often provide trend data for the same areas over time¹². Overall, levels of acute malnutrition oscillated between 10% and 20%, depending on areas, years and seasons; and were frequently higher in some areas (e.g. Gedo). As shown in figure 3.3, over the period 2000-2005, GAM trends in Somalia have been in both directions, down to 10% in 2002 and then increasing in 2003-04 (to 20%), then improving back to 20% in 2005. Comparison of GAM adjusted prevalence between 2000 and 2005 points to a decrease of 0.8 ppts/year (adjusted for seasonality).

In Southern Sudan, as shown in figure 3.4, between 2000 and 2005, trends in acute malnutrition remained fairly stable and hovered around 20-23% every year. During that period, data was collected in four out of six regions, i.e. Bhar El Ghazal, Eastern Equatoria, Jonglei and Upper Nile.

There was limited data available from small-scale surveys in Uganda. We focused on the Northern and North Eastern provinces and computed smoothed averages for the North only and for the period 2003-2005 (see figure 3.5). Levels of malnutrition in the Northern province were relatively low (10% or less) compared with the North Eastern province (around 20% overall). In the Northern province, trends in acute malnutrition remained fairly stable, and may reflect a slight improvement, i.e. from 11% in 2000 to just over 7% in 2004 and 2005. For the North Eastern province, data for 2003 and 2004 was examined and pointed to much higher levels of malnutrition, yet an improvement. Indeed, mean unadjusted GAM was 22% in 2003 compared with 18.6% in 2004; and the difference was significant ($p < .05$).

C. SUB-NATIONAL TRENDS

Mean GAM prevalences were computed by season-year at provincial/regional level based on small-scale survey data typically reported at district or lower level. Within countries, the data pointed to substantial differences in mean GAM prevalence between provinces. In fact, in each of the five countries under study, one province seemed to have significantly higher acute

¹¹ Note that data from Coast province (i.e. Kwale, Taita Taveta and Tana River) were also included in the dataset but excluded from the final analysis in order to reduce variation.

¹² Areas where nutrition data were collected between 2000 and 2005 – and analyzed for this exercise – included: Gedo (Burdhubo, Luuq, Belet Hawa districts and Bardera town), Bakool (Huddor, El Berde, Rabdure, Wajid and Tayeglow districts), Bay (Baidoa, Burhakaba, Dinsor, Berdale and Kansadhere), Lowe Juba (Jamame and Kismayo), Middle Juba (Bualle and Jilib), West Galbeed (Hargeisa, Salahley and Balley Gubadley), Galgadud (Elder, Dusamareb and Adaado), Toghdeer (Burao and Hawd of Toghdeer), Awdal (Lughaya and Zeila), Mudug (Galcayo, Galdogob, Jariban and Burtinle), Sahil, Sanaag/Sool (Sool plateau, Taleex, Huddun and Las Anod), Hiran (Belet Weyne, Jalalaqsi and Buloburti), Bari (Allula, Kandala, Bargal, Iban, Bossasso, Iskushuban, Quardho and Bari overall), Nugal (Burtinle, Garowe, Dangoroyo, Eyl, and Lower Nugal valley) and Mogadishu (IDPs).

malnutrition rates compared to other provinces. High prevalence areas included: the Somali region in Ethiopia, North Eastern provinces in Uganda and Kenya, Gedo in southern Somalia and Jonglei in Southern Sudan. In these areas, factors contributing to high levels of wasting possibly included conflict and displacement, drought and livelihood patterns (e.g. pastoralism in Ethiopia and Kenya's North Eastern province).

In Ethiopia, we observed relatively large differences between regions, and more specifically between the Somali region and others (see figure 3.6). Indeed, in Somali, we found very high GAM prevalence throughout, except in 2004 (with a GAM peak above 30% in 2003 during the hunger gap). Other regions for which data was available, i.e. Amhara, SNNPR and Oromiya, experienced much lower levels of acute malnutrition (i.e. slightly below or above 10% most of the time, and even below in SNNPR in 2001-2002). Within all regions except Amhara, GAM prevalence varied significantly from year to year; however, these variations must be taken with caution as the geographic areas sampled from one year to another within regions are not always comparable.

In Kenya, levels of acute malnutrition also varied significantly between provinces, and within provinces between years (see figure 3.7). Among the four provinces for which data were available (i.e. Coast¹³, Eastern, North Eastern and Rift Valley), Coast – predominant agro-pastoral – had the lowest levels of acute malnutrition (GAM averaged 7.6% for 2004-2005), and the North Eastern province – predominantly pastoral – was found to have the highest levels of GAM throughout (i.e. over 20% for all years combined); and was closely followed by Rift Valley in most years (19.2% mean GAM for all years combined). Looking at crude GAM mean for all years combined, we observed a difference of close to 14 ppts between high prevalence areas in North Eastern province and low prevalence areas in Coast in 2004-2005.

The analysis of Somalia data also revealed relatively large differences in prevalence of acute malnutrition between regions (see figure 3.8). Gedo in particular, with an unadjusted mean GAM of 22.5% for all years combined - and a GAM peak of 37.1% reported in 2001, had consistently higher malnutrition rates compared to other regions (i.e. 12 ppts higher than Mudug, which had the lowest mean GAM prevalence among all regions).¹⁴ Indeed, Gedo is known to be a particularly vulnerable area, with a long history of widespread insecurity and clan clashes, population movements, high proportion of IDPs, the effects of which have been exacerbated by recurring drought.¹⁵ Our results also show some variation in GAM prevalence between years within most regions (except Bari, Nugal, Hiran and Mudug); note however, that sample areas within regions are not always comparable from one year to another; therefore results must be interpreted with caution. Results from the MICS survey carried out in Somalia in 1999 were compared against the above-mentioned findings for 2000-2001. The MICS survey confirmed that acute malnutrition rates tended to be higher in southern Somalia (including Gedo, Bakool, and Bay), compared to the North; and that within the North, the eastern part showed higher levels of wasting compared to the West.

¹³ Note that only a few surveys/data points for 2004 and 2005 were available for Coast.

¹⁴ Note that Awdal region also displayed high GAM (26.8%); however, this figure only reflects the situation at one point in time in 2001 (i.e. the peak year in terms of malnutrition).

¹⁵ Food Security and Analysis Unit for Somalia, FAO, *Gedo: A Complex Emergency*, 2002.

In Southern Sudan, for all years combined, crude mean GAM prevalence ranged from 14% (in Eastern Equatoria) to 26% in Jonglei (in center east), which was by far the area with most widespread acute malnutrition, especially in 2002 – with a GAM peak of over 30% (the difference between mean GAM in Jonglei and other regions for all years combined was highly significant, $p < .001$). The above-mentioned findings coincide with results from the MICS survey conducted in 2000, according to which Jonglei had by far the highest prevalence of low MUAC ($< 125\text{mm}$) compared to other regions (i.e. 18.9% vs. 3% to 10% in other regions).¹⁶ The MICS also tended to coincide with small-scale survey results, except for Bar El Ghazal.¹⁷ In Southern Sudan, we did not observe as much variation in GAM prevalence within regions and between years, compared to other countries, except in Jonglei and, to a certain extent, in Upper Nile (see figure 3.9).

Finally, in Uganda, although we had limited data, we found that the North Eastern region had much higher levels of GAM (i.e. 19.5% for all years combined) compared with other regions (with mean GAM ranging from less than 5% in Western and Eastern to 9.5% in Northern, where mostly IDPs were surveyed).¹⁸ These discrepancies can be partly explained by the fact that the North Eastern region is a drought prone area and has been subject to widespread insecurity (inter-tribal feuds). In addition, large variations in levels of acute malnutrition were observed within regions and between years (see figure 3.10).

D. SEASONALITY

Seasonality seems to have some effect on GAM prevalence in most countries (except Uganda); indeed, we have observed between 2 and 4 ppts difference between the best and worst season (i.e. lowest GAM versus highest GAM prevalence). The effect of seasonality on GAM was significant in Ethiopia, Somalia and Southern Sudan. However, peak (worse) seasons differed from country to country; and even from area to area. For instance, Southern Sudan and Kenya showed higher GAM levels during the hunger gap (HG), as expected; while Ethiopia had peaks of malnutrition during the moderate season (M), and Somalia during post-harvest (PH) - or equivalent “season” for pastoralists. In these two countries (Ethiopia and Somalia), the peak seasons for acute malnutrition correspond to the onset of the rainy season, which tends to bring about infection; this could explain the above-mentioned patterns. Another possible explanation for Somalia is that poor rains caused the hunger season to extend in time to what is usually the post-harvest season in a normal year (see table 3.2 and figures 3.1 to 3.4).

E. LIVELIHOOD AND INTERNALLY DISPLACED PERSONS

Associations between wasting, livelihood, and IDP status were explored controlling for potential confounders (e.g. drought, floods, pest infestation, and insecurity). These

¹⁶ Note that the MICS only measured MUAC and no other nutrition indicator.

¹⁷ Bar El Ghazal had a relatively high average GAM prevalence according to small-scale survey data (19.5%) and relatively low prevalence of low MUAC according to the MICS (5.2%).

¹⁸ Note that one data point for North Eastern (i.e. year 2000, 12%) and data points for other regions are missing in figure 10 due to missing values for seasons.

associations were primarily looked at using regression as described earlier. The results can also be presented as adjusted means, as given in table 3.3. These results are essentially the same as produced from regression, but easier to interpret. They are calculated in SPSS using the general linear model (GLM), univariate, with prevalence as the dependent variable, livelihood and IDP status as fixed factors, and the potential confounders as covariates (the descriptive statistics option is used to determine n's.) Based on results from regression analyses, adjusted means between different groups were compared, while controlling for other factors. Table 3.3 displays adjusted GAM averages by livelihood group and IDP status.

Livelihood seemed to be significantly associated with nutritional status in most countries. Indeed, levels of acute malnutrition were substantially higher among pastoralists in Ethiopia (Somali region) and Uganda ($p < .05$), compared to all other groups. In Ethiopia, adjusted mean GAM among pastoralists was 7 and 4 ppts higher than among agriculturalists and agro-pastoralists, respectively. Note however that in Ethiopia, pastoralists were all found in the Somali region. This implies that high wasting among pastoralists could be related to other factors that are specific to that area. Therefore we cannot conclude with certainty that there is a direct association between pastoralists and wasting in Ethiopia. In Uganda however, wasting among pastoralists was at least 15 ppts higher than among other groups. Finally both in Ethiopia and Somalia, agriculturalists were better off than other livelihood groups (see table 3.3).

Testing across countries (on the merged dataset), agro-pastoralists and agriculturalists were 2 ppts and 5.6 ppts better off compared to pastoralists, respectively; note that the differences in GAM prevalences between livelihoods were highly significant.

A number of small-scale surveys were conducted in IDP camps in all countries except Kenya. Both in Southern Sudan and Ethiopia, IDPs were found to be worse off than non-IDPs. Indeed, adjusted mean GAM prevalence was 7 ppts higher among IDPs in both countries. Note however that again, in Ethiopia, IDPs are concentrated in the Somali region; therefore one cannot distinguish whether the association between IDP status and acute malnutrition is genuine or due to other factors.

F. EFFECTS OF DROUGHT ON WASTING PREVALENCES

An approximation to the occurrence of drought is shown in table 2.3, and figures 2.3 and 2.4. In analyzing the small scale surveys, drought estimates were taken from the reports themselves, as they applied to the areas covered. The average effects of drought by season and year, for each country, from the small-scale surveys, is shown in figures 3.1-3.5. By inspection, the size of the effect of drought on GAM prevalence, was as much as 10 ppts in Kenya, and nearer 5 ppts in the other countries. Note that this applies to the areas surveyed, which themselves were selected because of concern for food shortages. Across countries (in a merged dataset), and controlling for seasonality and livelihood (and displacement), the average effect of drought (by year) was estimated at 3.6 ppts.

This means that it is to be expected that drought will raise wasting prevalences by about 3.6 ppts; interventions that succeed may mitigate this, and conditions may be judged particularly

severe when the increase is higher. A related point is that the measurement in the hunger season is correlated with those in later seasons – once high the prevalence tends to stay high for several months.

Note also that, although relationships between wasting and other factors (e.g. insecurity, pest infestation, floods) were explored, no significant association was found with any of these.

Associations of wasting with food aid are discussed in Part B.

SECTION 4: SPECIFIC STUDIES

A. USING ARM CIRCUMFERENCE VERSUS WEIGHT-FOR-HEIGHT Z-SCORES TO IDENTIFY MALNOURISHED GROUPS AND INDIVIDUAL CHILDREN

Introduction

All the small-scale surveys available used weight-for-height z-scores (whz) as the main outcome measure. In part, this is because age is so inaccurate that weight-for-age (wt/age) cannot be usefully calculated. In part wasting is operationally considered the key measure anyway by many of the agencies involved, although the rationale for this needs more clarity (see later). Other surveys used arm circumference (AC) as the sole basis for estimating malnutrition among population groups, assuming this is a likely alternative measure of wasting, but these were not included in this study. Arm circumference is also widely used for purposes of screening individuals to determine entry into programmes (e.g. in Ethiopia), potentially providing a source of data for population assessment and surveillance. Thus the issue arises of how data from arm circumference compares with whz. An example would be: if some areas have estimates from whz and others from arm circumference, can their relative levels of malnutrition be estimated? In other words how does a prevalence from one index compare with that from the other? A similar issue arises concerning whether trends in malnutrition can be deduced if the indicator at one time is based on whz and at another on arm circumference. If so, the utility of a set of surveys would be broadened by combining the two approaches; if not, there is a strong case for standardizing on one or other.

Another issue, very relevant to screening procedures, is: will the same children be selected by either low arm circumference or low whz (albeit the cut-points for each may need adjusting)?

Some of the datasets available to us included measures of both arm circumference and whz, allowing the relation to be studied. The general issue is how well correlated are these two measures and how far can they substitute for each other? For the present purposes this applies mainly to prevalence estimates, but it is also of interest to know whether the same individuals would be selected by either measure. The opportunity was therefore taken to investigate this. The specific research questions are:

1. Can prevalences of low AC be compared with prevalences of low whz, so that estimates of malnutrition at area (or group, e.g. camp) level can be combined to assess:
 - a. priorities at-one-time from either one or the other indicator, and
 - b. trends assessed if whz is used at one time and AC at another? What cut-points for AC give best estimates for -2SDs weight-for-height (whz)?

2. How well do prevalences of low AC identify areas with low whz (using <-2SDs to define wasting)? And, while we are at it, how well does AC identify low whz individuals?

Datasets

Datasets from seven small-scale surveys plus one larger survey were selected as containing measurements weight, height, age, and mid-upper arm circumference (AC), and including some with high wasting prevalences, as listed in table 4.1. These were cleaned to remove outliers and code missing values. The aggregation to cluster or county levels used to assess misclassification was done using SPPS aggregate routine to generate new datasets at this level. These were then merged to give a new dataset including the seven surveys, as shown in table 4.1, last row.

Cut-points for arm circumference to approximate wasting from whz

The Sool (Somalia) dataset was used for preliminary analyses to set up procedures, leading to methods applied to the other datasets (see table 4.1).

Age selection. It was found that the relation between whz (using regression, with whz as dependent variable) and AC deviates most from a linear fit at <12 mo, controlling for gender. The mean residual (of whz) was 0.65 for <12 months, then 0.2 to -0.1 for 12-48 months, then -0.4 at 48-59 months. Thus we can improve the fit between whz and AC by removing <12 mo children; in practice we might need to use height (about 65-70 cm seems to equal 12 mo in these data). Children 12-60 months are included in these analyses.

Heaping of AC measurements. In Sool (and later seen in Akobo) a problem is that there is a large heap (excess number, due to rounding of observations) of exactly 13.0 cm AC measurements (n=63, or 7%), so it makes a lot of difference if < 13.0 or <=13.0 is chosen as the cut-point (7 ppts, in fact). Eventually it was decided for simplicity to use < 13.0 cm, < 12.5 cm, and < 12.0 cm as the cut-points to test (note <= was not used except when initially investigating in Sool). However in future applications the tendency to record a greater number as exactly 13.0 cm needs to be dealt with.

Equivalent cut-points for group prevalences. Prevalences for different cut points of AC were compared with prevalences for <-2SDs whz initially at individual level in the Sool dataset (n=900). Results are shown in table 4.3: % wasting by whz = 12.8% (104/813); % low AC (< 13.0 cm) = 9.3% (76/813). (Because of the measurement heaping, the prevalences by AC

≤ 13.0 cm were considerably higher, i.e. 16.0%. Note that if the exact 13.0s were split equally above/below 13.0, the AC prevalences would average at 12.7%, almost exactly like wasting by whz.¹⁹⁾

These results, for Sool and then applying the method to the other datasets, are shown in table 4.2. For Sool, this shows that the prevalence of wasting in children of 12-59 months was 12.8% by whz < -2 SDs, and 9.3% by AC < 13 cm. For the other datasets, the AC cut-points giving prevalences spanning the wasting prevalence are shown, the closest being highlighted in the table, and these best cut-points were used for assessing sensitivity and specificity (see below). Thus, for example, in Moroto the AC cut-point nearest to the whz-derived wasting prevalence was 12.5 cm, giving wasting of 21.8% compared with low AC of 18.3%.

The wasting prevalences in the seven datasets averaged from 6.5% (Kajo) to 21.8% (Moroto) (excluding Gulu). Usually the prevalence < 13.0 cm AC was the better estimate of the low whz (wasting) prevalence; but in Moroto and Nakapi < 12.5 cm AC was better. This means that the children in Moroto and Nakapi had slightly thinner arms at a given whz – maybe this is an ethnic or environmental difference, and it would be useful to know if this is in line with what is known comparing these children in Uganda with others in Southern Sudan and Somalia. (This could be important, since if there was a way to distinguish populations or areas where 12.5 or 13.0 cm gave the better predictor this might help methodology in the future.)

Overall, if a single value has to be decided, in these populations a cut-point of < 13.0 cm AC provides the nearest prevalence estimate to those calculated as prevalences < -2 SDs whz – but the correspondence is not all that close. When the correlation is only moderate, trying to identify areas below a cut point based on an indicator from values of a second indicator leads to classification errors, which were investigated next.

Testing AC-for-height. AC increases somewhat with age or height (less than weight does). Whz tends to fall with age. Thus differences in classification between the two might be affected by age, or height which was available here. Ac-for-height references have been put forward by WHO²⁰, with computing algorithms. These were used to compute the z-score for height of each AC measurement, as follows.

The equations given in the Annex to the WHO (1997) paper allow calculation of the expected AC for height and gender, and second the SD of the expected ACs. The standard deviation score (z-score) is then calculated as [(actual AC – expected AC (for the height and gender))/SD] = ACHZ. (Look-up tables are also given, and on a random check gave the same results.) This AC/ht z-score value was used in the analyses as an alternative to AC itself, but, as will be shown, did not improve the whz-AC association to any useful extent.

¹⁹ We could also smooth this by calculating the expected number < 13.0 cm from the mean (14.56) and SD (1.358).

²⁰ Mei Z, Grummer-Strawn LM, de Onis M, Yip R. Bull World Health Organ. 1997; 75(4):333-41. The development of a MUAC-for-height reference, including a comparison to other nutritional status screening indicators.

Classification errors between low AC and wasting at individual level. These errors are conventionally and usefully quantified from the extent of true and false positives and negatives, expressed as the sensitivity and specificity. The definition of these is illustrated using figure 4.1 as discussed later. The sum of sensitivity (Se) and specificity (Sp) is a summary statistic that defines the extent of misclassification – this varies between 1.0 and 2.0, and the value $((Se + Sp) - 1) * 100$ gives the % by which the classification is better than random.

In the Sool dataset, the sensitivity plus specificity (at individual level) for < 13.0 cm equals 1.31 (table 4.3). These results for Sool are shown in the first row of table 4.2, seventh column. This means that for selecting children, using $AC < 13.0$ cm is 31% better than random assignment. This rather low classifying power of AC into wasted/not wasted categories (which reflects the limited correlation between the two measures) carries through to population level – as discussed next – and also means that manipulating cut-points is unlikely to greatly reduce misclassification errors.

The (Se + Sp) statistic is shown for the other datasets, using the cut-point at which the prevalences by low AC most closely approach wasting ($< -2SDs$ whz), unless otherwise noted. Overall, in these datasets low AC selects wasted children about 30-40% better than random – less than generally perceived.

Using the AC/ht z-score, the Se+Sp statistics were similar to AC itself, for individual classification, as shown in the last column of table 4.2. The difference did not suggest that it would be worthy standardizing for height for selecting children using AC.

Classification errors between low AC and wasting at population level, defined by area. To see how well AC defines areas with high and low wasting we need to generate a number of area-level cases. By cluster in these datasets is the obvious way. So the files were aggregated at cluster level, to give $n=30$ for each file, with prevalence $< -2SDs$ whz treated as the correct measurement (gold standard), and prevalences < 13.0 cms AC, computed.

The level of $\geq 10\%$ prevalence of wasting (by whz) was initially taken as the definition of what we were trying to predict. The AC-based prevalences were also cut at $\geq 10\%$ (here there is nothing special about 10%, as it is a derived variable, so there is no reason for heaping, and $>$ and \geq should not make any difference). So the question was: how well does a classification by area using 10% low AC (< 13.0 cm here) select areas that have 10% or more wasting by whz?

Illustrating this with the Sool data again, the sensitivity plus specificity of defining areas with $\geq 10\%$ wasting by $< -2SDs$ whz, using the AC indicator of < 13.0 cm, at $\geq 10\%$ prevalence, was 1.48 (table 4.4). In this case 16 of the 30 clusters really had $\geq 10\%$ wasting (by whz); 10 of the 16 would have been correctly identified using $AC < 13.0$ cm. However, 6 would not have been identified; and 2 clusters would have been incorrectly classified as high wasting using the low AC criterion. (The cut-point of ≤ 13.0 cm AC was also tested, and performed worse than < 13.0 cm in data where the heaping at exactly 13.0 cm was a problem.)

For the other datasets, these procedures were used to calculate the sensitivity and specificity at the AC cut-point that gave the nearest estimate to the prevalence from whz, to predict wasting

prevalences near to those observed (given in brackets). The results are shown in table 4.2, second last column. The discrimination was significant at area level as determined by chi-squared (Se+Sp of 1.35 or higher had $p < 0.05$). As mentioned earlier, this is also interpreted as, for example, Se+Sp = 1.35 providing 35% better discrimination than random.

Here again, at cluster level, standardizing AC by height produced no improvement (column 8 of table 4.2).

AC correctly predicted wasting least in the datasets with low wasting prevalences– which is to be expected, and where this application is less needed. Thus further analysis omitted dataset 3, from Kajo, where wasting was only 6.5% (by whz). The Gulu dataset was also not used, being a different type of survey as well as having low wasting prevalence.

For monitoring it will be easier to standardize on one cut-point – unless there are clear reasons to predict when they should vary. Examining the third and fourth columns of table 4.2 shows the comparisons; while the prevalence of < 13.0 cm AC is usually the closest, it tends to be somewhat higher than < -2 SDs whz, by up to 5 pts (e.g. Moroto). This is large enough a difference that the AC-derived prevalence is not an adequate replacement for wasting (from whz), for mixing the two estimates for assessing differentials (e.g. for targeting), or for analyzing trends. Seasonal changes themselves may be 5 pts. Therefore, without additional information, it appears that prevalences of low AC are not sufficiently close to wasting (by < -2 SDs whz) that they can substitute for it. In terms of classification of areas, there will be substantial misclassification errors. And for estimating trends the errors are too high to draw conclusions by comparing a prevalence from low AC with one from whz.

Do classification errors differ by area? Classification errors were looked at in more detail using the merged aggregate dataset. The scatterplot of wasting versus low AC by area is shown in figure 4.1. Testing by regression, none of the lines by dataset are significantly displaced vertically from each other (excluding Kajo, #3), using dummies for each dataset with Moroto (having the highest prevalence) as the comparison group. As for slopes, the two most different (Sool and Akobo, 1 and 7) are significantly different at $P = 0.06$, from testing the interaction

This means that although classification errors are quite extensive, they do not differ significantly by dataset, so at least the same rules can be applied to different areas. The different slopes are probably not all that important in the middle of the range. Therefore the picture of classification for the six areas is likely to be similar in all areas. Table 4.5 shows the cross-classification for 15% prevalence by either -2 SDs whz, or < 13.0 cm AC. (The level of 15% was used here as that likely to be important in detecting crises.) In the combined datasets there are 160 areas (the few with reported AC-derived prevalences $> 40\%$ have been excluded as outliers). Of these, 80 have prevalences of $\geq 15\%$ by whz, and 79 by low AC. Of course, these are not all the *same* areas, which is the problem. Of the 80 with high wasting by whz, 57 are correctly identified by high prevalence of low AC (71.3%, i.e. Se). There are

22 false positives, and 23 false negatives. Of the 79 predicted by AC to have high wasting, 57 are correctly identified (PPV²¹, = 72%).

These relations can be adjusted by varying the prevalence cut-points – for example using >10% prevalence of low AC (<13.0 cm) to predict >15% prevalence of low whz, or by varying the definition of low AC (e.g. to 12.5 cm). However, the effectiveness is determined by the strength of the relation between whz- and AC-derived prevalences, as illustrated in figure 4.1. Thus adjustments to the procedures may be useful depending on needs for targeting, for example; but not a great amount of improvement will be obtained by varying the cut-points.

Conclusions. The conclusions on the questions specified are as follows.

Prevalences from weight-for-height (whz, wasting) are broadly comparable with prevalences from low AC, with 13.0 cm cut-point as the best approximation to -2SDs whz. However the differences even at aggregate level (e.g. by area surveyed, or dataset) are up to 5 ppts (in this sample of datasets), which is too high to allow comparison of the two indicators for trend analysis, and not too good for differentials (e.g. for targeting). (Nonetheless, the similarities are enough, for example, that a prevalence of 5% low AC is unlikely when wasting is really 15%, and vice versa.) At more disaggregated levels – cluster is reported here, but other sub-areas like county give similar results – the classification of wasting by low AC is significantly correct, but the extent of misclassification again would limit the substitution of one indicator for another.

For screening individuals, while whz and AC are certainly correlated significantly, there is considerable misclassification. (But, it needs to be considered whether we really know that whz better defines risk and response to intervention than AC, see below).

These analyses show that whz and AC while related do not fully substitute for each other. For the current purposes AC-derived prevalences (using 13.0 cm and children 12-60 months) can be used as a broad check on wasting (from whz), but the relation is not tight enough to derive a predicted wasting prevalence, for integration with other <-2SDs whz prevalences, when only AC-derived prevalences are available.

What are we actually trying to measure? Further consideration of interpretation is needed: what is being actually assessed? This needs to be carefully specified, because the answer is not as simple as ‘wasting’. The inferences may also be somewhat different for population groups and individuals.

For population groups (e.g. areas) the usual applications are to assess priorities for intervention (from at-one-time rankings, or better from trends). These interventions may be aimed at reducing mortality risk in children; or mitigating food insecurity for the community; or have other related objectives (and the same indicators may not be suitable for all these). Taking reduction of child mortality risk, through area-level food and nutrition programmes, as

²¹ Positive predictive value (PPV) is the proportion of the areas predicted to be of high prevalence (in this case by arm circumference) that actually are high prevalence (here by wasting from whz).

a specific example: the selection of area depends on several factors, particularly which areas have the greatest mortality risk, and which will respond to intervention (and the type of intervention can also be adjusted) to reduce the mortality. This implies that the indicator – wasting in this case – adequately predicts both risk and likely response. This pushes against the state of current knowledge: we are unclear how good wasting is, and with what severity, as a predictor of mortality under these conditions; and even less clear how good it is in predicting response. Moreover as we have seen, whz and AC will select substantially different population groups; but there is little to guide us in knowing whether AC or wasting, in these conditions, better predicts mortality risk and response. This is an area for research and clarifying priorities.

Analogous arguments apply to screening: a substantially different group of children will be screened into programmes by low whz or AC – the issues concern which selects those with highest risk and most potential for response. Moreover at both population and individual levels wasting (whz-derived) is not necessarily the gold standard; AC might itself be as good.

What is the best AC cut-point for screening children who are severely wasted (<-3SDs whz)? As a final step, although not a main objective of this research, the data were convenient to briefly study this issue of screening for severe wasting for selection for possible treatment. Two datasets were looked at, Jilibi and Moroto, chosen as both having high wasting prevalences (<-2SDs). Results are shown in tables 4.6. It can be seen that selection of children of < -3SDs whz – undoubtedly significantly wasted and likely to be at increased mortality risk – hardly overlaps at all with selection by AC, at either 11.0 or 12.0 cm! In the case of Jilibi, of the 24 children < -3SDs whz, only 3 are selected by AC <11.0 cm, and only 5 by AC < 12.0 cm. In Moroto this is somewhat better, but not a lot. The (Se+Sp) values are correspondingly low. Moreover in all cases the number of false positives is more than true positives.

The problem is not so much with the cut-point but that with this degree of wasting there is not much selection power for AC at all. The correlation is low for individuals, and the scatterplot looks quite like that at area level in figure 4.1. AC is not very good for picking up moderate wasting (<-2SDs) at 13.0 cm (or other values, not shown), as already seen in table 4.3 above, and if anything worse for severe wasting

Conclusion: AC will identify substantially different children than whz, for either severe or moderate wasting.

B. WHAT DO VARIATIONS IN WASTING AND STUNTING PATTERNS AMONG PASTORALISTS COMPARED TO NON-PASTORALISTS MEAN?

This question needs to be addressed for the practical reason that it is conventionally assumed that a higher prevalence of wasting means greater need (or deprivation), whatever group is being assessed. Thus resource allocation decisions tend to be made based on direct comparisons. For example, at one point in time wasting in Somalia may be at 15%, and in Uganda (or Malawi) at 10%. The direct comparison suggest higher priority to Somalia; but commonsense indicates that as wasting is *usually* around 15% in Somalia, and 5% in

Uganda/Malawi, maybe the direct comparison is too simple. The argument is sometimes made that a high percentage of Somali children are wasted due to chronic deprivation – but if this were so, why would they be taller, which they are? Chronic deprivation leads to stunting.

While the conventional wisdom is that all children under five grow much the same, and this is well-established, a more detailed specification is that all children of adequate birth weight with healthy mothers in a relatively clean environment grow much the same. This does not say anything about whether different groups have varying degrees of reduced growth in response to dietary inadequacy and growth inhibitors (mainly infection). We saw earlier (figure 2.5) the rapidly diverging growth patterns of Ugandan and Somali children with age.

There are straightforward biological reasons why children from different ethnic groups might grow differently. *In utero* development may differ, because of maternal size and nutrition (current and prior, including the mother's own birth size); maternal size could be both genetically and environmentally determined (no-one argues that *adult* size is necessarily the same across all ethnic groups). For post-natal development, diet and child rearing can be very different across environments and groups. In particular, the traditional pastoralist lifestyle involves high intakes of animal products (especially milk, but also meat and sometimes blood)²², which might well be expected to favor linear growth. The custom of giving butterfat in infancy, thought to be related to low fat content of nomadic mothers' milk, probably favours early weight gain in infancy.²³

The issue appears to mainly apply here to comparing pastoralists with others. While pastoral life-style and ethnic group do overlap substantially, nonetheless in the Kenya data DHS 2003 - which records ethnicity - we can identify pastoralists in agricultural or urban livelihood conditions; and non-pastoralist groups in the same areas as pastoralists – even if they have different lifestyles, they are still subject to many of the same deprivations, such as drought. The first of these can be seen with Somali ethnic groups in North Eastern Province and elsewhere; and the second from pastoralists and others in Rift Valley Province (RVP).

Pastoralists generally are less stunted and more wasted – taller and thinner – than other groups, as children and adults. Selected results are in table 4.7. In North East Province, Somalis are the only ethnic group in the sample, with 23% stunting and 25% wasting. In Rift Valley Province (RVP), Turkanas are similar (20% stunting, 23% wasting), but Masais are relatively less wasted and more stunted (30% stunting, 15% wasting), although still distinct from the other groups in RVP, which have 32% stunting and only 6% wasting. The latter figure ('other') is an average of other ethnic groups (mainly Kalenjin, Kikuyu, and Luhya). (For comparison, typical patterns of stunting-wasting in e.g. Ethiopia, Kenya, Uganda – see figure 2.6 – are 30-45% stunting and 3-10% wasting.)

In Coast, the group (n=48) defined as Somali is stunted (38%) but not wasted (6%). In Nairobi, the group of Somalis (n=44) has low stunting (11%) and somewhat high wasting

²² Nathan, Martha A., Fratkin, Elliot M., Roth, Eric A. (1996). Sedentism and Child Health Among Rendille Pastoralists of Northern Kenya. *Social Science Medicine* Vol. 43, No. 4, pp. 503-515.

²³ Gray, Sandra (1998). Butterfat Feeding in Early Infancy in African Populations: New Hypotheses. *American Journal of Human Biology* 10: 163-178.

(11%). The other groups whose lifestyle is traditionally pastoralist (Turkana and Masai) are only found in the sample in their usual areas (RVP).

An issue then is whether the low stunting high wasting (or tall-thinness) is a sign of serious malnutrition, and how it is related to lifestyle and/or ethnicity; specifically whether the wasting is to be interpreted the same as for other groups. A first way to investigate is to see if there are differences related to socio-economic status (SES) or environmental factors. For the pastoralist groups not many SES variables vary, but roofing material does show some differences. These are given in table 4.7, and graphed in figure 4.3. This shows a strong relation between wasting and roofing – presumably reflecting differences in lifestyle and SES – such that pastoralists who change to a less traditional lifestyle are substantially less thin. They do not become less tall, however – the slope on stunting is insignificant. Growth patterns for nomadic pastoralists, and the effects of settlement, have been quite widely studied, and the conclusions are usually that sedentism is associated with poorer nutritional status (more stunting, with effects on wasting less clear)²⁴.

For the traditional pastoralists – see figure 4.2 – the pattern of tall-thinness (low stunting – high wasting) is very clearly different from other groups in a similar environment – e.g. in RVP for all the other ethnicities. (The Masai are surprising, in not being very thin even in traditional housing.) Thus in RVP wasting of 6% in non-pastoralist groups co-exists with wasting of 23% in the Turkana people; this becomes, for those with traditional (grass roof) housing, 9% compared with 29%. It is difficult to believe that the about 25% wasting in the pastoralists is all a sign of severe malnutrition, due for example to drought. First, the pastoralist children are significantly taller; second the other groups have much lower wasting prevalences, but would be expected to be affected also by drought.

The likely interpretation is that an *increase* in wasting prevalence among the pastoralist children would indeed be a sign of drought, and could co-exist with little stunting, at least for a season. What is the baseline from which we should measure? Results elsewhere in this report have indicated that around 15% wasting has been common for the last few years (and this has not been associated with high levels of stunting, so should not mean chronic deprivation). A rule-of-thumb then would be to use the increase in wasting over ‘normal’ as the indicator of nutritional deterioration. If this were taken as 5% in non-pastoralists, and 15% in pastoralists, we would probably get comparable figures.

²⁴ Fratkin, Elliot, Roth, Eric A. and Nathan, Martha A. (2004) Pastoral Sedentarization and Its Effects on Children’s Diet, Health, and Growth Among Rendille of Northern Kenya. *Human Ecology*, Vol. 32, No. 5, October 2004 (Pgs 531-559).

Fujita, Masako, Roth, Eric A., Nathan, Martha A. and Fratkin, Elliot (2004). Sedentism, Seasonality, and Economic Status: A Multivariate Analysis of Maternal Dietary and Health Statuses Between Pastoral and Agricultural Ariaal and Rendille Communities in Northern Kenya. *American Journal of Physical Anthropology* 123: 277-291.

Little, Michael A., Gray, Sandra J., Pike, Ivy L., Mugambi, Mutuma (1999). “Infant, Child, and Adolescent Growth, and Adult Physical Status.” In Little, M. A. and Leslie, P. (eds.), *Turkana Herders of the Dry Savanna: Ecology and Biobehavioral Response of Nomads to an Uncertain Environment*, Oxford University Press, New York pp. 187-204.

Shell-Duncan, Bettina, and Obiero, Walter O. (2000) Child Nutrition in the Transition from Nomadic Pastoralism to Settled Lifestyles: Individual, Household, and Community-Level Factors. *American Journal of Physical Anthropology* 113: 183-200.

Second, we could use changes in underweight, which includes changes in both wasting and stunting, moreover from more similar baselines (see table 4.7), as an indicator of when malnutrition is rapidly increasing. This has the drawback of needing adequate age determination, however.

In sum here are the tentative conclusions, which further research would be useful to substantiate:

1. In pastoralists tallness seems inherent and not much changed by environment, whereas thinness is much reduced outside the traditional areas or lifestyle.
2. However, not all thinness is likely to be due to chronic deprivation, which would be expected to lead to stunting.
3. Therefore interpretation of wasting among pastoralists should concentrate on *changes* in prevalences – first when rapid increases are seen, and second from a baseline that is higher for pastoralist (say 15%) than non-pastoralists (say 5%).
4. If age determination were feasible, underweight would average out the tallness-thinness with shortness-less thinness, to give an indicator more comparable across groups; here again changes in prevalence would provide the more useful indicator.

C. ASSOCIATION WITH ORPHANHOOD

The AIDS epidemic is creating an unprecedented number of orphans, with associated concern for their welfare, health and nutrition. Previous studies in the region (e.g. Lindblade et al, 2003²⁵) had indicated that orphans were not significantly worse off, a surprising result found elsewhere and further investigated in earlier studies by Tulane on behalf of UNICEF, IFPRI, and WFP (Rivers et al, 2004, 2005)²⁶. The results of these studies, which covered all regions in Africa, have been extracted and summarized as described in this section.

The initial research question was: are orphans worse off nutritionally than non-orphans? The data sources were DHS and MICS surveys carried out recently, specifically Ethiopia, DHS 2000; Kenya, DHS 2003; Sudan, MICS 2000; Uganda, DHS, 2000/1. Two analytical problems arise in these analyses. First, the number of cases of orphans in the survey samples is small. The possibility that this was in part due to failure of the surveys to capture all orphans that should be in the sample had been addressed in earlier work (Rivers et al, 2004, 2005), based in part on estimates in ‘Children on the Brink’ (UNAIDS, UNICEF, USAID, 2004²⁷), leading to the conclusion that it was unlikely that the proportion in the survey

²⁵ Lindblade K.A., Odhiambo F., Rosen D.H., DeCock KM (2003). Health and nutritional status of orphans <6 years old cared for by relatives in western Kenya. *Tropical Medicine and International Health*. 8 (1): p. 67-72.

²⁶ Rivers J, Silvestre E, Mason J (2004). Nutritional and Food Security Status of Orphans and Vulnerable Children: Report of a Research project supported by UNICEF, IFPRI, and WFP.

Rivers J, Mason J, Silvestre E, Mahy M, Monasch R, Gillespie S. (2005). The Nutrition and Food Security Status of Orphans and Vulnerable Children in Sub-Saharan Africa. Paper presented at the International Conference on HIV/AIDS and Food and Nutrition Security, Durban, April 2005; forthcoming in Conference Proceedings.

²⁷ UNAIDS, UNICEF, USAID (2004). *Children on the Brink 2004: A Joint Report on Orphan Estimates and Program Strategies*. Washington, D.C.

samples was a substantial underestimate of the population proportion. The approach thus needs to deal with low n's as far as feasible (e.g. by favoring means rather than prevalences in small n cells). Second, the numbers of orphans increase with the child's age, as the probability of being orphaned increases with age; thus this possible confounding effect of age on nutritional indicators (which are not age independent) needs to be controlled.

The mean values for weight-for-age z-score (waz) by age band and country are shown in table 4.8. The age-bands are split at 18 months as this is the age at which the waz tends to stop falling. As expected the non-orphan group is by far the largest, and other results can be compared with this. Only weight-for-age is shown here, and the results are essentially the same using stunting and wasting. None of the orphan groups are significantly different, within country and age-band, from the non-orphan group. This is probably not only due to the low n's – in most cases the orphan groups are if anything *better* off than the non-orphan group. Reasons for this might be to do with the need to compare not just orphanhood, but with households without one or more parents because of other reasons. This, plus adjusting for age, is shown next.

Taking account of whether parents are in the household, for orphans and non-orphans, gives 9 categories, as shown in table 4.9. Unavoidably, this produces smaller cell numbers, and those with $n \geq 30$ are shown in bold to facilitate interpretation. Again none of the cells by country and age-band were significantly different from the reference group (both alive, both in household). Comparing effect of father not in household because of death or other reasons, when mother is in the household, shows some consistency – for example in Ethiopia, S Sudan and Uganda the z-score is somewhat lower for the 'father dead, mother in household than for the 'both alive, father not in household's groups; e.g. for the 18-59 month group in Uganda, mean waz is -1.322 (120) compared with -1.158 (634) respectively. But in general the mean waz values are not noticeably different for the orphan groups than for the reference group (both alive, both in household). The disaggregation of the orphan groups by whether a parent (and which) is in the household does not seem to extract groups with additional malnutrition.

These data were aggregated in various ways, without bringing out dramatic differences when countries were combined. One expression of the findings, shown in table 4.10, uses predictions of prevalences by group controlling for age and selected socio-economic variables (e.g. education), and standardizing within countries so that the results can be combined (the method is described in Rivers et al, 2005; data from Rwanda and Tanzania are included). The results expand on those in the previous table, and stress some surprising results. For example, paternal orphans seem *better* off when the mother is *not* in the household – compared either with when the mother is in, or with non-orphans. Non-orphans are also better off when the mother is *not* in the household. This must be picking up some more complex sociology; but the result is found when controlling for at least the usual SES factors, and thus presumably refers to protective factors not measured by these.

This suggests further research, to address the question: who *are* the paternal orphans, and non-orphan children, living with neither parent, or with father only (for non-orphans)? And why are they apparently doing relatively well? Until we know more about this, we can only

go as far as concluding that the evidence appears to suggest that orphans are less vulnerable to malnutrition than was feared (and maybe less even than the general population), but we do not know why.

D. HOW ELEVATED IS CHILD MORTALITY IN SOUTHERN SUDAN?

Estimates available with ESARO from a variety of surveys suggested that child mortality in Southern Sudan was not raised as much as expected, considering the situation and extent of malnutrition. A brief field visit was made by Catherine Ampagoomian, in December 2005. Her trip report is included as Annex 14. Here is a brief summary of the conclusions.

The child mortality rates (U5MR was usually considered) was enquired about in a number of interviews with assistance agencies (e.g. CARE, Save the Children/UK, FEWS, Concern, IRC, Tearfund) running programmes, and in health centres and hospitals, during visits to Rumbek, Nyamlil, and Juba, as well as in Lokichokio (in Kenya).

Anecdotal reports suggested that mortality was raised in the past in the general child population, although not necessarily in line with reports and survey results of elevated wasting prevalences in children. Case fatality rates for children admitted to health centre and hospital wards were about 5% of admissions. This is not unusually high for those that get access to in-patient treatment (and is on the low side for severe malnutrition).

Average levels of U5MR for Sub-Saharan Africa are about 1/10,000/day, and a level of 2/10,000/day is regarded as significantly elevated. Some program reports gave relatively normal estimates (around 1/10,000/day), but others indicated values up to 6 times this rate. Survey results also showed a normal level in a majority of cases – as was known and the initial reason for the field study – but a few were raised up to 3 times normal. The confidence intervals of the survey estimates are not given: approximations based on some assumptions would put these at +/- 1-2%, roughly enough to distinguish twice-normal from normal.

The overall impression is that child mortality can be normal (for Africa) in Southern Sudan; but in many times and places becomes substantially raised, by several times. This results from displacement and conflict, drought, and the associated ill-health, food insecurity, and malnutrition. The field visit did seem to confirm that the crises indeed were causing child deaths in excess of normal, probably to a greater extent than indicated by the survey results. For the surveys, it is important to estimate and present the child mortality confidence intervals (due at least to sampling), and to reconsider the survey methods (both interview and sampling methods) to decide whether these should be upgraded to give more reliable estimates. At the same time it needs to be considered how more reliable estimates would be used, in order to decide if these would be worth the extra expense – or if surveys should focus on other, more easily measured, indicators.

SECTION 5: NOTES ON NUTRITION SURVEYS METHODOLOGY

For each country, all small-scale surveys reports that were made available were reviewed, and careful attention was paid to methodology, including sampling design and sample size, data collection techniques, indicators and data analysis procedures. In addition, for all countries except Kenya and Eritrea, sample raw datasets made available by NGOs, UN agencies or government were looked at in order to identify possible issues with the survey data. Attention was given to digit preference and precision of weight and height measurements, minimum, maximum values and recoding of missing values, standard deviations, skewness and kurtosis values, distributions for relevant variables (e.g. height, weight, age, MUAC, Z-scores), age heaping and computation methods for estimating severe and moderate wasting prevalence.

A. REGIONAL SYNTHESIS ON SURVEY METHODOLOGY AND DATA ISSUES

Survey Methodology

Regionally, the vast majority of nutrition surveys' methodologies abided by international standards.

- Almost all surveys resorted to probability sampling (either multi-stage cluster sampling with probability proportional to size at first stage, exhaustive or systematic random sampling) and provided representative estimates of malnutrition prevalence (i.e. based on sufficient sample sizes).
- In most cases data collection methods for anthropometric measurements were also according to standards, and with comparable age bands (i.e. 6-59 months) for all surveys across the region.
- All nutrition surveys provided estimates of GAM (and separately moderate and severe weight-for-height and oedema) expressed in both Z-scores and percent of the median. Arm circumference for children under five, and in some cases for caretaker or pregnant and lactating women, was sometimes included. Few surveys reported on underweight and stunting.
- A large number of assessments provided mortality estimates (both crude and for children under five), but usually without confidence intervals. Note that including mortality as at present gives such inaccurate estimates that it is at best an ineffective use of survey resources; and indeed it risks giving wrong conclusions (in either direction).
- Overall, methodological constraints included:
 - Sampling bias due to exclusion of hard-to-reach or insecure areas in the sampling frame.
 - Movements of population (including nomadic people) posing problems for sampling and data collection.
 - Difficulty to determine children's age with accuracy.
 - Confidence intervals for mortality estimates are rarely reported.

Data Issues

The following issues were identified across all countries by looking at sample raw datasets:

- Age heaping (around 12, 18, 24, 36 and 48 months), which results from the difficulty to determine children's age with accuracy (see above). This poses problems for estimating prevalence of underweight and stunting; and to a certain extent distorts inclusion/exclusion for anthropometric measurements based on age cut-off points, and cross-tabulation analysis by age-bands.
- Digit preference/heaping (i.e. rounded figures) for height, weight and MUAC, which may affect the accuracy of wasting prevalence estimates.
- Coding issues (i.e. recoding missing values and flagging extreme values/outliers), which also may cause major errors in mean values of wasting and low arm circumference.
- It would be very useful for analysis if wasting and oedema were treated separately, rather than pooled as 'GAM'. Oedema and wasting are two quite different processes, with very different prevalences. Oedema generally carries a much higher mortality risk than wasting (certainly at <-2SDs wt/ht), and has a much lower prevalence (when malnutrition is extensive). Important changes in oedema rates may get obscured when oedema is added in with wasting. Confusion in the other direction, whereby oedema changes obscure wasting changes, are less problematic but still worth avoiding.
- Finally, this pooling of wasting and oedema is unhelpful in terms of responding: a 5% oedema prevalence would be very serious, but 5% wasting much less so: adding them together mixes these two different conditions and fails to bring this out.

B. METHODOLOGY DEVELOPMENT FOR THE REGION

The information provided above can be used as a basis for discussions on improvement and harmonization of nutrition surveys' methodologies across the region. Some of the methodological questions that could be addressed at regional level are listed below.

- Which nutrition indicators should systematically be included in nutrition surveys? At the moment, global acute malnutrition (and moderate/severe) is the single common indicator to all surveys conducted in the region. It might be relevant to include other indicators, such as underweight, stunting and MUAC. This raises the issue of weight-for-age and height-for-age data validity, especially in light of the difficulty to determine age precisely.
- Related to the above, how to improve the accuracy of age data?
- Should we emphasize the distinction between wasting and oedema in analysis and reporting - to better inform response (see section B)?
- To what extent should we rely on arm circumference as a nutrition indicator - and for programme screening? More work is needed on using MUAC-based prevalences as indicators – they can be made reasonably close to wt/ht-based indicators, but not enough that a mixture will give valid trends. A more extensive problem (although not one directly addressed in this work) is that screening using wt/ht or MUAC will select substantially different children; the implications of this have not been adequately addressed.
- Which other indicators, if any, should systematically be collected to explore possible causes of malnutrition and better inform response (morbidity, water and sanitation, food security, e.g. CSI etc.)?

- How to address sampling bias in relation to hard-to-reach and/or insecure areas?
- How to conduct sampling and collect data among nomadic populations?
- Should sampling universe rely on livelihood or agro-ecological zones rather than administrative units?
- How to interpret wasting prevalence, and possibly stunting and underweight, across various ethnic groups?
- Related to the above, should we – and how to - harmonize trigger levels for response across the region?
- How reliable/accurate are mortality estimates derived from small-scale nutrition surveys (considering sample size, recall period etc.) and should mortality be estimated in small-scale surveys? While waiting for these answers, we recommend for the time being that confidence intervals be systematically calculated and reported.
- Are there better sampling design alternatives than the 30x30 cluster sampling methodology? The 30x30 sampling procedure is not ideal, although not necessarily wrong. There are several issues. First, it was originally designed for estimating immunization coverage, and is inefficient with the design effect (about 2) found for anthropometric data. Second, it does not in practice give an equal chance of selection to each household as the second stage (in-cluster sample selection) is not random, but systematic (e.g. every n'th household in a line from the centre). This adds to the sampling error, may introduce bias, and moreover is not assessed since errors are treated as if this stage was random. It also may bias associations analyzed at the household (or other) level. It has the advantage of apparent simplicity and familiarity. At a minimum the trade-offs should be made transparent; possibly, with evolution in some cases to the more widely used procedures in national surveys, of both stages using random selection (as in DHS or MICS). It's quite possible that considerable bias is introduced – this could be assessed by follow up validation surveys, or conceivably by comparison with DHS/MICS results.
- To what extent do we need to carry out surveys among specific, highly vulnerable groups, such as destitute pastoralists, and how to go about it?
- Do we have good examples of surveillance systems in the region and can these be adapted to other countries in the region?

C. REVIEW OF SURVEYS METHODOLOGIES AND DATA ISSUES BY COUNTRY

Ethiopia

Survey Methodology

Before 2002, the survey methodologies applied by NGOs in Ethiopia varied, and nutrition surveys did not necessarily generate reliable, representative and precise data. Since 2002 however, for emergency nutrition surveys, NGOs are obliged to use the standard methodology recommended by the Disaster Preparedness and Prevention Commission (DPPC), otherwise they cannot operate. The DPPC guidelines on Emergency Nutrition Assessments provide detailed information on recommended sampling methodologies, data collection techniques, analysis protocol etc. (for nutrition, mortality, morbidity and immunization indicators). Regarding sampling methods, when systematic or simple random sampling are not feasible,

two-stage 30x30 cluster sampling with probability proportional to size (PPS) at first stage (selection of clusters) is recommended (taking into account the design effect). The guidelines also recommend that anthropometric measurements be precise with weight, height and MUAC measured to nearest .1 Kg/cm; and children below 24 months be measured lying down. The guidelines also stipulate that all surveys “should report on the prevalence of oedema and low weight-for-height as defined by the percentage of the median and Z-scores” (DPPC, 2002).

Therefore, since 2002, all agencies use the 30x30 two-stage cluster sampling methodology with PPS; except for surveys carried out in IDP/refugee camps, for which exhaustive or systematic sampling is more appropriate. All surveys rely on comparable age bands, i.e. children from 6 to 59 months, as per guidelines Agencies tend to abide by the DPPC guidelines for data collection methods, with a few exceptions (see below).

Methodological constraints:

- Movements of nomads pose problems for sampling and data collection.
- Age is often difficult to establish from the carer; therefore agencies tend to use length cut offs children ≥ 65 cm and ≤ 115 cm for inclusion in anthropometric measurements.
- Some organizations measure height/length to the nearest .5 cm, this may have a notable effect on the accuracy of estimates of wasting. They used to measure all children lying down (and add 1 cm during analysis); now they measure length for those below 24 months and height for the older children (i.e. as per guidelines).
- Timing for nutrition surveys may not always be appropriate as some surveys are conducted just before the harvest. In this case the usefulness of the data is questionable since one expects the nutrition situation to change soon after the harvest. Note however that the change in the nutrition situation following the harvest may not be that large. Indeed, our recent analysis of Ethiopia data on the extent of seasonality indicated that the difference in GAM prevalence between pre-harvest time (i.e. hunger season) and post-harvest season was relatively small; indeed the hunger season showed slightly higher prevalence than the post-harvest season (difference of .9 ppts). Also note that the differences in GAM were larger compared to the moderate season (3.5 ppts).

Data Issues

We obtained a large number of datasets for three different NGOs, which allowed us to identify specific problems with the data. These are listed below.

- Some NGOs only measure height/length to the nearest .5 cm.
- Due to the difficulty of recording the exact age of children (in months) - since in many cases, children do not have a health card and mothers do not recall the child’s birth date precisely, age heaping was observed in all the datasets, and was sometimes very pronounced, especially among older children (i.e. above 24 months), as expected.²⁸

²⁸ “Age heaping” refers to the tendency of enumerators or respondents to report certain ages at the expense of others (i.e. usually 12, 24, 36 and 48 months).

- Digit preference (i.e. rounded figures) for height and weight was also observed in a number of datasets.
- In some cases, the data analyst failed to recode/flag extreme Z-scores values (especially for height-for-age).

Kenya

Survey Methodology

- The sampling methodology applied in most surveys was two-stage 30x30 cluster sampling with PPS. The sample size for children under five was usually between 700 and 1,100; however, in 2000 quite a number of surveys had a sample size of less than 600.
- All surveys (for which reports were available) relied on comparable age bands and included children between 6 and 59 months.
- Indicators included in all cases GAM (moderate, severe, oedema; with prevalence calculated both in Z-scores and percent of the median). Some surveys (less than half) also included under-five mortality rate, crude mortality rate (CMR), stunting, underweight and MUAC.
- Most survey reports indicated that children under 24 months were measured lying down and all surveys reported precise measurement techniques (i.e. to nearest .1 cm for height and MUAC and to nearest .1 Kg for weight).
- Methodological constraints:
 - Some areas often left out of the sampling frame due to inaccessibility/remoteness or due to insecurity.
 - Movements of nomads pose problems for sampling and data collection.
 - Age is often difficult to establish from the carer; therefore agencies tend to use length cut offs children ≥ 65 cm and ≤ 115 cm.

Data Issues

We could not obtain any raw datasets from any of the organizations operating in Kenya to look at possible data issues. However, given that a number of surveys include height-for-age and weight-for-age indicators, it would be interesting to look at the extent of age heaping in surveys conducted in Kenya.

Somalia

Survey Methodology

- The sampling methodology used in all – except a few – surveys conducted outside of camps was two-stage 30x30 cluster sampling with PPS. In IDP camps, organizations resorted to exhaustive or systematic random sampling. Therefore, all except exhaustive surveys relied on a sample size of approximately 900 – or more – children under five.
- All surveys relied on comparable age bands and included children between 6 and 59 months.

- GAM (i.e. weight-for-height moderate and severe, and oedema, calculated in both Z-scores and % of the median) was included in all surveys. Some surveys included arm circumference, often only for the caretaker. A number of surveys, especially recent ones, provided estimates of under-5 MR and CMR. The sample size for estimation of mortality was usually around 900 households and, in most cases, the recall period was 3 months. Most survey reports did not include confidence intervals for mortality estimates. A large number of surveys also included data on feeding practices, morbidity, immunization and other relevant information (e.g. CSI).
- Most survey reports indicated that children under 24 months were measured lying down and that children were measured/weighed to the nearest .1 cm/Kg.
- Methodological constraints:
 - Difficulties were encountered in determining the exact ages of children, as in most cases it is unknown and there is no birth registration and no child health card. Therefore age determination is based on mothers recall using local calendar of events. To identify children below 59 months, lengths cut-offs are usually used (65-110 cm).
 - In some surveys, some areas were often left out of the sampling frame due to insecurity.
 - Difficulties were encountered in obtaining accurate population figures in the absence of precise census data.
 - Movements of population (including nomadic people) also pose problems for sampling and data collection.

Data Issues

Three raw datasets were looked at; all were from the same organization.

- Age heaping was observed in most datasets but the surveys only reported on wasting, and not on underweight and stunting.
- Digit preference (i.e. rounded figures) for height and weight was also observed.
- In some cases, the data analyst failed to recode/flag extreme values for Z-scores.

Southern Sudan

Survey Methodology

- The sampling methodology applied in the vast majority of surveys conducted since 2000 was two-stage 30x30 cluster sampling with PPS.
- The sample size for children under five was usually between 700 and 900. Surveys in IDP/refugee camps usually relied on exhaustive or systematic random sampling.
- All surveys relied on comparable age bands and included children between 6 and 59 months.
- Indicators included in all cases GAM (weight-for-height moderate and severe, and oedema; with prevalence calculated based on both Z-scores and percent of the median). In most cases under-five MR and CMR were also reported. About half of the surveys also collected data on children's arm circumference, and a few of them on caretaker's arm circumference. No survey reported stunting or underweight prevalence.

- About a third of the survey reports indicated that children under 24 months were measured lying down; and all surveys reported precise measurement techniques (i.e. to nearest .1 cm for height and MUAC and to nearest .1 Kg for weight).
- In most surveys (but not all of them) the recall period for estimation of U5MR and CMR was 3 months. Few surveys reported on mortality rates with confidence intervals. The sample size for estimation of mortality varied between 3,000 and 4,500.
- Methodological constraints:
 - In many surveys, some areas were often left out of the sampling frame due to inaccessibility/remoteness or insecurity.
 - Age is often difficult to establish from carer. To determine which children are below 59 months, organizations tend to use length cut offs ≥ 65 cm and ≤ 115 cm. Some NGOs use different cut-offs (e.g. ACF, 110 cm for height limit).

Data Issues

Five sample datasets were looked at, all from the same NGO. Age heaping was observed in most datasets. However, this is not a major problem given that surveys only report on wasting, and not on underweight and stunting.

Uganda

Survey Methodology

- The sampling methodology used for the vast majority of surveys conducted was two-stage or three-stage 30x30 cluster sampling with PPS; in some cases, especially for surveys in camps, agencies resorted to systematic random sampling. The sample size for children under five was usually minimum 900.
- All surveys relied on comparable age bands and included children between 6 and 59 months.
- All surveys reported on GAM (weight-for-height moderate and severe, and oedema; with prevalence calculated with both Z-scores and percent of the median). A large number of surveys also reported on arm circumference for children under five and or pregnant and lactating women. Only two surveys provided estimates of stunting prevalence, and none of underweight. A number of surveys also provided estimates of under five mortality and CMR, but without confidence intervals; using a 3-month or 6-month recall period, and based on a sample size of about 900 households.
- Some, but not all survey reports indicated that children under 24 months were measured lying down. All surveys reported precise measurement techniques (i.e. to nearest .1 cm for height and MUAC and to nearest .1 Kg for weight).

Data Issues

Five raw survey datasets from two organizations were looked at. The following issues were identified:

- Age heaping (i.e. around 12, 18, 24, 36 and 48 months) reflecting over-dependence on mother/caretaker for child age in most cases or limited use/availability of immunization

cards as a source of age information. However, most surveys do not provide stunting and underweight estimates.

- In some cases, the data analyst failed to declare missing value codes as missing or recode/flag extreme values for Z-scores; this causes major errors in mean values.

SECTION 6: NUTRITION SURVEILLANCE AND ANALYSIS IN THE GREATER HORN OF AFRICA: ASSESSMENT AND RECOMMENDATIONS FOR CAPACITY BUILDING

Within in the context of the Nutrition Information Analysis Project in the Greater Horn of Africa, interviews were carried out with colleagues in UNICEF and partner organizations in the six countries under study, in order to assess current in-country capacity in the area of nutrition surveillance and analysis (see Annex 10). This report provides a summary of the capacity assessment exercise, identifies needs for capacity building and training within each country and provides recommendations for capacity development in nutrition surveillance and analysis in the region.

A. REGIONAL SYNTHESIS

All six countries have expressed the need for substantial capacity building and training among government and agencies' staff in nutrition data analysis and interpretation.

Additional capacity building needs have been expressed in certain countries, for example, information management training in Kenya, capacity building in mid-level technical management of nutrition assessments in Somalia, and nutrition policy in Southern Sudan. These specific needs could be addressed separately (e.g. additional/complementary training modules or seconding personnel).

In Ethiopia, Eritrea and Southern Sudan, there is no course or university degree in public nutrition. In Kenya and Uganda, the University of Nairobi and Makerere University now delivery Master's degrees in (applied) nutrition; however, in both cases, the faculty lacks capacity and expertise.

In sum, overall, there is a lack of human and technical capacity to carry out nutrition surveillance and analysis in the region. Based on this conclusion, we suggest the following next steps: (i) addressing the issue of the overall lack of staffing, (ii) building capacity through training and (iii) strengthening the capacity of local universities to deliver relevant coursework in the medium to long run (see below).

B. RECOMMENDATIONS FOR CAPACITY BUILDING IN THE REGION

There are several possible ways of building capacity in nutrition surveillance and analysis in the region. One option is for people to enroll in distance learning programmes such as those offered by the University of Western Cape Summer and Winter schools. These could focus on specific modules, for in-service use, and could contribute to broader public health training at certificate, diploma or in some cases MPH level. While the major part of the course could be undertaken off site, students may have to attend summer or winter courses for a few weeks.

Another option would consist of specialized in-country training sessions. However, to be effective, these would have to be undertaken over several weeks, and followed by a period of self-teaching (using CD ROMS, e.g. Tulane's PANDA) and subsequent follow-up training for consolidation of skills. Note however that in-country workshops are unlikely to bring the same level of skills as would formal education as suggested above.

It is important to note that both of the above-mentioned options would require students to dedicate part of their working (paid) time to studying (i.e. minimum one hour per day). This was not perceived as a major constraint by the people consulted. However, distance learning was not the preferred option. Indeed, there is not much of a distance learning culture in the region, and most colleagues argued that in-service distance learning would not be feasible and would expect too much from the trainees. Instead, onsite training sessions were seen as a more effective way of bringing relevant skills to government and agencies' staff.

In addition to the above-mentioned short/medium term initiatives, there is a dire need to build the capacity of local and regional institutions and universities to deliver graduate level courses and degrees in public nutrition. Efforts in that direction have already been made in Kenya, with the University of Nairobi (UoN), with a special focus on emergency nutrition and food security. We should attempt to build on what has already been done and further strengthen the capacity of UoN faculty, despite current constraints. Faculty capacity building could also be provided to Makerere University, within the framework of the new Master's degree in nutrition. This could be done through support from and partnerships with the University of Western Cape or Tulane. To the extent possible, this type of partnership should also be extended to universities in other countries, e.g. Ethiopia and Eritrea. Collaboration with AMREF for capacity development through training could also be considered.

Based on the above, we recommend the following steps: First, decision-makers at UNICEF and in governments should consider whether they do want and have sufficient resources to have that kind of capacity in house. This is a very important first step upon which depends any further action. If that is the case, measures should be taken to ensure that, within each country office or government, staff can devote part of their time to analysis and interpretation of nutrition surveillance information; this might imply creating new positions or recruiting additional staff. In addition, staff capacity needs to be strengthened in the short-term. As mentioned above, this can be done through in-country training sessions whereby professionals will acquire specific skills in nutrition data analysis and interpretation over several weeks; keeping in mind that these are unlikely to bring the same level of skills as would formal education. Finally, the capacity of local and regional institutions and universities to deliver graduate level courses in public nutrition needs to be strengthened so that, in the future,

agencies and governments in the region can recruit qualified and skilled personnel. Several initiatives are under way and could be pursued through partnerships between local universities and other institutions with relevant experience and expertise in public health and nutrition. We propose developing collaboration between Tulane and University of Western Cape for this purpose.

C. ASSESSMENT AND CAPACITY BUILDING NEEDS BY COUNTRY

Eritrea

Currently, within the Ministry of Health, a team composed of three people (including one health worker, one statistician and one team leader, i.e. international staff seconded by the EU) is responsible for carrying out nutrition surveillance; surveys are conducted twice a year in all provinces. Because none of them has been formally trained in nutrition, it is felt that the team needs more exposure to nutrition and health data analysis and interpretation. In addition, the team's capacity to develop and conduct surveillance could be upgraded.

UNICEF's capacity in terms of personnel is limited, although the office is hoping to fill in an international position for emergency nutrition in the next year. The person currently responsible for nutrition at UNICEF would welcome a refresher course in nutrition data analysis.

As in Ethiopia, in Eritrea, there is no course or diploma delivered in the field of nutrition or even public health. People who work in nutrition usually have a statistics, nursing or biology background; others graduated overseas.

Ethiopia

At Federal level, it was felt that there is a need to strengthen the capacity of the disaster assessment team to carry out nutrition data analysis. Indeed, while the team is responsible for all aspects of emergency nutrition assessments, i.e. from survey design through data collection to analysis and reporting; due to lack of capacity, external assistance is usually required to conduct the analysis of the data collected (usually, Save the Children UK provides support). Therefore, it was recommended that the disaster assessment team be trained in data analysis and interpretation (for nutrition and health data) and use of statistical analysis softwares, such as EPI Info. At the moment, there is only one nutrition expert in the team, therefore only one person to be trained; the team would thus benefit from additional human capacity.

At regional level, DPPB staff lacks the capacity to conduct basic analysis of nutrition information and interpret results. Training for Early Warning Department and Ministry of Health staff in nutrition data processing, analysis (using EPI Info) and interpretation has been initiated – by UNICEF - in two regions (Tigray and SNNPR). This type of training should be extended to other regions and be immediately followed by practical application of the skills acquired in order to consolidate capacity. High staff turnover is a major constraint.

In Ethiopia, there is no diploma delivered in nutrition; therefore there are no qualified nutritionists. Typically, people who work in nutrition have a biology or agriculture background. This is a major constraint given the scale of nutrition interventions implemented in the country.

Kenya

In Kenya, emergency nutrition assessments are the responsibility of the Office of the President (Arid Lands). However, their staff does not have a nutrition background. They recently requested UNICEF to provide training in designing and conducting nutrition assessments.

The Ministry of Health has limited expertise in designing and conducting nutrition surveys; however, the Ministry of Planning, and within it the Central Statistical Bureau, provides useful expertise for sampling design and data analysis. Yet, their ability to centralize and manage nutrition information needs to be strengthened. UNICEF is planning to train ten people among CBS staff in nutrition assessment (i.e. design, data collection, analysis etc.) and information management so as to complement their skills.

UNICEF contracts consultants or NGOs to conduct nutrition surveys. Within UNICEF, the project officer in charge of nutrition has the skills to carry out in-depth analysis of nutrition and related data but is unable to devote time to this type of activity due to heavy workload.

It was felt that the office of Arid Lands and the Ministry of Health need to build their capacity in all aspects of nutrition surveillance and analysis, i.e. survey design, data collection, data management, analysis, interpretation and reporting. However, high staff turnover is seen as a major constraint.

Courses and graduate degrees in nutrition are available in Kenya. The University of Nairobi delivers a post-graduate degree in Applied Nutrition. Kenyatta University offers programmes in nutrition and education, with only one unit focusing on emergency nutrition. Karen College of Nutrition trains nutritionists at undergraduate level, with emphasis on dietetics and clinical nutrition. However, according to UNICEF, harmonization of nutrition curricula across the various institutions is necessary in order to ensure good quality education (in terms of breadth, quality etc.). UNICEF is hoping to work on this particular issue next year (if funds permit).

Somalia

There seems to be adequate capacity at local level to collect nutrition data, as data collection teams are well trained and experienced. However, capacity lacks for mid-level technical management of nutrition surveillance, i.e. planning, managing and budgeting nutrition assessments, performing quality control etc. (which requires Master's level of education plus probably additional training/experience). In addition, staff's skills in nutrition information analysis, interpretation and reporting/presentation need to be strengthened.

FSAU indicated that the University of Nairobi (UoN) offers a Master's degree in applied human nutrition. Nutrition Works and FAO carried studies on training needs assessment and capacity development in emergency nutrition in Africa/Kenya. Based on these studies, regional stakeholders agreed to strengthen the capacity of the University of Nairobi to deliver courses in emergency nutrition and food security. Subsequently, FAO invested in the development of a specialized curriculum, and courses in emergency nutrition were pre-tested with students from the Applied Nutrition Training Programme (with collaborative teaching from UoN, Kenyatta University and FSAU/FAO) in 2004-2005. Although efforts are being made to pursue these initiatives, the limited capacity of the faculty at the University of Nairobi is a major constraint. A number of experts and institutions (including Tufts and Tulane) have been approached to provide external support to the faculty and build their capacity in the field of emergency nutrition and food security; discussions are ongoing.

Southern Sudan

UNICEF OLS has two nutritionists who have been focusing on “reactive” emergency response (note that UNICEF contracts NGOs to carry out nutrition surveys). Their capacity to conduct analysis of nutrition data needs to be reviewed and strengthened to ensure that nutrition information is used for timely programme planning.

The Ministry of Health has appointed one nutrition focal point who has limited experience in nutrition policy and needs support in that area; technical expertise in nutrition within the government is also lacking. In order to build government's capacity in those two areas, UNICEF proposes to second experienced and trained staff to the government as a first step (i.e. one person for policy and one person for technical expertise).

Recognizing the lack of capacity to conduct nutrition surveillance and implement nutrition interventions in Southern Sudan, UNICEF has contracted ACF to provide training in basic nutrition and nutrition assessments for Sudanese staff (from government and NGOs). Twenty people were trained this year.

There is hardly any Sudanese person who has been formally trained in nutrition. Therefore, there is a great need for capacity building in nutrition surveillance and, in particular, nutrition data analysis, building on what has already been done through ACF's training.

Uganda

In Uganda, most surveys are conducted by private firms or NGOs. The Ministry of Health has only three staff members in the nutrition team and does not have the human capacity to design and implement nutrition surveillance. Ministry of Health staff also lacks research and analytical skills.

With only one project officer responsible for nutrition, UNICEF does not have the human capacity to conduct nutrition surveillance and analysis of nutrition information.

Apart from the regular DHS and ad hoc small-scale surveys, there is not routine nutrition surveillance system in place in Uganda; and no capacity to develop and implement such system. In addition, it is felt that the nutrition information that is available is not always used effectively to inform response.

Therefore, additional staff and training in nutrition data analysis and interpretation is required within the Ministry of Health. UNICEF would also welcome additional human capacity, especially to carry out broad analysis of nutrition information.

Until recently, there was no diploma offered in the field of public nutrition in Uganda. As a result, most people involved in nutrition surveillance and programming have an agriculture background. Nevertheless, Makerere University has recently launched a Master's programme in Nutrition. However, the university has very limited capacity and cannot host more than 10 students at a time. In addition, the faculty lacks capacity and expertise as the professors who are involved in the programme have been pooled from other departments, such as agriculture and food technology. Makerere and other universities also deliver courses and degrees in public health and epidemiology.

SECTION 7: IMPLICATIONS AND NEXT STEPS

The most pressing needs suggested from this study are for fostering agreement on methods and approaches, and for building the capacity to apply these. The overall objective would be to improve the capacity to get timely, valid, and correctly interpreted information, to support interventions to protect and improve nutrition and food security. This probably should apply to countries in the GHA together with those elsewhere in the Eastern and Southern Africa region. The present project followed on similar analyses in Southern Africa, and reaches similar conclusions on capacity needs. Combining initiatives across the broader region would be likely to bring economies of scale and make sense overall. In addition, certain issues identified at the Nairobi regional workshop in October 2005 that launched this project could not be fully dealt with within the time and resources available, and need still to be followed up. The four areas outlined here are therefore: methodology development and regional meeting; developing higher level training for building capacity in training institutions; developing materials and in-country/on-site training; and follow up research. Most of these activities have been elaborated in the context of southern Africa, for example in a proposal, which can be updated now, circulated after the NIPSA project in 2005²⁹.

1. Regional methodology workshop. A considerable number of issues have come up (see section 5 above) that could now be addressed on the basis of recent experience. These include:

²⁹ "Food and Nutrition Security in southern Africa: Developing Information and Response Systems, Concept note and outline proposal." J.B. Mason, S. Gillespie. 20 July 2004). This was also part of the documentation for the October 2005 regional workshop.

- selection and interpretation of anthropometric indicators for different purposes (e.g. use of wasting; comparability of prevalences across different populations and ecologies);
- estimating mortality rates;
- food security indicators for early warning;
- sampling methods for surveys;
- use of data from clinics and programs for monitoring and surveillance;
- methods for selecting children for entry into programs (including use of arm circumference for screening);
- methods for evaluating impact, e.g. of food aid.

The workshop will need to be carefully prepared, with good background material assembled and prepared for each of these topics. Linkage with existing approaches must be fully made, for example with the 'Smart' procedures, with FSAU/Somalia, etc. This should lead to outputs of useful manuals and training materials, and back-up from institutions in the region and outside.

2. Develop higher-level courses and training. For long term building of capacity (see section 6 above) in the countries in East and Southern Africa, a number of people in key institutions will need to be trained to diploma or Masters levels. One good prospect for this is through a collaboration of Tulane (School of Public Health and Tropical Medicine) with the University of the Western Cape (UWC, School of Public Health), in which additional coursework would be added into the well-established Post-Graduate Diploma in Public Health, which already contains relevant material on nutrition. This program operates in part by distance learning (using print materials) and extends to many countries in Africa.

3. Develop in-country/on-site training in nutritional surveillance. This is potentially the most extensive activity, involving training exercises of varying depths in countries. It would draw on people trained through the higher-level training, and on the capacity of Tulane and UWC, then increasingly on others (e.g. University of Nairobi) as their capacities increase. A mix of in-country workshops, in service training from supporting institutions, troubleshooting, and other support will be needed.

4. Follow up research. Issues identified as priority at the regional meeting and subsequently, include the following:

- impact of food aid: some relevant data on food distribution with WFP was identified, and the opportunity of linking this to the anthropometric indicators could now be taken;
- a similar opportunity may exist for cash transfer programmes;
- the situation of destitute pastoralists was flagged as of concern at the October 2005 regional meeting, but suitable data could not be found as yet in the studies – this needs further research;
- the linkage of HIV/AIDS with nutrition could only be studied at all for Uganda; with new data now becoming available (e.g. in the Kenya 2005 DHS survey) this could now be pursued further;
- the data compiled and interpreted on conditions in drought prone areas could now be used to evaluate the recent effectiveness of early warning indicators in

predicting malnutrition from drought (preferably combined with assessing the impact of food aid).

Mobilizing resources for these activities itself constitutes an important next step. The regional methodology workshop would be an early priority, and be relatively limited in its resource requirements. The training initiatives have been written up in proposal form³⁰ in the context of southern Africa, and this can be readily elaborated to include countries in Eastern Africa as well. Probably the action here is to discuss with UNICEF the appropriate procedures to now further develop and circulate proposals for funding support for activities such as those outlined here.

³⁰ See previous footnote.

ASSESSMENT OF CHILD NUTRITION IN THE GREATER HORN OF AFRICA

PART A: FIGURES AND TABLES

SECTION 2:

Table 2.1. Datasets used for this report.

Country	Year	Timing (Season)	By	Child age range	Datasets? Analysed? (see note)	Comment
Eritrea	1995		DHS		G, not yet	
	2002	Mar-July	DHS		G, not yet	
	1993-2002		MOH		?	Micronutrient surveys
Ethiopia	1996	Jun-Jul (Mod/Hunger)	CSA		G, Y	
	1998	Jun-Jul (Mod/Hunger)	CSA		G, Y	
	2000	Jun-Jul (Mod/Hunger)	CSA		G, Y	
	2000	Feb-Jun (Post-hvst/Mod)	DHS		Y	
	2004/5	Jan-Feb 05 (Post-hvst)	CSA		G, Y	
	2005	Apr-Aug (Mod/Hunger)	DHS		No	Data not yet available
Kenya	1994		CBS		G, No	
	1998	Mar-May (Mod)	DHS		Y	
	2000	Sept-Oct (Lean)	MICS		Y	
	2003	May-July(Mod/Lean)	DHS		Y	
S Sudan	2000	July-Aug (Hunger)	MICS II		Check	
Uganda	1995	Mar-Aug	DHS		Y	
	2000/1	Sept-Feb	DHS		Y	

G, dataset with govt, not available outside. Y, yes, analysed for this report.

Table 2.2. Seasonality: harvests and hungry seasons.

Country	J	F	M	A	M	J	J	A	S	O	N	D	Comment
Eritrea													
Ethiopia	H											H	Varies by region Two harvests
Kenya										H			Main harvest Varies by region
Somalia									H				
S Sudan												H	
Uganda										H			

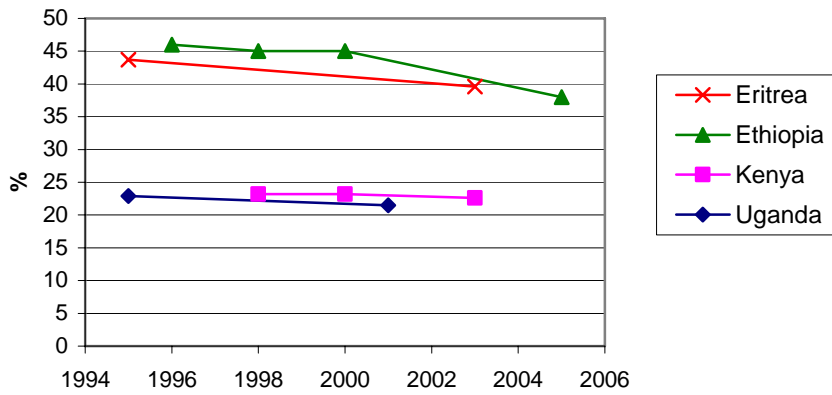
H = harvest	Post-harvest	Moderate hunger	Hunger gap/lean
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Table 2.3. Estimates of degree of drought (from indicators in figure {drought indicators}).

	2000	2001	2002	2003	2004	2005
Kenya	3	2	2	1	3	3
Ethiopia	3	2	2	1	2	2
Uganda	0	0	1	0	1	2
Sudan	0	2	3	0	2	2

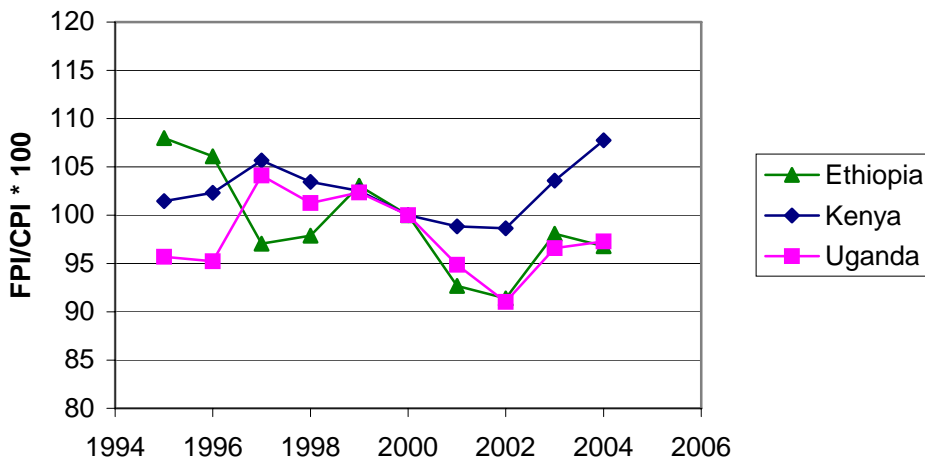
Drought	None	Some	Moderate	Severe
Colour	0	1	2	3

Figure 2.1. Trends in national prevalences of children underweight.



Note: child ages are 6-59 months for Kenya and Uganda, 3-59 months for Ethiopia, and 0-36 months for Eritrea. Underweight is < - 2SDs by WHO/NCHS standards. **CHECK**
Sources: see text.

Figure 2.2.a. Relative prices of food (FPI/CPI), 1995-2004.



Note: FPI/CPI is expressed as food price index (2000=100) divided by consumer price index (2000=100), multiplied by 100.

Figure 2.2.b. Consumer and food price indices (2000 = 100) for Uganda, Kenya, and Ethiopia, 1995-2004

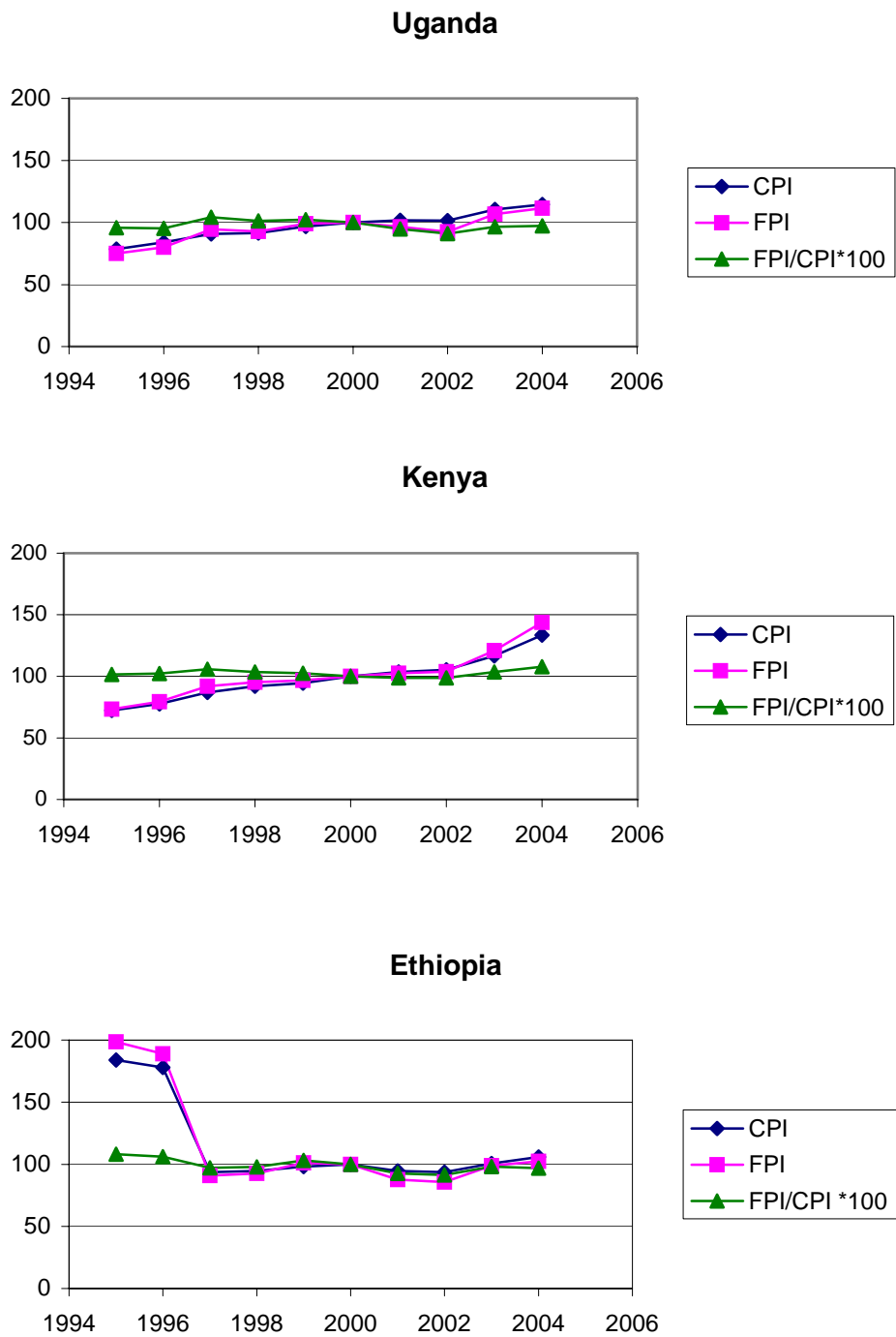


Figure 2.3. Estimates of the water requirement satisfaction index for agriculture, 2000-2005. Maps kindly provided by USGS through the FEWS project

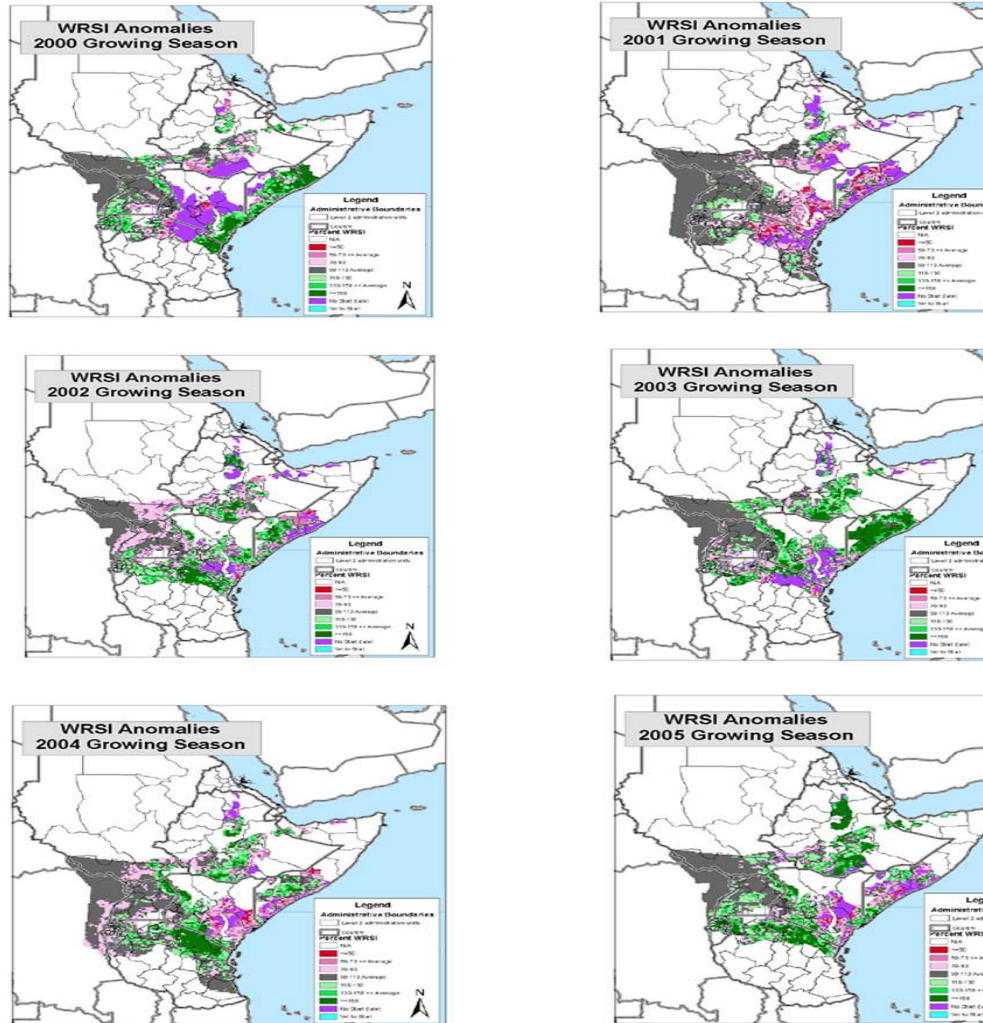


Figure 2.4. Indicators of drought, 200-5: from FAO (GIEWS), the WRSI, FAO Cereal Crop Production Indices, and food aid shipments.

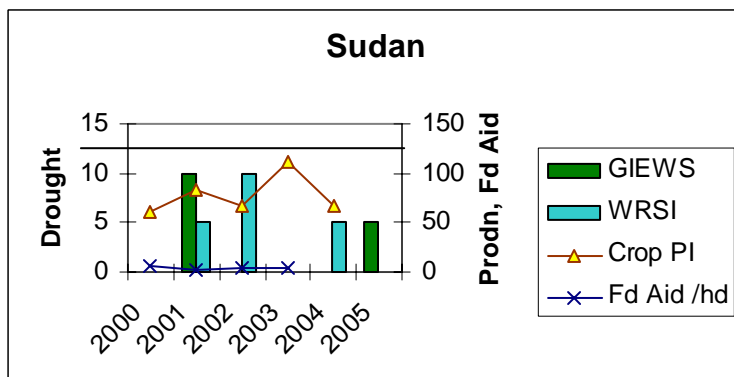
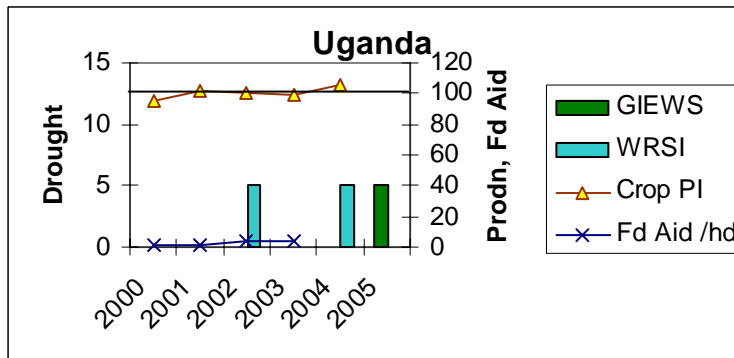
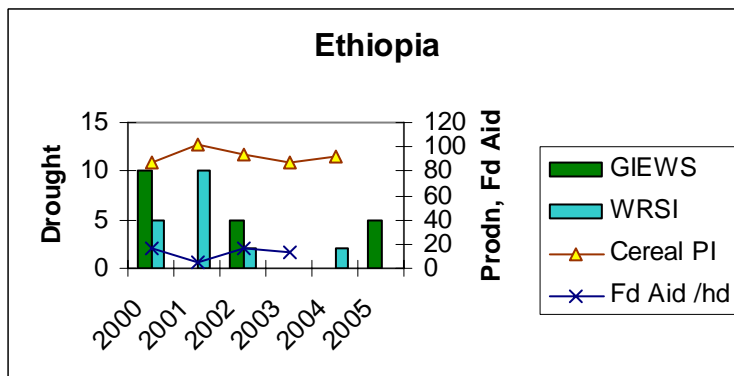
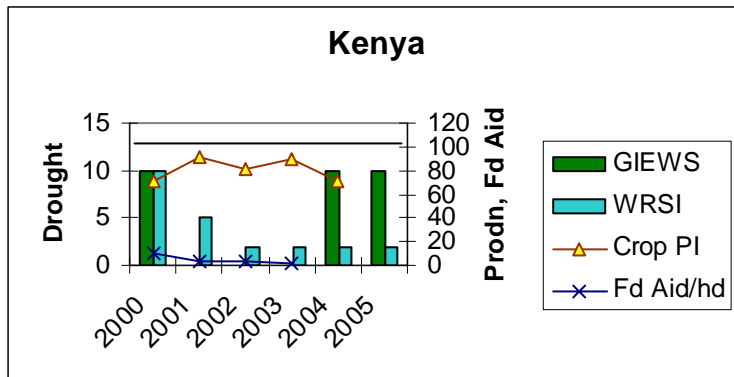


Table 2.4. Maternal and new born data

	Low birth weight, %	Maternal mortality ratio	Prevalence BMI <18.5 in women
Kenya	11%	1000	12%
Uganda	12%	880	9%
Ethiopia	15%	850	26%
Somalia	16%	1100	-
Eritrea	21%	630	41%
Sudan	31%	590	-
India	30%	540	41%

Sources: birth weight, SOWC, 2005, table 2 (1998-2003) except Somalia, SOWC, 2000, (1990-97); MMR, SOWC, 2005, table 8, 2000 (adjusted); BMI, SCN, 2004, annex 11.

Figure 2.5. Patterns of child stunting and wasting by age group, comparing Somali with Ugandan children.

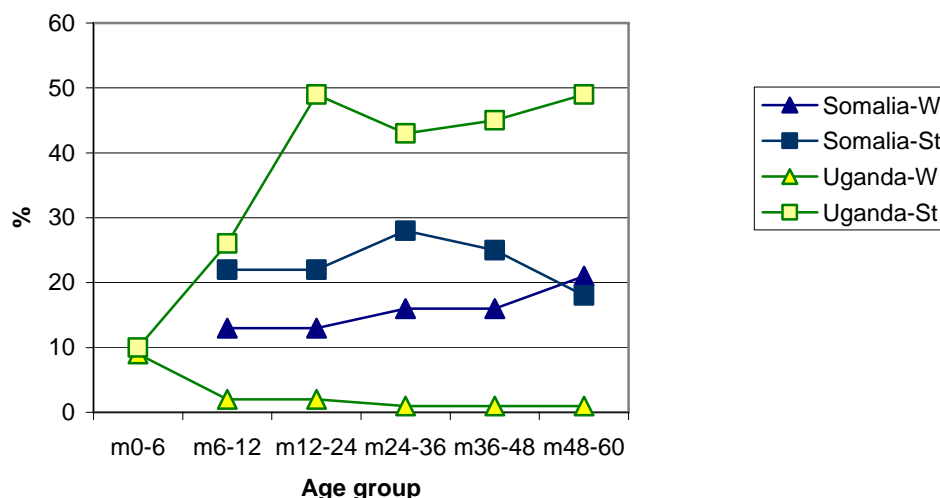


Table 2.5. Estimated populations of pastoralists in the Greater Horn of Africa by country.

NUMBERS AT A GLANCE			
	Total Population (estimated)(1)	Number of Pastoralists (estimated)	Pastoralists as Percentage of Total Population (estimated)
Djibouti	466,900–650,000	93,000–130,000	20 percent(2)
Eritrea	4.5 million	1 million–1.5 million	33 percent(3)
Ethiopia	70.5 million	7–8 million(4)	10 – 12 percent
Kenya	30 million	6 million(4)	20 percent
Somalia	9.6 million	6.7 million	70 percent(5)
Sudan	40.2 million	n/a	60 percent of non-urban areas(3)

(1) Source: U.S. Department of State Country Background Notes.

(2) Source: U.S. Embassy, Djibouti. May 17, 2005.

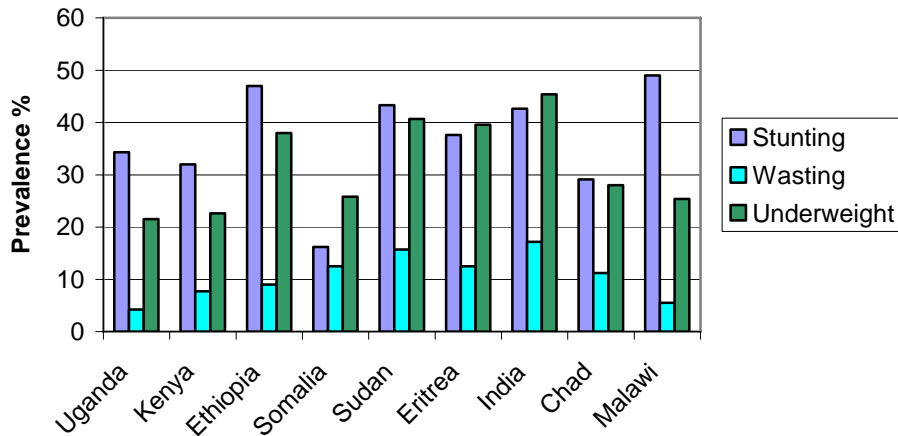
(3) Source: Pastoral and Environmental Network in the Horn of Africa (<http://www.penhanetwork.org>).

(4) Source: John Markakis, Pastoralism on the Margin. MRGI, October 2004.

(5) Source: FEWS NET, September 2004.

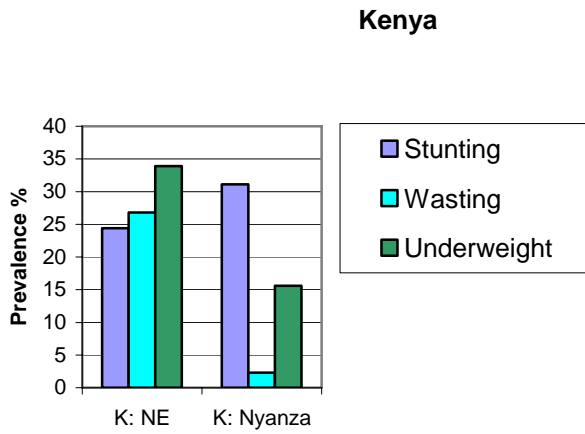
Source: <http://www.reliefweb.int/rw/RWB.NSF/db900SID/EGUA-6GUSDV?OpenDocument>

Figure 2.6. Patterns of child stunting, wasting, and underweight by country in Greater Horn of Africa, with data from Chad, India, and Malawi for comparison, from recent survey data.

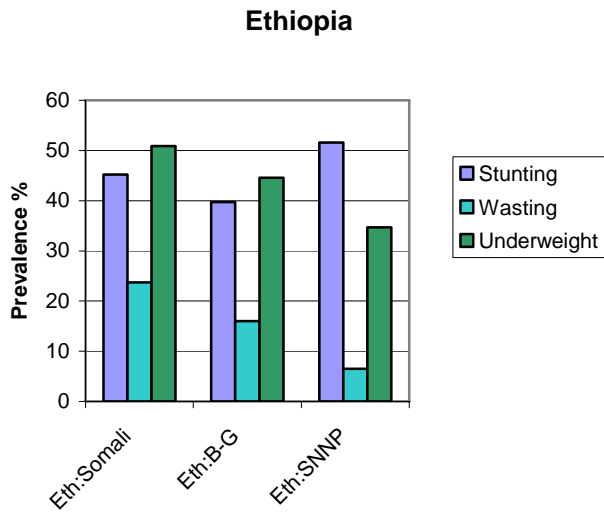


Notes. Uganda, DHS 2001, 0-47 months; Kenya, DHS 2003, 6-36 m; Ethiopia, CSA 2005, 3-59 months; Somalia, UNICEF/MICS 2000, 6-59 months; Sudan, MICS 2000 (see WHO), 0-59 months; Eritrea, DHS 2002 (see WHO), 0-59 months. For comparison: India, 11 state survey, rural (see WHO). 0-59 months, 1996-7; Chad, 0-59 months, MICS 2000; and Malawi, 0-59 months, 2000, DHS.

Figure 2.7. Patterns of child stunting, wasting, and underweight by areas in Kenya (NE, pastoralist; Nyanza, other livelihoods) and Ethiopia (Somali, lowland/pastoralist; Beshangul-Gumuz, mixed; SNNP, other).



Source: Kenya DHS 2003 (from WHO), 0-59 months



Source: DHS, 2005.

Figure 2.8. Prevalences of underweight children (0-36 months) by province in Kenya, 1998-2003.

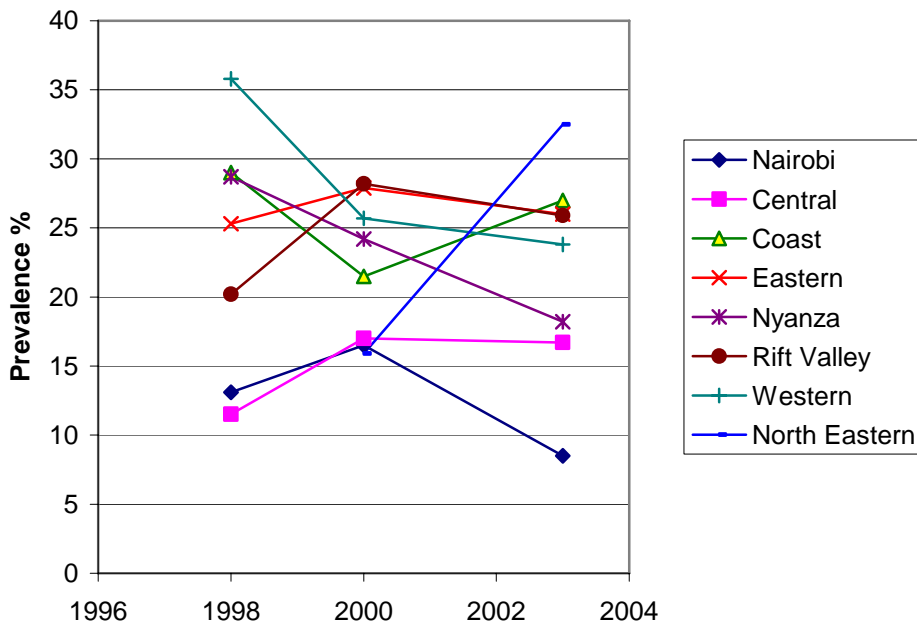


Figure 2.9. Estimated national trends in prevalences of child (0-59 months) stunting, wasting and underweight in Ethiopia, from Central Statistical Authority (CSA/WMS) and from DHS surveys.

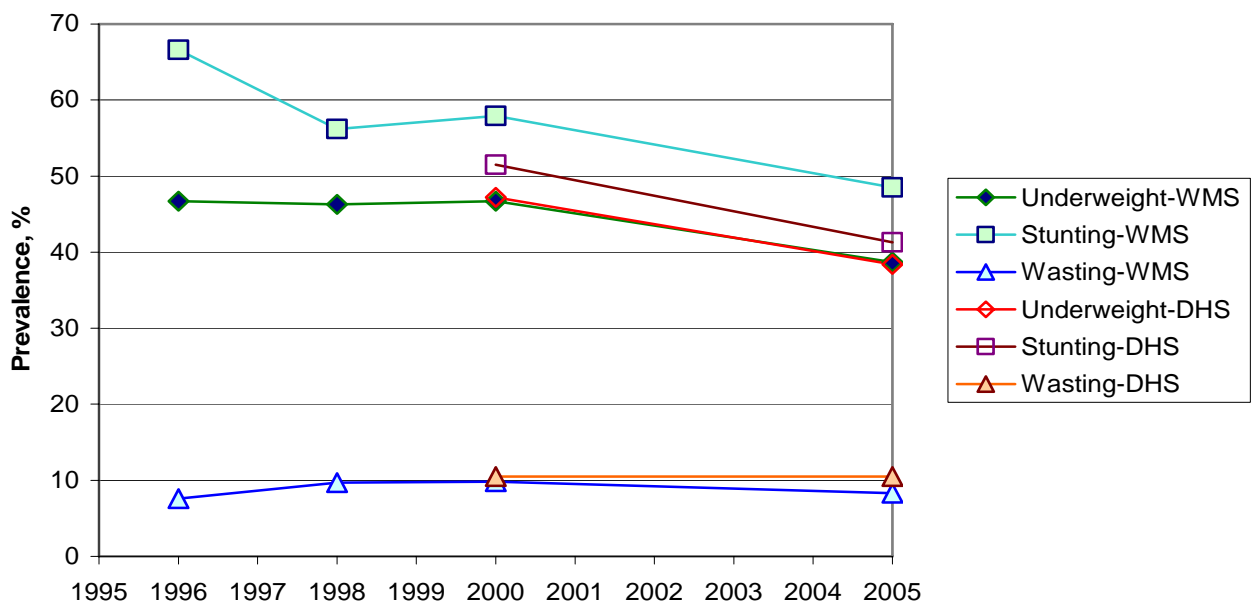


Figure 2.10. Trends in prevalences of wasting from CSA/WMS surveys by region (grouped as lowlands and highlands) in Ethiopia, 1996-2005.

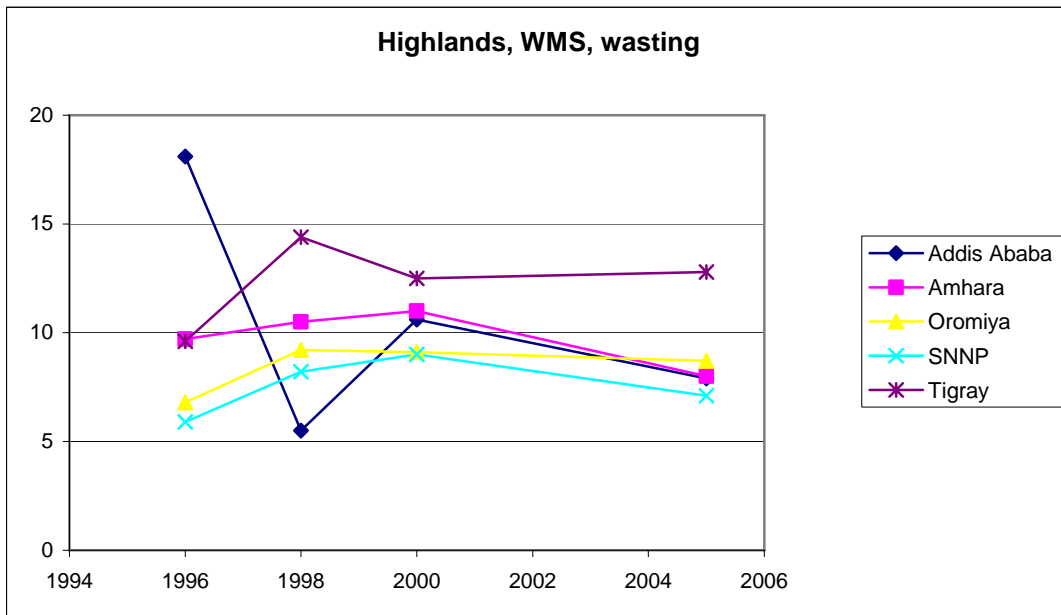
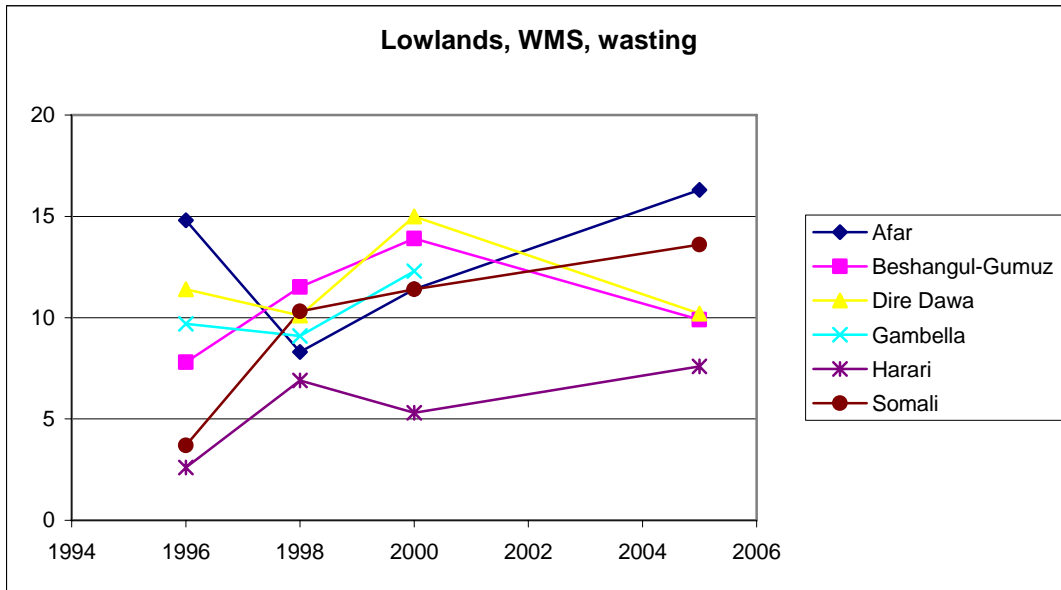


Figure 2.11. Trends in prevalences of wasting from CSA/WMS and DHS surveys carried out in approximately the same seasons (Jun-July 2000, CSA; Apr-Aug 2005, DHS) by region (grouped as lowlands and highlands) in Ethiopia, 1996-2005.

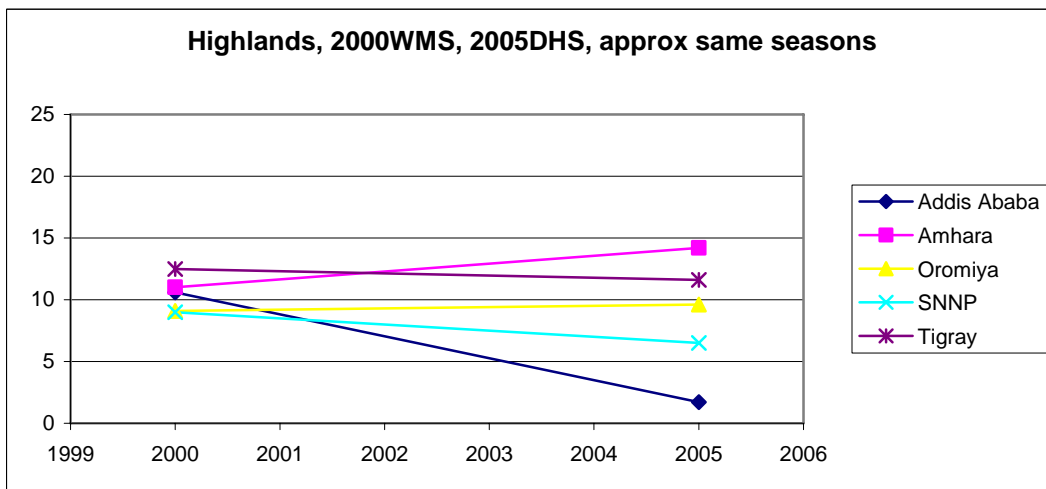
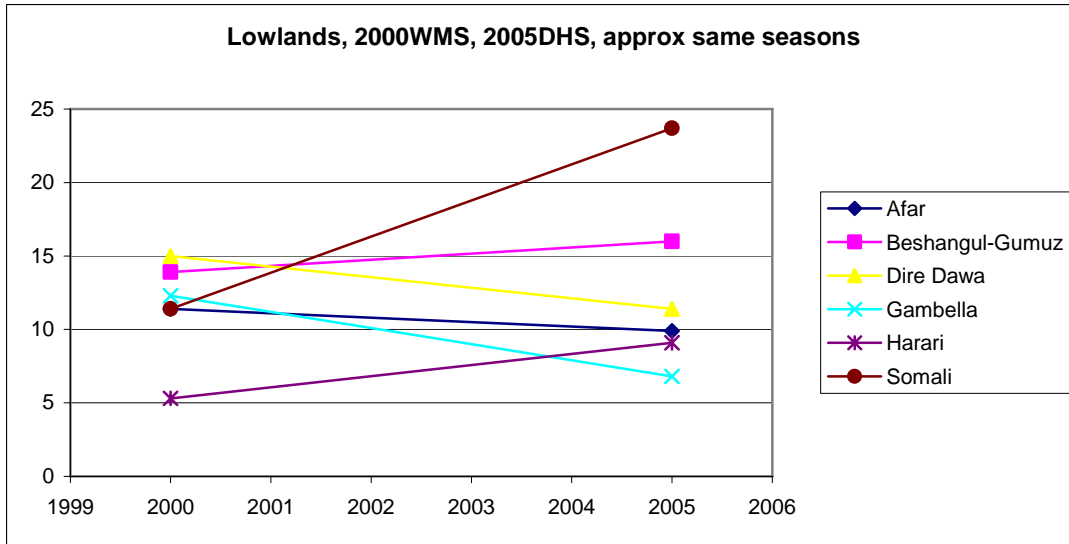
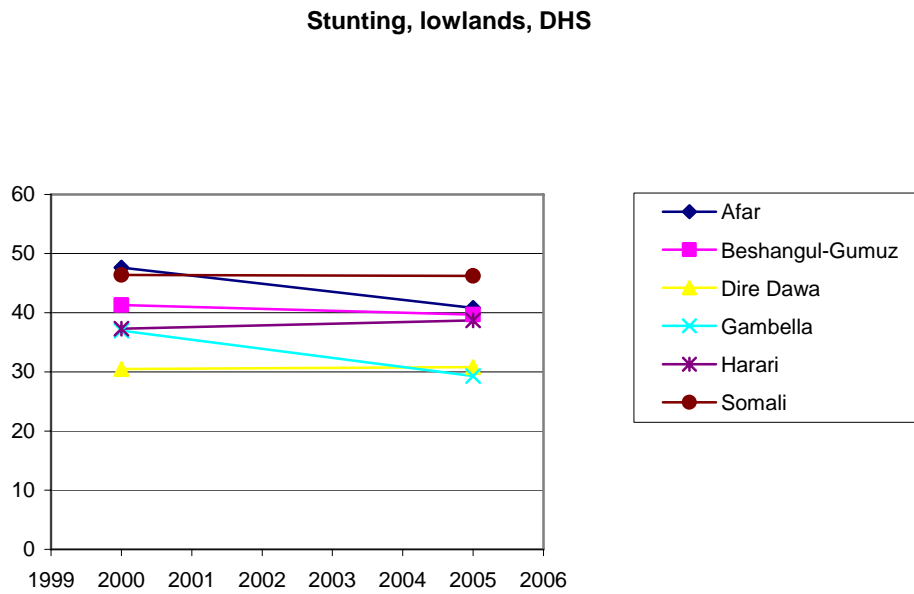
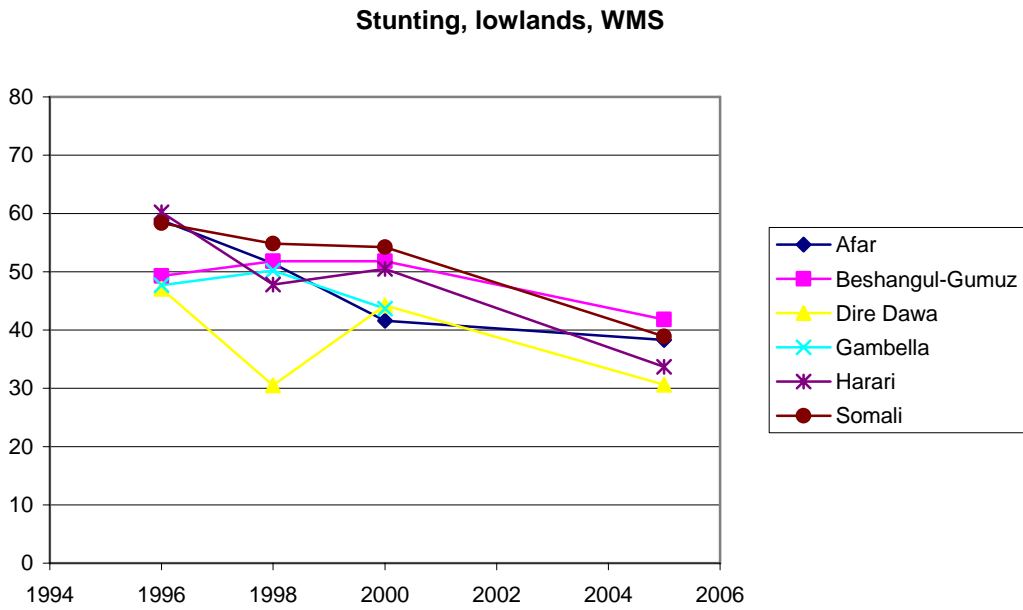
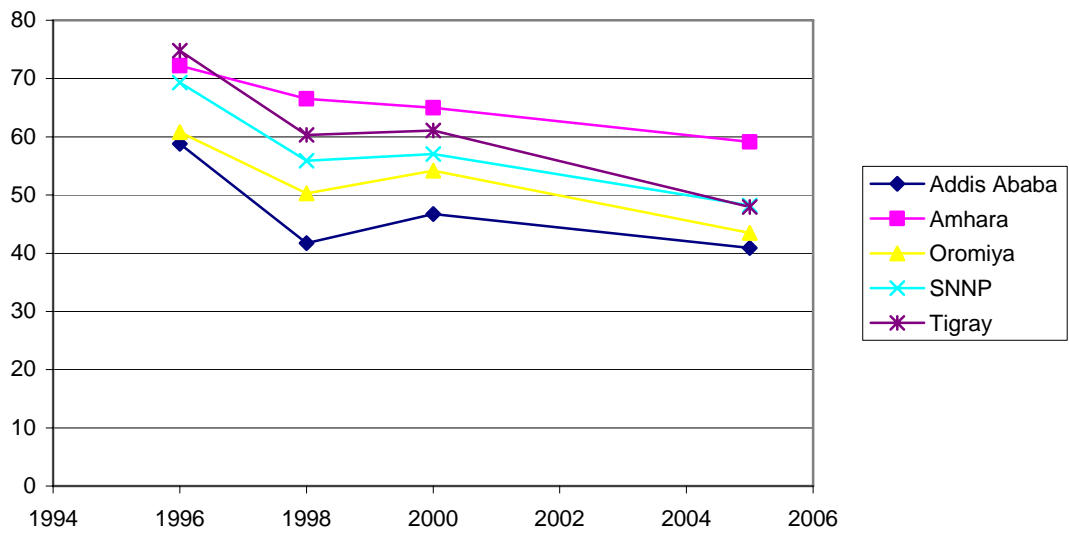


Figure 2.12. Trends in prevalences of stunting, from CSA/WMS and DHS surveys, by region in Ethiopia, 1996-2005.



Stunting, highlands, WMS



Stunting, highlands, DHS

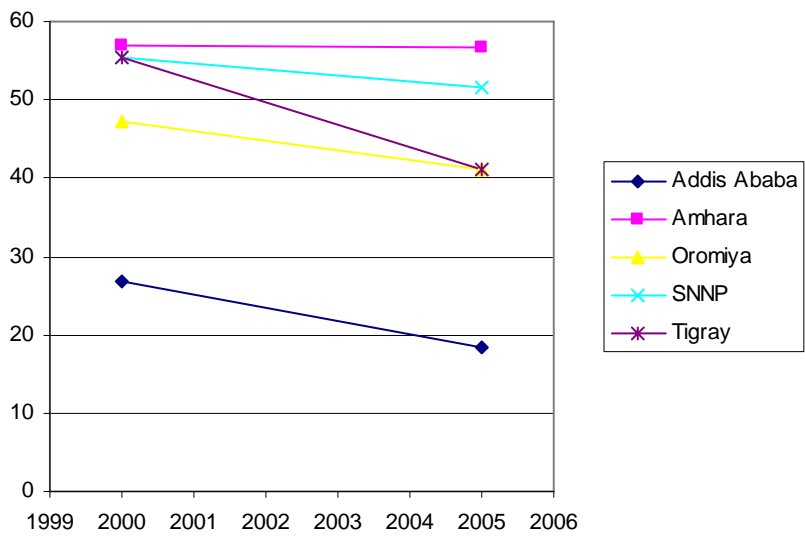


Figure 2.13. Trends in prevalences of underweight children by region in Uganda, 1988-2001.

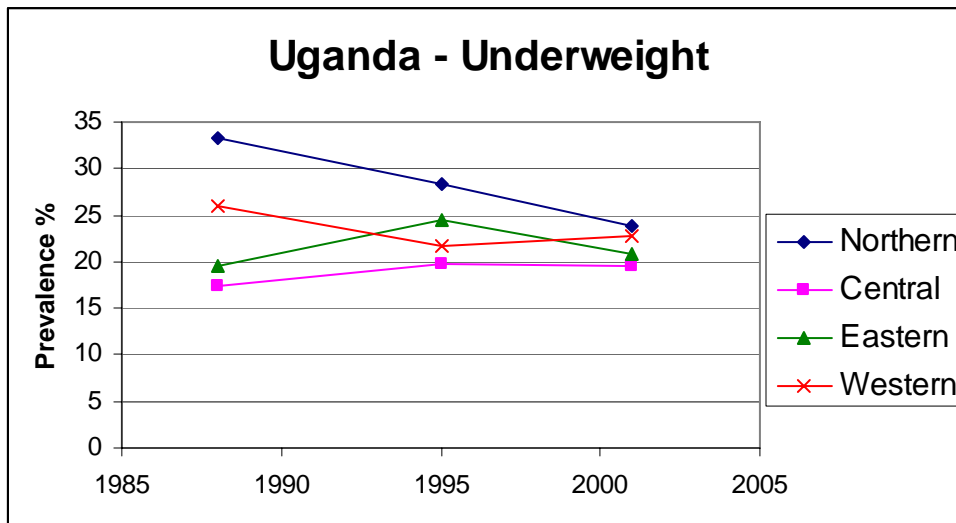
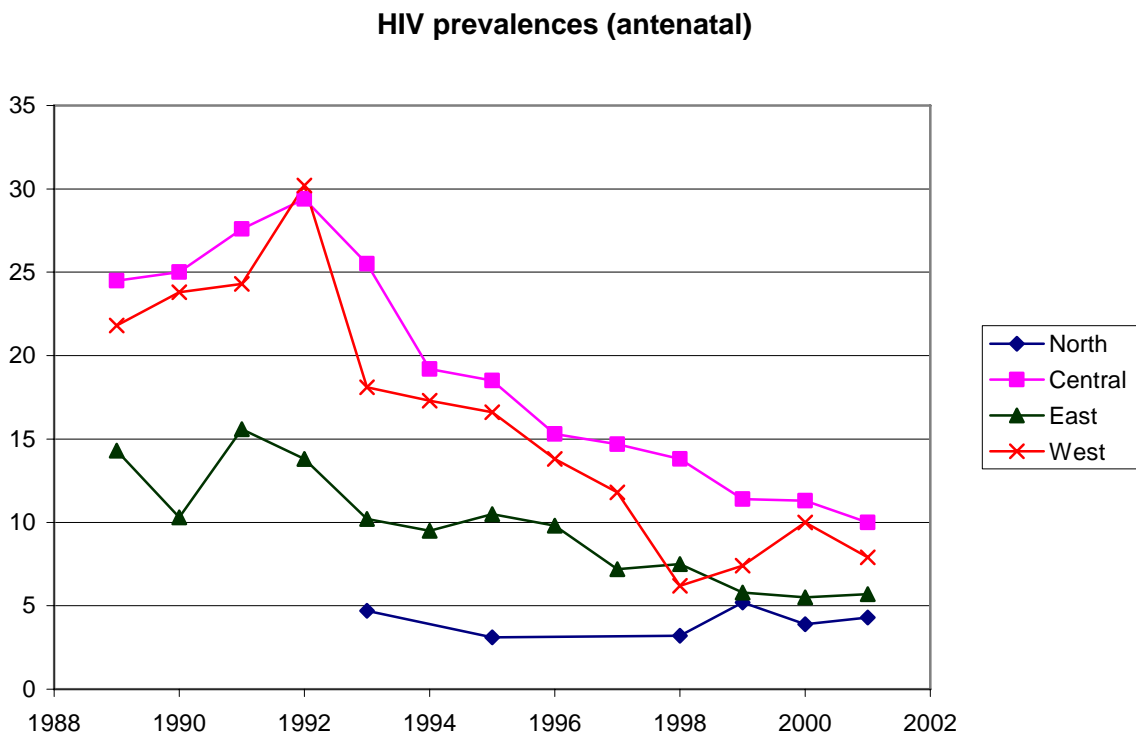


Figure 2.14. Trends in prevalences of HIV-positive women from antenatal clinic surveillance in Uganda, averaged by region, 1989-2001



SECTION 3:

Table 3.1: Coefficient corresponding to years with significant increase in wasting prevalence compared to excluded year

Variable	Ethiopia	Kenya	Somalia	S. Sudan	Uganda
2000	7.179 (.000)	5.574 (.041)	1.678 (.299)	N/A	
2001	1.502 (.423)	2.856 (.305)	3.936 (.057)		
2002	4.449 (.0100)			2.715 (.116)	
2003	5.763 (.001)	9.507 (.001)	2.444 (.200)	1.870 (.229)	2.961 (.127)
2004		9.344 (.001)	6.093 (.001)	-.881 (.589)	-.524 (.712)
2005	2.294 (.252)	7.336 (.002)	-2.344 (.336)	.150 (.896)	

Cells represent: Unstandardized coefficients (p-values)

Table 3.2: Coefficient corresponding to differences in wasting prevalence by season

Variable	Ethiopia	Kenya	Somalia	S. Sudan	Uganda
Moderate	3.904 (.008)	-1.265 (.578)	- 2.861 (.028)	1.004 (.446)	.705 (.710)
Hunger	2.676 (.036)	1.894 (.321)	- 3.898 (.059)	3.713 (.014)	.370 (.810)
Post Harvest					

Cells represent: Unstandardized coefficients (p-values)

Table 3.3: Adjusted means by livelihood and IDP status

	Ethiopia	Kenya	Somalia	S. Sudan	Uganda
Pastoral	17.3 (18)	18.8 (33)	16.1 (50)	N/A ³¹	22.2 (7)
Agro-Pastoral	13.0 (15)	20.4 (4)	16.3 (14)	N/A	4.5 (3)
Agricultural	10.1 (50)	N/A (0)	12.4 (7)	N/A	6.6 (32)
Urban	N/A	18.6 (7)	16.0 (17)	N/A	5.1 (3)
IDPs	19.4 (8)*	N/A	15.4 (18)**	27.6 (5)	8.3*** (21)
Non-IDPs	12.8 (83)	N/A	15.9 (70)	20.6 (130)	5.5 (15)

Cells represent: adjusted mean (n)

* IDPs are all in Somali region

** IDPs are spread across several regions

*** IDPs are concentrated in Northern province.

³¹ Note that no data on livelihoods was available for Southern Sudan.

Figure 3.1: Ethiopia GAM (%) by Year and Season Pooled

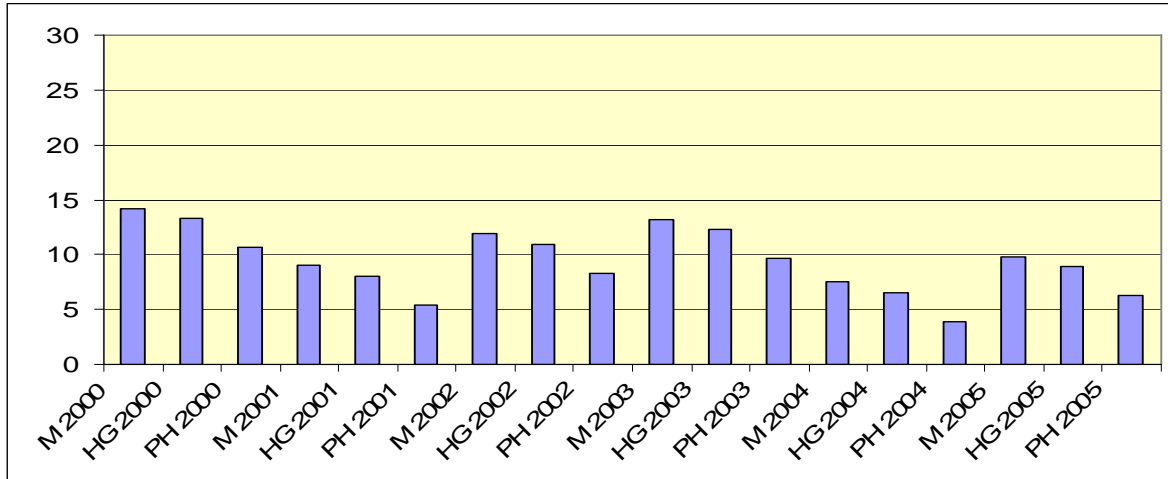


Figure 3.2. Eastern and North East Kenya GAM (%) by Year and Season Pooled

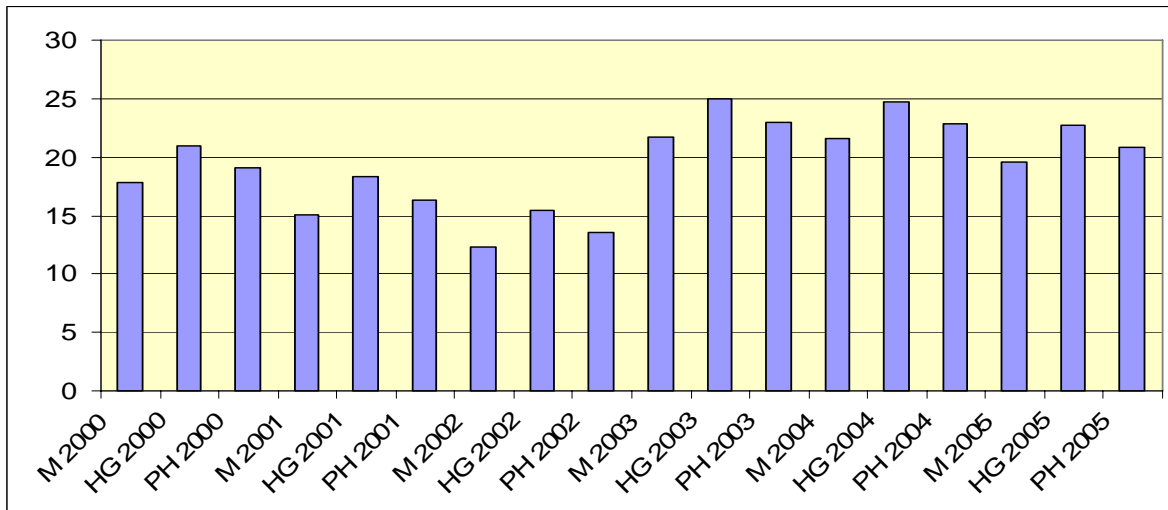


Figure 3.3 Somalia: GAM (%) by Year and Season Pooled

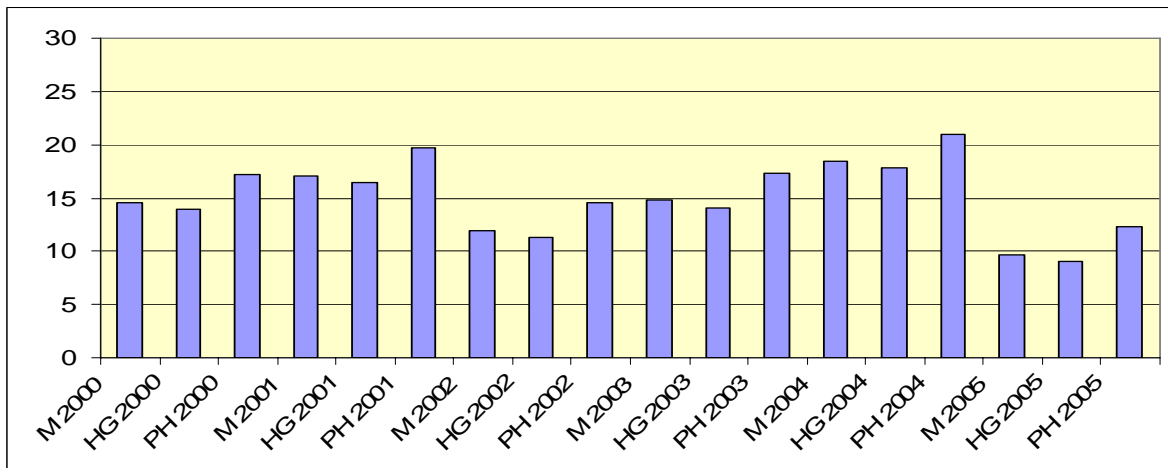


Figure 3.4. Southern Sudan: GAM (%) by Year and Season Pooled

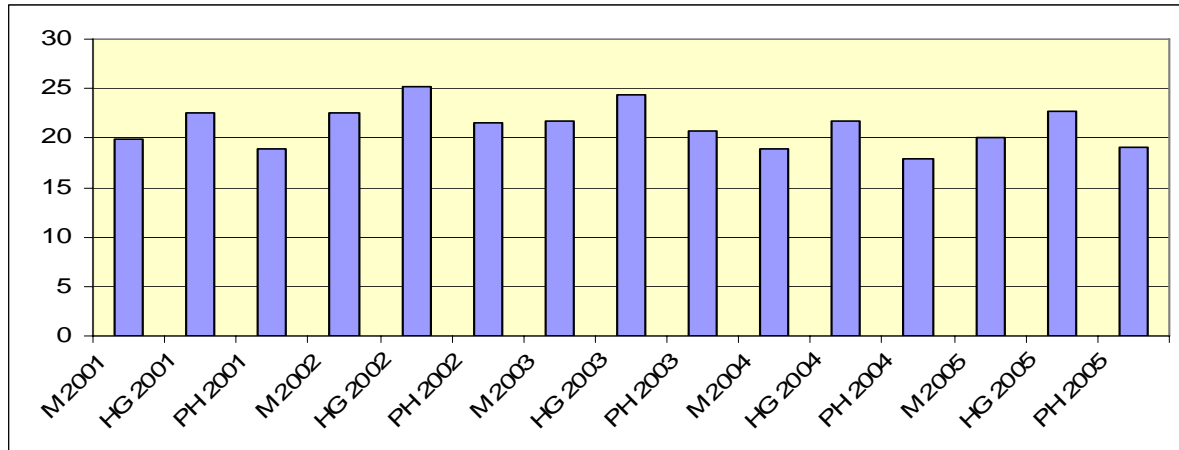


Figure 3.5. Northern and North Eastern Uganda: GAM (%) by Year and Season Pooled³²

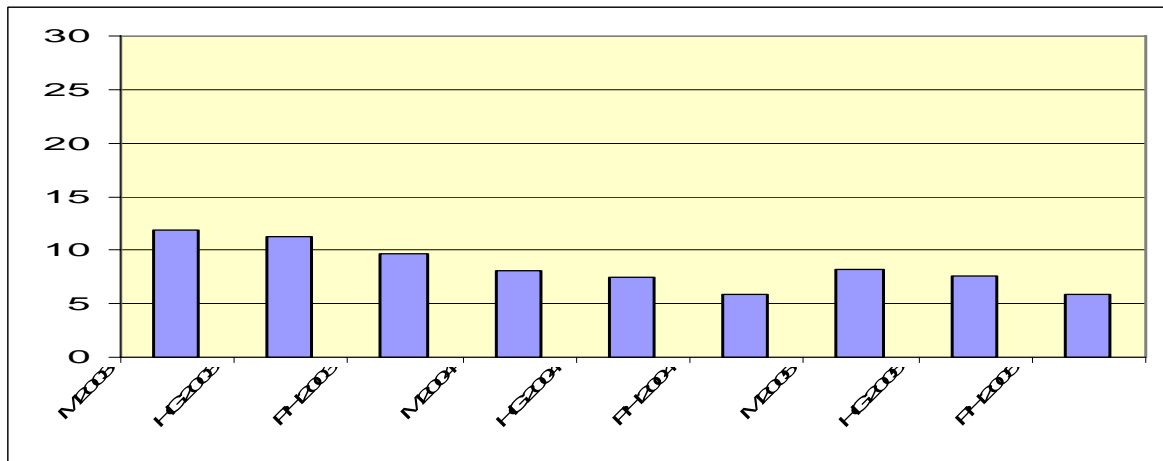
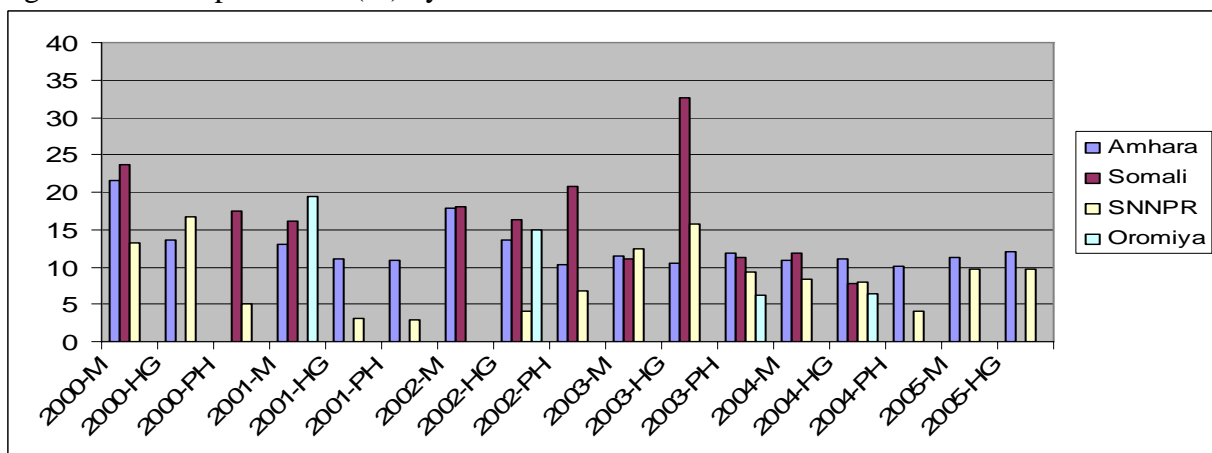


Figure 3.6. Ethiopia: GAM (%) by Season-Year and Area



³² Due to large variations between regions and lack of data points for other regions, we are only displaying adjusted GAM trends for the years nutrition data was available in Northern province (i.e. 2003-2005).

Figure 3.7. Kenya: GAM (%) by Season-Year and Area

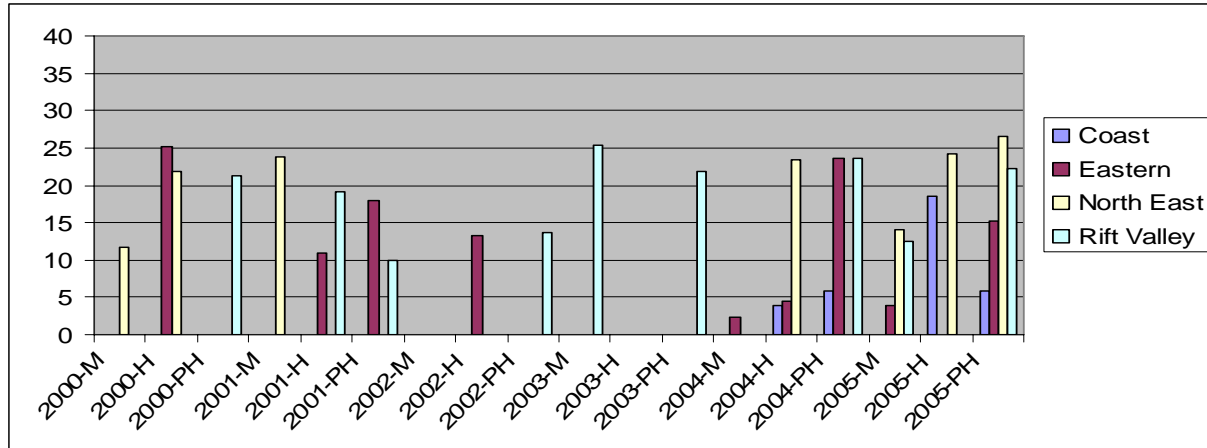


Figure 3.8. Somalia: GAM (%) by Season-Year and Area

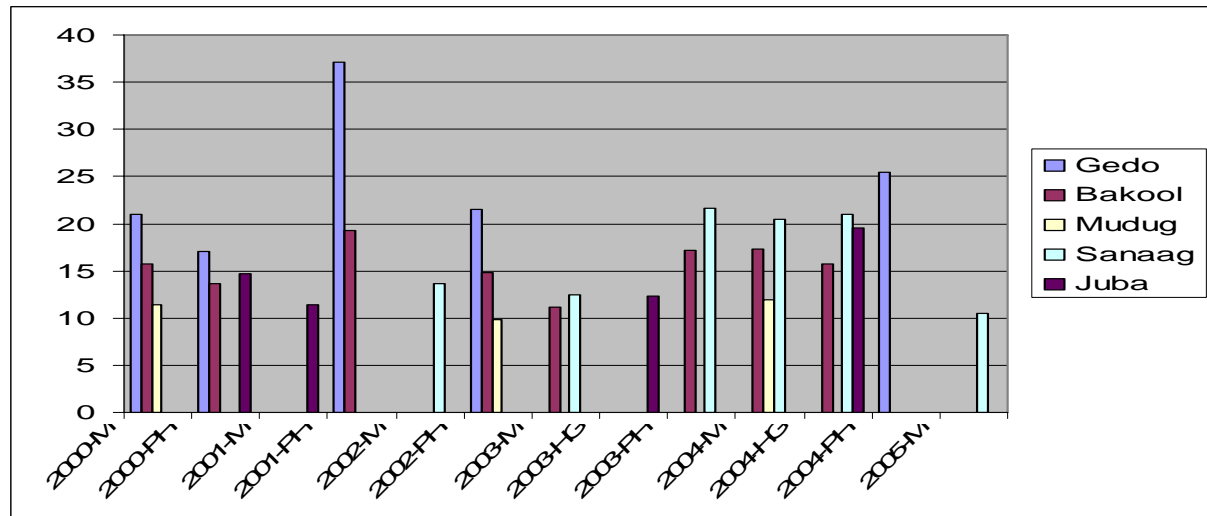


Figure 3.9. Southern Sudan: GAM (%) by Season-Year and Area

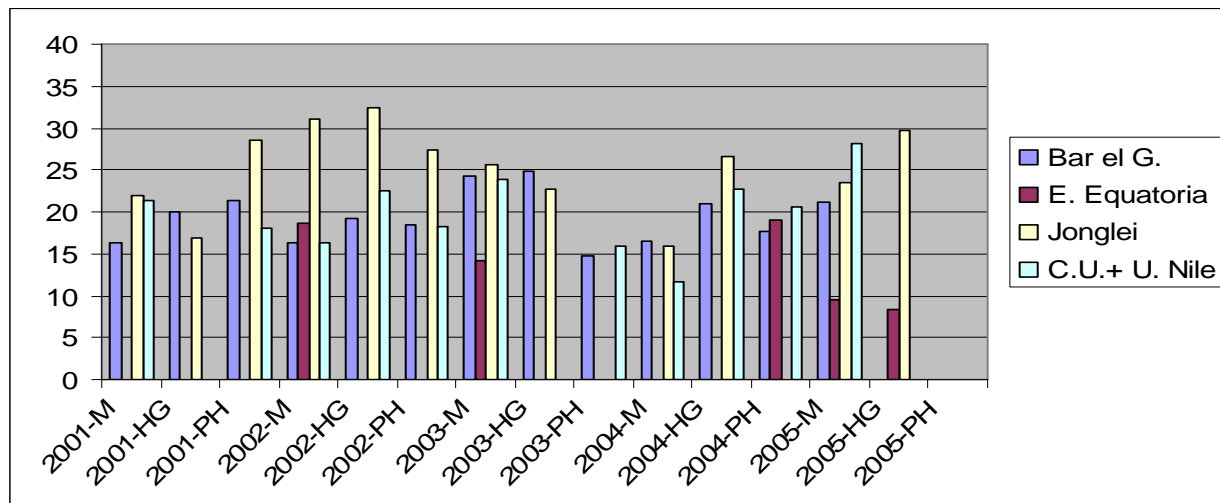


Figure 3.10. Uganda: GAM (%) by Season-Year and Area

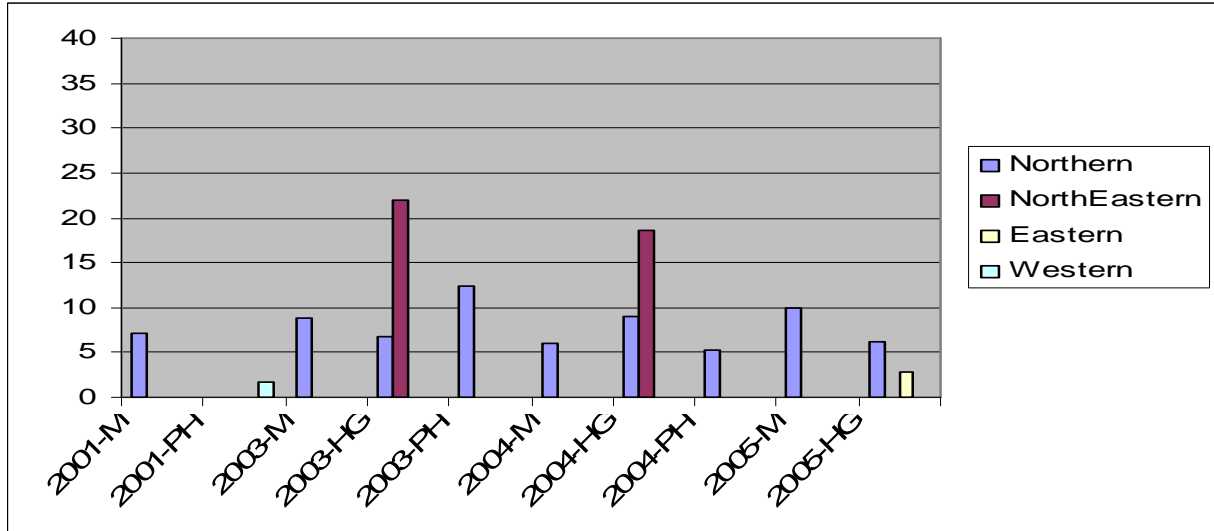
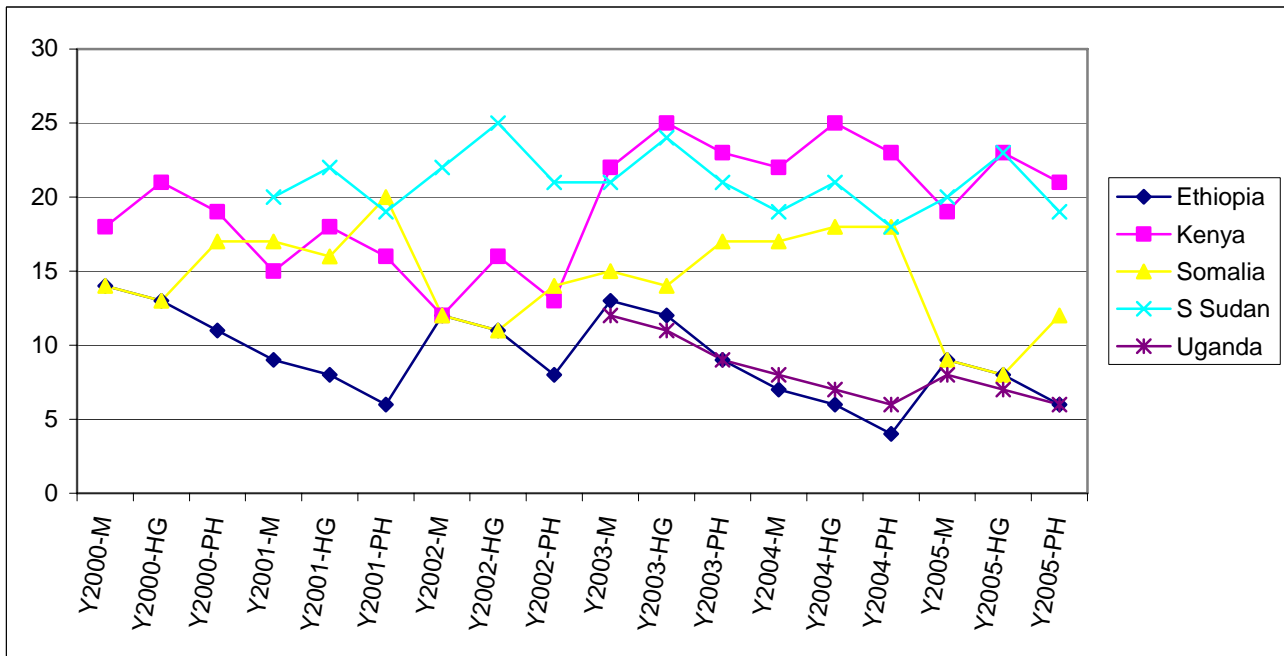


Figure 3.11. GAM (%) by Season-Year and Country



SECTION 4:

Table 4.1. Datasets used in these analyses.

Number	Area	N	Filenames	Comment
1	Sool, Somalia	901	Sool dataset.sav Aggr-sool.sav	
	Gulu, Uganda camps	5451	guluB.sav	Low prevs (0-10% by camp); not used for main analyses.
2	Jilibi, Somalia	913	jilibB.sav aggr-jilib.sav	
3	Kajo Keji, S Sudan	915	kajoB.sav aggr-kajo.sav	Prevs about 6%, not used in later analyses.
4	Kotido, Uganda	931	kotidoB.sav aggr-kotido.sav	
5	Moroto, Uganda	952	morotoB.sav aggr-moroto.sav	
6	Nakapi, Uganda	897	nakapiB.sav aggr-nakapi.sav	
7	Akobo, S Sudan	925	akoboB.sav aggr-akobo.sav	
	Combined aggr	208	Aggr-seven.sav	Combines w/h and ac prevs by cluster (or similar area, approx 30 by dataset)

Table 4.2. Relationships between prevalences estimated by whz <-2SDs and by low AC defined by different cut-points, by dataset (children 12-59 months).

Survey	Prevs from WHZ <-2SDs	Prevalences from AC, cms			Se+Sp using AC, @ best cut-point		Se + Sp using AC/ht z-score, @ cut-point -2.5z	
		<13 cm	<12.5 cm	<12 cm	by cluster**	by individual	by cluster**	by individual
Sool	12.8%	9.3% *			1.48 (10%)	1.31	1.35 (15%)	1.53
Gulu	4.1%		4.9%		1.44 (5%)	--		
Jilibi	17.1%	16.8%	9.4%	5.5%	1.48 (20%) 1.20 (15%)	1.33	1.30% (20%)	1.29
Kajo	6.5%	7.4%	4.0%	1.7%	1.27 (5%)	1.36	1.32 (5%)	1.46
Kotido	15.1%	18.7%	9.8%	4.8%	1.78 (15%)	1.42	1.26 (15%)	1.33
Moroto	21.8%	26.7%	18.3%	10.4%	1.08 (20%) 1.43 (15%, @13)	1.39 [1.48@13]	1.17 (25%)	1.43
Nakapi	16.8%	22.1%	14.4%	5.4%	1.39 (15%) [1.32@13] 1.26 (20%) [1.43@13]	1.28 [1.34@13]	1.22 (20%)	1.26
Akobo	19.5%	16.4% *	8.4%	2.2%	1.26	1.31	1.38 (20%)	1.33

Note: best cut-points are highlighted for AC; for AC/ht, in 5 of the 7 surveys the best match was at Ac/ht < - 2.5 SDs prevalence; for Kotido and Akobo it was at -3.0 SDs.

* extensive clumping of AC = 13.0 cms

** the % in brackets (e.g. 10% for Sool) is the prevalence cut-point that the classification power is estimated at, for both whz- and AC-derived indicators.

Table 4.3. Child-level classification by AC (<13.0 cms) and whz (<-2SDs), Sool, children 12-59 months; numbers of children shown in cells

		Whz		Total
		<-2SDs	>=-2SDs	
Arm circ	<13.0	38	38	76
Cms	>=13.0	66	671	737
	Total	104	709	813

Chi-sq (p<0.001) Se 0.365 Sp 0.946 Se+Sp 1.312

Table 4.4. Cluster-level classification by AC < 13.0 cms and whz , -2SDs, prevalences cut at 10% for both, Sool, children 12-59 months; numbers of clusters shown in cells, classified by prevalence within each cluster.

		Prevalence whz <-2SDs		Total
		>= 10%	< 10%	
Prevalence AC < 13.0 cms	>= 10%	10	2	12
	< 10%	6	12	18
	Total	16	14	30

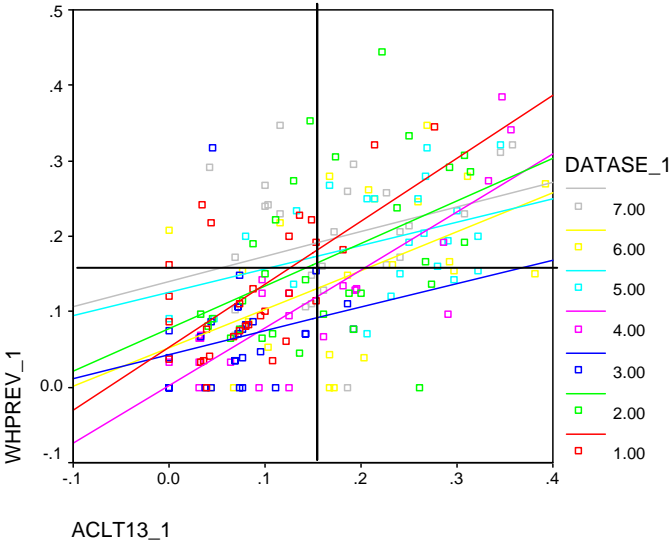
Chi-sq (p<0.01) Se 0.625 Sp 0.857 Se+Sp 1.482

Table 4.5. Classification of areas defined as having \geq or $<$ 15% prevalence of $<$ -2SDs whz, or of $<$ 13.0 cms AC, data merged from datasets 1,2,4-7; children 12-59 months; numbers of clusters are in cells.

		Prevalence whz <-2SDs		Total
		\geq 15%	$<$ 15%	
Prevalence	\geq 15%	57	22	79
AC $<$ 13.0 cms	$<$ 15%	23	58	81
Total		80	80	160

Chi-sq Se 0.713
P<0.001 Sp 0.725
 Se+Sp 1.438

Figure 4.1. Scatterplot of prevalences by area of <-2SDs whz and < 13.0 cms AC.



Note definitions as follows:

Table 4.6. Jilibi

MUALT11 * WHPR3SD Crosstabulation

Count

		WHPR3SD		Total
		.00	1.00	
MUALT11	.00	739	21	760
	1.00	17	3	20
Total		756	24	780

MUALT12 * WHPR3SD Crosstabulation

Count

		WHPR3SD		Total
		.00	1.00	
MUALT12	.00	718	19	737
	1.00	38	5	43
Total		756	24	780

Se+Sp for Ac = 11 is 1.10, for AC = 12 is 1.16.

Moroto

MUALT11 * WHPR3SD Crosstabulation

Count

		WHPR3SD		Total
		.00	1.00	
MUALT11	.00	719	28	747
	1.00	24	11	35
Total		743	39	782

MUACL12 * WHPR3SD Crosstabulation

Count

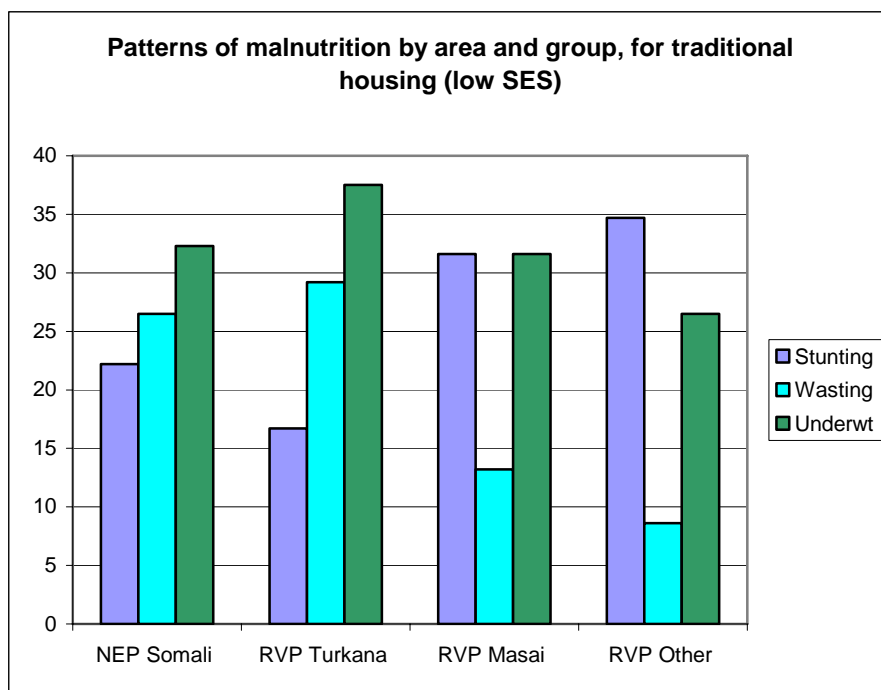
		WHPR3SD		Total
		.00	1.00	
MUACL12	.00	675	23	698
	1.00	68	16	84
Total		743	39	782

Se+Sp for Ac = 11 is 1.26, for AC = 12 is 1.32.

Table 4.7. Stunting, wasting and underweight prevalence by province, ethnic groups and socio-economic status (roofing).

Province	Group	Roofing	Stunting	Wasting	Underweight	n
North Eastern	Somali	Grass	22.2%	26.5%	32.3%	279
		Tin	28.6%	11.4%	30.6%	36
		Total	23.2%	24.5%	32.0%	319
Rift Valley (RVP)	Turkana	Grass	16.7%	29.2%	37.5%	48
		Tin	26.7%	0%	13.3%	15
		Total	20.0%	23.0%	30.0%	90
	Masai	Grass	31.6%	13.2%	31.6%	38
		Tin	30.0%	6.7%	20.0%	30
		Other	29.1%	17.7%	34.2%	79
		Total	30.3%	14.5%	29.6%	152
	Other	Grass	34.7%	8.6%	26.5%	245
		Tin	30.7%	3.8%	20.2%	477
		Total	31.9%	6.0%	22.7%	767

Figure 4.2. Patterns of malnutrition by area and group, for traditional housing



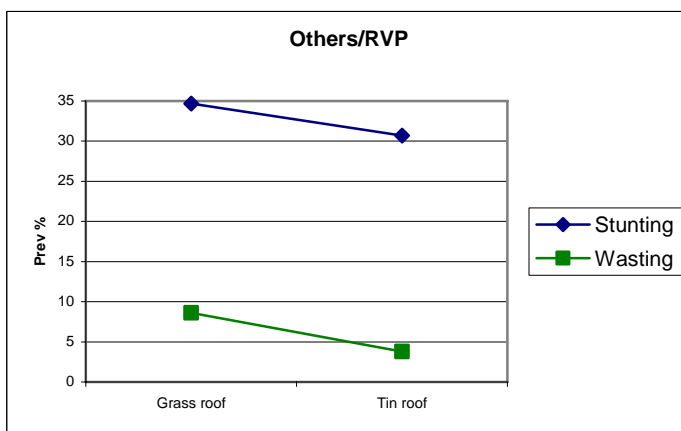
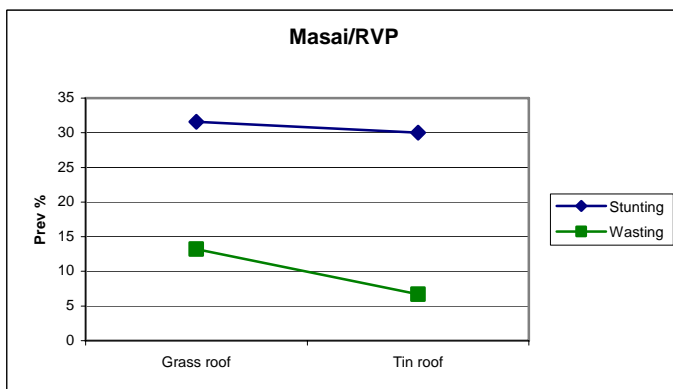
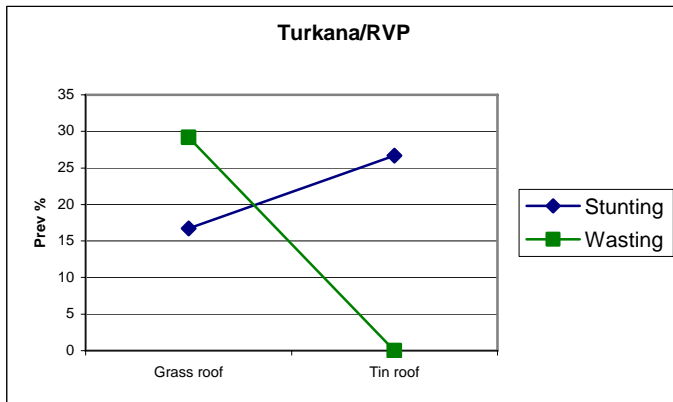
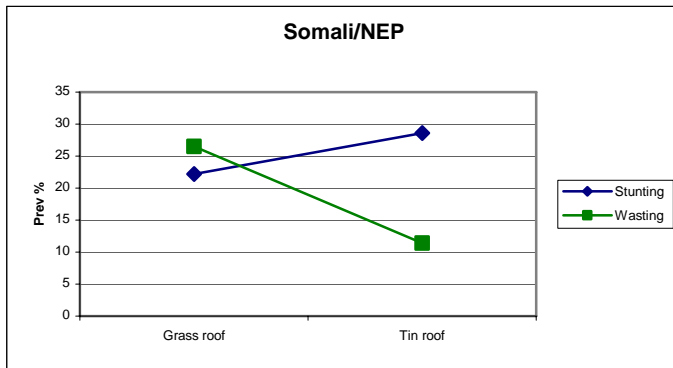


Figure 4.3
 Patterns of stunting and wasting by ethnic group, area, and SES (as roofing).
 Note: slopes are significant for wasting, in Somali, Turkana., and other/RVP. No stunting slopes significant.

Table 4.8. Mean waz scores by orphan status for children 0-17 and 18-59 months old by country.

	Children 0-17 months old				Children 18-59 months old			
	Non-orphan	Maternal orphan	Paternal orphan	Double orphan	Non-orphan	Maternal orphan	Paternal orphan	Double orphan
Ethiopia	-1.21 (2575)	-2.04 (8)	-1.21 (34)	--	-1.89 (6227)	-1.82 (82)	-1.87 (201)	-1.79 (14)
Kenya	-0.50 (1553)	-0.08 (5)	-0.56 (30)	0.17 (2)	-1.11 (3192)	-1.00 (26)	-1.00 (149)	-1.21 (18)
S Sudan	-1.06 (325)	-0.47 (1)	-0.73 (28)	--	-1.32 (556)	-0.73 (6)	-1.54 (66)	-0.23 (6)
Uganda	-0.86 (1797)	-2.11 (2)	-1.20 (19)	--	-1.16 (3628)	-1.43 (31)	-1.22 (140)	-1.08 (7)

Sources: Ethiopia, DHS 2000; Kenya, DHS 2003; Sudan, MICS 2000; Uganda, DHS, 2000/1. Data extracted from Rivers et al, 2004 and 2005³³.

³³ Rivers J, Silvestre E, Mason J (2004). Nutritional and Food Security Status of Orphans and Vulnerable Children: Report of a Research project supported by UNICEF, IFPRI, and WFP. Dec 2004.

Rivers J, Mason J, Silvestre E, Mahy M, Monasch R, Gillespie S. (2005) The Nutrition and Food Security Status of Orphans and Vulnerable Children in Sub-Saharan Africa. Paper presented at the International Conference on HIV/AIDS and Food and Nutrition Security, Durban, April 2005; forthcoming in Conference Proceedings.

Table 4.9. Age-adjusted mean waz scores by orphan status and whether parent is in household, for children 0-17 and 18-59 months, by country.

Age month	Mother dead		Father dead		Both alive				Both dead	
	Father not in hh	Father in hh	Mother not in hh	Mother in hh	Both in hh	Father not in hh	Mother not in hh	Neither in hh		
Ethiopia	0-17	-2.061 (4)	-1.485 (4)	--	-1.208 (34)	-1.232 (2189)	-1.106 (375)	-1.116 (2)	-0.0375 (9)	--
	18-59	-1.898 (39)	-1.748 (43)	-1.406 (14)	-1.907 (187)	-1.903 (5026)	-1.882 (848)	-1.595 (75)	-1.659 (278)	-1.790 (14)
Kenya	0-17	0.530 (4)	-2.520 (1)	0.439 (1)	-0.592 (29)	-0.504 (1105)	-0.492 (434)	-0.160 (5)	0.378 (9)	0.166 (2)
	18-59	-0.660 (13)	-1.342 (13)	-0.655 (13)	-1.035 (136)	-1.119 (2299)	-1.094 (733)	-0.593 (30)	-1.147 (130)	-1.211 (18)
S Sudan	0-17	--	-0.484 (1)	-0.0833 (2)	-0.775 (26)	-1.123 (279)	-0.670 (41)	--	-1.187 (4)	--
	18-59	--	-0.734 (6)	-2.096 (4)	-1.509 (62)	-1.331 (471)	-1.245 (75)	--	-1.320 (6)	-0.231 (6)
Uganda	0-17	-2.109 (2)	--	-1.321 (2)	-1.188 (17)	-0.865 (1406)	-0.874 (376)	--	-0.362 (15)	--
	18-59	1.441 (14)	-1.425 (17)	-0.635 (20)	-1.322 (120)	-1.160 (2753)	-1.158 (634)	-0.890 (60)	-1.232 (181)	-1.082 (7)

Note: cells with n > 30 are bolded; smaller n's should be considered unreliable.
 Extracted from Annex 4 of Rivers et al, 2005 (pp 53 on)

Table 4.10. Calculated prevalences of underweight (and n) by orphan status and whether parent is in household, for E Africa region, children 18-59 months.

Orphan type	Parent in household?			
	Father only in hh	Mother only in hh	Both in hh	Neither in hh
Maternal	25.5% (110)	NA	NA	32.5% (91)
Paternal	NA	30.1% (880)	NA	16.2% (87)*
Double	NA	NA	NA	26.0% (73)
Non-orphan	19.8% (227)* (mother not in)	29.3% (3,104) (father not in)	28.8% (14,302)	24.8% (860)*

NA: not applicable.

*: cell prevalence significantly lower than non-orphan, both in household (28.8%); no other cells significantly different from this.