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Division of Agricultural Statistics (DSA)

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Research Report

Nutritional Situation of Young Children in Rwanda: An Analysis of Anthropometric data collected by the Household Living Conditions Survey 1999 – 2001.

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1. INTRODUCTION

The high prevalence of child malnutrition has plagued Rwanda since the first studies in the 1970s documented high rates of stunting and wasting. The problem has been compounded by periodic occurrences of political and social unrest over the last three decades. Over the years, wasting or acute episodes of malnutrition have remained high. While the repeated and prolonged periods of civil unrest have undoubtedly contributed to the high prevalence of hunger, poverty and chronic malnutrition that plague Rwanda, nutrition outcome for children less than five years old is determined by numerous factors including feeding practices, exposure to disease, and care given to children.

Between 1999 and 2001, the Rwandan government, undertook a nationally-representative Household Living Conditions Survey ((*Enquête Intégrale sur les Conditions de Vie des ménages* or EICV as it will be referred to in this report). The primary objective of this survey was to provide the Rwandan government and donor community with an assessment of the poverty situation in Rwanda. The survey gathered information on a wide range of economic and social issues (e.g. employment, health, education, incomes, expenditure, subsistence agriculture, consumption, migration and access to basic services). The survey also collected information on the sex, age, weight and height of children 3 to 59 months old in order to assess their nutritional situation.

In addition to the data collected in the EICV survey, the Ministry of Economy and Finance collaborated with the Farming Systems Research Project of the Division of Agricultural Statistics (FSRP/DSA) in the Ministry of Agriculture, to carry out three additional surveys using a sub sample of the EICV households. The FSRP/DSA surveys were focused on 1) agricultural production and land use; 2) household demographics; and 3) rural labor and death history.

This paper presents the results of descriptive analysis of the nutritional data collected in the EICV survey. As part of a larger analytical effort aimed at better understanding the factors that affect human livelihoods in Rwanda, this paper represents an initial attempt to use the anthropometric data on children's weight, height and age to determine the prevalence of stunting, wasting and underweight among Rwandan children 3 to 59 months by age groups, sex, rural/urban areas and by province. It also examines the seasonal prevalence of malnutrition and looks at the differences in nutritional outcomes in various agriculture production zones. Finally, the data are compared to malnutrition rates in other countries in the region, and to previous nutritional surveys undertaken in Rwanda over the past 10 years.

Beyond providing essential information on the character and scope of the prevalence of nutrition deficiencies in Rwandan children, the estimation of anthropometric indices in particular provide basic nutritional data that can be combined with the aforementioned socioeconomic data collected in the EICV and subsequent surveys for more in-depth analysis of the living situation in Rwanda. Although the EICV and subsequent surveys address the problem of household food production and consumption, they did not collect data on the other main determinants of child nutrition, namely health and care. A comprehensive nutritional analysis that enables us to more fully understand why so many children suffer from malnutrition in Rwanda will not be possible until additional information is collected on the basic, underlying and immediate determinants of child survival, growth and development[3].

[3] UNICEF 1996. UNICEF has developed a conceptual framework outlining the mechanisms through which nutritional outcomes are determined. Basic determinants include the political, economic, cultural and social structure

2. BACKGROUND

Rwanda is a small country in central Africa, surrounded by Uganda, Burundi, Tanzania and the Democratic Republic of Congo. It is the most densely populated country in Africa. The vast majority of the population of Rwanda lives in rural areas and is engaged mainly in subsistence agriculture that is constrained by increasing land pressure and declining agricultural productivity. The average farm size has been estimated to be a little more than two-thirds of a hectare (.71 hectares), a decline from pre-war levels of 1991 (1.06 hectares)[4]. Declining soil fertility, very low use of productivity enhancing inputs, and increasing problems with crop pests and diseases all contribute to low agricultural productivity.

These constraints make it increasingly difficult for farm families to meet their basic food needs. In fact, food insecurity is widespread in Rwanda. Analysis of EICV survey data reveals that over 70 % of the rural population is considered to be food poor (compared to 30% in urban areas).[5]

Poverty not only directly affects the ability of households to secure the necessary food to meet the calorie and nutrient requirements of its members, it can also decrease the ability of a household to provide a "healthy environment" for children in which to grow and develop. A healthy environment includes access to potable water, proper means to dispose of waste, adequate hygiene (personal and environmental), adequate care for sick children, access to education, among others. Without a healthy environment, children are at increased risk of exposure to disease.

Maintaining good health is essential for children to grow and develop at normal rates. There is a high prevalence and vulnerability to communicable diseases such as malaria, meningitis, and high risks of cholera in Rwanda. Diarrheal diseases are common among children and diarrhea has the most marked effect on anthropometric status[6]. Infections may reduce a child's appetite, decrease nutrient absorption by the body, increase metabolic requirements or cause direct nutrient loss; all of these outcomes of disease may adversely affect a child's growth.

Sexually transmitted diseases and HIV infection are also growing problems in Rwanda. Estimates as to HIV infection vary but the prevalence amongst adults is estimated at 11.21% as of the end of 1999.[7] Children living with a chronically ill parent face many hardships that can be detrimental to their well-being (increasing poverty, greater responsibility for household functions, less parental care, etc). Children who are orphaned by HIV/AIDS are more likely to be malnourished or fall ill and they are less likely to receive medical attention.[8]

Major national health indicators reflect the limited capacity of Rwanda's health sector to provide adequate care for the population. The 2000 National Demographic and Health Survey (DHS) estimates the infant mortality rate to be 107 per 1000 live births, the under 5 child mortality rate to be 196 per 1000 live births, and the maternal mortality rates to be 1,071 out of 100,000 live births. Immunization coverage has declined in Rwanda from 87% of children completely

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which provide the potential resources that families and communities need to ensure the underlying determinants such as household food security, care for women, adequate health services and a healthy environment. These conditions contribute to adequate dietary intake and good health for the child which in turn enable the child to grow and develop to his or hers potential.

[4] Kelly et al 2001

[5] MINECOFIN 2002. A food poverty line was estimated to be FRw 45,000 per equivalent adult per year. Food poverty is defined as the situation where food consumption expenditure falls below the food poverty line. Profile of Poverty in Rwanda

[6] World Health Organization 1995 pg. 178

[7] International Federation of the Red Cross. 2001

[8] UNICEF 2002

immunized in 1992 to 76% in 2000. Use of existing health facilities appears to be very low with only 18% of women giving birth at a health center. This compares to Malawi where 50% of women deliver their children at health centers.

3. METHOD

In children, the most common anthropometric indices used to measure growth are height-for-age (HA), weight-for-age (WA), and weight-for-height (WH). Low height-for-age (HA) is considered an indicator of shortness or stunting. It is frequently associated with poor overall economic conditions, which result in long-term, inadequate calorie intake and/or repeated exposure to illness, and other adverse conditions. Height-for-age is the recommended indicator that best reflects the process of failure of a child to reach linear growth potential.[9]

Low weight-for-height (WH) for a child is considered an indicator of thinness or wasting and is generally associated with recent or ongoing severe weight loss. Weight loss in children presenting low weight-for-height is usually due to recent illness and/or insufficient calorie intake (caused by food shortage, weaning practices or other events). Weight-for-age (WA), is primarily a composite of weight-for-height and height-for-age, and fails to distinguish tall, thin children from short, well-proportioned children. Because it is influenced by both the height of the child and the weight, it is more difficult to interpret.[10]

In this report, the anthropometric indices, height-for-age (HA) and weight-for-height (WH) are analyzed to assess the nutritional situation of children under five years of age[11]. The indices are reported in terms of Z-scores (also referred to as standard deviation (SD) units), using the CDC/WHO 1978 reference population median. The Z-score in the reference population has a normal distribution with a mean of zero and standard deviation of 1. The Z-score cutoff point recommended by WHO, CDC, and others to classify low anthropometric levels is 2 SD units below the reference median for the three indices. [12] The proportion of the population that falls below a Z-score of -2 is generally compared with the reference population in which 2.3% fall below this cutoff. Children are classified as either moderately or severely malnourished. Children with a Z-score less than -2 and equal or greater than –3 for one of the indices are considered moderately malnourished. The cutoff for *very* low anthropometric levels (to identify cases of severe malnutrition) is usually more than -3 SD units below the median.

The EICV survey consists of a sample of 6,540 households from 570 cells or enumeration areas using a two-stage design to provide estimates at prefecture (province) level. The EICV survey collected data in two stages. In urban areas, data were collected between October 1999 and December 2000 and in rural areas data were collected between July 2000 and June 2001. Anthropometric data were collected from 4100 children from 3 to 59 months old and analyzed using *EPI Info*, a computer program for recording and evaluating anthropometric data for children and adolescents.

EPI-Info extreme value flags and WHO verification guidelines were used to identify Z-score values where there is a strong likelihood that some of the data items were incorrect; these data were not used in the analysis. WHO recommends that Z-scores falling outside an acceptable

[9] Hatloy 1999
[10] WHO 1995
[11] Limiting the children participation in the survey to less than five years of age reduces the possibility of differences in height being related to genetic differences. The World Health Organization has found that genetic differences in height across healthy, well-nourished populations only account for one centimeter of variation among five year-old children (WHO 1995).
[12] ibid

range of values be excluded from the analysis. Based on the WHO "fixed exclusion range", height-for-age Z-score (HAZ) < -5 and > +3, weight-for-height (WHZ) < -4 and > +5, and weight-for-age (WAZ) < -5 and > +5, were excluded from the analysis. [13]

Of the four thousand one hundred (4100) cases available in the EIVC survey for anthropometric analysis, EPI-Info flagged one hundred eighty (180). An additional ninety-eight (98) cases were excluded from the analysis because the Z-score for one of the indices fell within the fix exclusion range or EPI-Info was unable to calculate a Z-score for one of the three indices due to missing data. Only cases with Z-scores for all three anthropometric indicators (HAZ, WAZ, WHZ), falling within the acceptable range and not flagged, are used in the analysis of the report (3822 cases, 93.2% of the total cases across rural and urban samples).

[13] Technical Report Series (WHO). N0. 854-858. 1995.

4. PREVALENCE OF CHILDHOOD MALNUTRITION

Results from the EICV survey show that the prevalence of malnutrition among children under five years old is high, particularly for stunting. The mean height-for-age (HA) Z-score for sample children is –1.76 (SD of 1.44). This low mean HAZ score indicates that the average nutritional status of children is considerably lower than that of children in the reference population (where the mean HAZ = 0). The higher standard deviation (1.44 in this sample verses 1 for the reference group) reflects the greater variability of HAZ scores in this study relative to the well-nourished group.

Table 1 indicates that 45 % of Rwandan children between 3- 59 months had HAZ scores <-2 (indicating stunting) and 3.4% had WAZ scores < -2 (indicating wasting). In a well-nourished population such as the reference groups, only 2.3 percent of the children would be expected to fall below the cutoff and thus be classified as stunted or wasted.

Table 1 –Prevalence of Malnutrition for Rwandan Children, 3 – 59 months

	Percent Malnourished		Z-Score	
	Moderate and severely malnourished (Z-score below < -2)	**Severely malnourished (Z-score below < -3)**	**Mean**	**Standard Deviation**
Height-for-age (stunting)	45.0 %	20.1 %	-1.76	1.44
Weight-for-height (wasting)	3.4 %	.7 %	.07	1.14
Weight-for-age (Underweight)	21.7 %	3.9 %	-1.06	1.19

Source: EICV database, MINECOFIN 2002.

The extremely high prevalence of stunting (45 %) is of particular concern because it represents children's failure to grow. A low height-for-age is likely to have long-term impacts on both the physical and mental capacity of affected children. As Table 1 shows, 20% of stunted children had HAZ scores <-3, a level indicating severe stunting.

Comparisons of results for male and female children in Rwanda reveal that girls experience a much lower prevalence of stunting than boys and they have a slightly lower prevalence of wasting than do boys (table 2). Other studies undertaken in Sub-Saharan Africa have found that male children are "slightly more likely to be stunted" than girls (Sahn and Stifel 2001).

Table 2: Prevalence of Stunting and Wasting by Sex

	Height-for-Age Z-score Indicating Stunting				Weight-for-Height Z-score Indicating Wasting			
Sex	%>-2	Mean HAZ	SD	No. observations	%>-2	Mean WHZ	SD	No. observations
Boys	47.1*	-1.83	1.43	1853	3.4	0.03	1.13	1853
Girls	43.1*	-1.7	1.46	1969	3.3	0.11	1.15	1969

Source: EICV database, MINECOFIN 2002.

SD – Standard Deviation; larger SD indicates more variability in data

* Indicates the two rates of prevalence are different (statistically significant at .05 level).

4.1. Prevalence of Stunting and Wasting by Age Group

Disaggregating anthropometric results by age group helps identify the periods when child fail to thrive. With adequate care and nourishment, infants grow rapidly during the first six months of life. At approximately 6 months, the growth rate in infants slows considerably and continues to decline with age. Children may still exhibit marked growth spurts, especially during the first year of life. For children to thrive they must consume adequate amounts of appropriate food to meet their calorie and nutrient requirements and they must remain in good health.

The first two years of life corresponds with a child's weaning period. WHO and UNICEF recommend that from birth to 6 months infants are exclusively breastfed. At around 6 months, solid foods should be gradually introduced to the child's diet with continued breastfeeding up to or beyond 2 years of age. The Rwanda DHS-2000 survey results found that 84% of children under 6 months are exclusively breastfeed and that 79% of children between 6-9 months are being fed solid foods in addition to breast milk as recommended by WHO and UNICEF.

Despite these positive feeding behaviors, analysis of the EICV survey data by age indicate a pattern of heightened nutritional vulnerability starting at about 6 months and peaking during children's second year of life. As shown in table 3 below, the prevalence of wasting reaches a peak of 6.8% for the 12-17 month age group with a slight decline to 6.6% for the 18-23 month age group.

Although the majority of children are being fed according to the recommended practices, problems can develop when supplemental foods are of low nutritional value and do not provide the necessary calories and nutrients for optimal growth and development. The quality of the food and drinking water as well as a clean environment and proper sanitation are also of concern. Unhygienic conditions can increase exposure to diseases for a child, especially as children become more mobile. The EICV survey did not collect data on these issues.

Table 3: Prevalence of Stunting and Wasting by Age Group

Age group (months)	# of cases	% with diarrhoea[3]	Height-for-Age **Indicating Stunting**			Weight-for-Height **Indicating Wasting**		
			Mean[1]	SD[2]	%<-2.00	Mean	SD	%<-2.00
3-5	233	17.2	-0.50	1.23	11.6 %	.77	1.30	1.3 %
6-11	453	30.8	-1.35	1.41	34.4 %	.26	1.35	4.2 %
12-17	498	38.8	-1.85	1.32	44.0 %	-.14	1.34	6.8 %
18-23	334	28.1	-2.20	1.35	58.4 %	-.01	1.25	6.6 %
24-35	637	21.1	-1.75	1.55	45.7 %	-0.12	1.02	2.4 %
36-47	830	13.3	-1.87	1.45	47.2 %	0.05	0.93	2.3 %
48-59	837	11.0	-2.01	1.31	52.6 %	0.12	0.98	2.0 %
Total	3822	21.0	-1.75	1.55	45.0 %	-0.12	1.02	3.4 %

Source: EICV database, MINECOFIN 2002.

[1] All mean HAZ scores were statistically different from zero.

[2] SD – standard deviation; indicates the variability of the underlying data used in estimating the mean for the age group.

[3] Percentage of positive responses to the question: "Did *'child's name'* have diarrhea the past 15 days?"

Diarrhea is a common childhood illness in Rwanda. When children are sick, especially when they have diarrhea, their appetite decreases and their body uses the food they eat less effectively. Children can easily become dehydrated and malnourished when they have diarrhea. EIVC data reveal that approximately 39 % of children 12-17 months and 28% of children 18 – 23 months were reported to have suffered from diarrhea in the two weeks prior to the survey. These two age groups also reported the highest prevalence of wasting (6.8% and 6.6% respectively). After the second year of life, the percentage of children reported to have suffered from diarrhea declines with age.

The largest decline in wasting (from 6.6% to 2.4%) is observed in moving from the 18-23 to the 24-35 month group suggesting that a child's second birthday marks an important change in his/her ability to deal with factors that result in wasting (food intake levels and disease). After the second year, the percentage of children suffering from diarrhea also declines. By the time a child reaches 4 years (the 48-59 month age group) the prevalence of wasting is 2.0% and in this age group only 11% of children were reported to have suffered from diarrhea.

The prevalence of stunting surprisingly reaches a peak for children early in life. The EICV data found that more than 58% of children are already stunted by the time they reach their second birthday. This stunting rate occurs despite the high percentage of mothers complying with the recommended feeding practices (and the relatively low prevalence of wasting which reaches 6.6% of children in the 18-23 month age group). Without any information on feeding practices, food composition, and calorie intake as well as an evaluation of children's exposure to disease, access to adequate treatment and compliance to treatment, it is very difficult to determine the factors that cause the high rates of stunting so early in a child's life.

While there is a slight decline in stunting rates for children two and three years old (24-35 and 36-47 month age groups), the prevalence remains high (> 45%) and even increases to above 50% for children during their fifth year of life. In fact, close to half of children between 3 and 5 years of age suffer from stunting, a sign of the cumulative effect of repeated health problems and nutrition deficiencies throughout their early life. The persistent high rates of stunting in older age groups underscores the difficulty children have in catching up after exposure to poor nutrition and/or repeated illness during their first two years of life.

4.2. Prevalence of Stunting and Wasting by Urban/Rural Setting

Table 4 presents the rates of stunting and wasting for children living in rural and urban settings. Urban data include children in the capital (Kigali) as well as in each provincial urban center, although the number of cases in each provincial capital is insufficient to estimate the prevalence of malnutrition by urban center.

The EICV survey data reveal that 48 % of children living in rural areas are stunted (low HAZ), compared to 31 % of children living in an urban setting. For children living in the capital of Kigali 29 % are stunted. What is surprising is that with respect to wasting (WHZ < -2), the data reveal that urban children experience a higher prevalence of wasting (4.1%) than children in rural areas (3.2%). In fact the highest prevalence of wasting (5.9%) is found among children living in the urban capital of Kigali.

Table 4 – Urban/Rural Malnutrition

	Percent Malnourished		Z-Score	
	< -2 SD	< -3 SD	Mean	Standard Deviation
Height-for-age (stunting)				
Rural **	48.1 %	21.8 %	-1.89	1.39
Urban **	31.2 %	13.0 %	-1.20	1.55
Weight-for-height (wasting)				
Rural	3.2 %	.8 %	0.02	1.10
Urban	4.1 %	.3 %	0.27	1.30
Weight-for-age (underweight)				
Rural	23.7 %	4.3 %	-1.17	1.14
Urban	12.6 %	2.0 %	-0.56	1.28

Source: EICV database, MINECOFIN 2002.
In urban areas, data were collected between October 1999 and December 2000. In rural areas, data were collected between July 2000 and June 2001.
**Number of cases: Rural n = 3114; Urban n = 708 (Kigali 405, other urban centers 303 cases)

Table 5 shows the prevalence of stunting and wasting by age group by urban and rural setting. In both rural and urban settings the prevalence of stunting is highest for the 18 – 23 month age group. Over 60% of children living in rural areas have low height-for-age for this age group. For urban children the situation is not much better; 46.8% of children in the 18-23 month age group are stunted. After the second year of life, the prevalence of stunting declines slightly in both urban and rural settings, suggesting that some children are able to "catch up" in terms of growth rates and achieve the same heights as the reference group.

The prevalence of wasting in both rural and urban populations varies significantly from one age group to another. Children living in an urban setting experience a dramatic increase in wasting rates after their first year of life when the percentage of children wasted increases from 2.5% for children in the 6-11 month age group to12.9 % for children in the 18 – 23 age group. Unlike children in rural areas - for whom wasting rates are very low in their 4^{th} and 5^{th} year of life (under 2%)- close to 5% of four year olds and 3 % of five year olds living in urban settings are wasted.

Table 5: Prevalence of Urban/Rural Malnutrition by Age Group

	Rural			Urban		
Age group (months)	# of cases	Stunting (HAZ <-2)	Wasting (WHZ <-2)	# of cases	Stunting (HAZ <-2)	Wasting (WHZ <-2)
3-5	186	12.4%	1.6 %	47	8.5 %	0.0 %
6-11	373	36.7 %	4.6 %	80	23.8 %	2.5 %
12-17	403	47.1 %	6.9 %	95	30.5 %	6.3 %
18-23	272	61.0 %	5.1 %	62	46.8 %	12.9 %
24-35	494	48.6 %	2.6 %	143	35.7 %	1.4 %
36-47	684	50.7 %	1.8 %	146	30.8 %	4.8 %
48-59	702	56.4 %	1.9 %	135	32.6 %	3.0 %
Total	3114	48.1 %	3.2 %	708	31.2 %	4.1 %

Source: EICV database, MINECOFIN 2002.

4.3. Prevalence of Malnutrition in Rural Areas by Province and Agricultural Production Zones

The data presented in Table 6 show that children living in the urban capital of Kigali have the lowest prevalence of stunting (29.4%) among all 12 provinces. For rural populations, the percentage of stunted children is significantly lower in Umutara province (37.2 %) relative to the other provinces (i.e., the upper bounds of confidence interval for the prevalence of stunting in Umutara province falls below the lower bounds of those for the other the provinces). The highest prevalence of stunting (57.4 %) is found in the Gikongoro province, where over half of children under five years of age are stunted.

A disturbing characteristic of the high prevalence of stunting is that a large share of sample children with HAZ scores <-2 are severely stunted (i.e., exhibiting HAZ-scores < -3). In the provinces of Butare and Gikongoro over one in four children are severely stunted. In Cyangugu, Kibuye, Byumba Kibungo, approximately one in five children are severely stunted. When looking at the incidence and depth of extreme poverty estimated by province by the Ministry of Finance from the EVIC survey data, the data show that the poorest provinces are Gikongoro, Butare, Kibuye, Kigali Rural, and Byumba (in order of poorest to less poor).[14]

The prevalence of wasting does not follow the same pattern as stunting among the provinces. While the urban center of Kigali revealed a relative low prevalence of stunting, it has the highest prevalence of wasting (5.9%) among all the provinces. For children living in rural areas, the Gisenyi province has the highest prevalence of wasting with 5.4% of children under 5 years old wasted. In three of the provinces (Byumba, Kibungo, and Kigali Rural), the percentage of wasted children is the same or less than the level in the reference population (2.3%). The percent of severely wasted children (WHZ scores <-3) is less than 2% in all provinces.

Table 6: Malnutrition by Province

Province	Number of cases	Stunting (HAZ score <-2)		Wasting (WHZ score <-2)	
		%	CI	%	CI
Butare	331	48.6 %	43.2 - 54.1	3.3 %	1.4 – 5.3
Byumba	388	48.7 %	43.7 - 53.7	1.5 %	1.6 – 2.8
Cyangugu	321	49.8 %	44.4 - 55.3	2.8 %	2.8 – 4.6
Gikongoro	204	57.4 %	50.5 - 64.2	4.4 %	1.6 – 7.3
Gisenyi	294	46.6 %	40.9 - 52.3	5.4 %	2.8 – 8.0
Gitarama	304	49.0 %	43.4 - 54.7	3.6 %	1.5 – 5.7
Kibungo	346	46.2 %	41.0 - 51.1	1.4 %	0.0 – 2.7
Kibuye	195	49.2 %	42.2 - 56.3	4.1 %	1.3 – 6.9
Kigali Rural	341	45.7 %	40.4 - 51.1	2.3 %	0.1 – 4.0
Ruhengeri	365	42.2 %	37.1 - 47.3	3.0 %	1.3 – 4.8
Umutara	328	37.2 %	31.9 - 42.6	3.4 %	1.4 – 5.3
Kigali (urban center)	405	29.4 %	24.9 - 33.8	5.9 %	3.6 – 8.2
Total	3822	45.0 %	43.4 – 46.6	3.4 %	2.8 – 4.0

Source: EICV database, MINECOFIN 2002.
Note: "CI" represents the 95 percent confidence interval

[14] EICV database, MINECOFIN 2002.

Table 7: Food Production Zones

Province	Zone		Food availability*
Kibungo	A	highest production	> 95% of kilocalorie requirement met through own production in 2001
Byumba			
Umutara			
Gikongoro	B	high production	60–75 % of kilocalorie requirement met through own production in 2001
Gitarama			
Kibuye			
Butare			
Gisenyi	C	low production	48-56% of kilocalorie requirement met through own production in 2001
Kigali Rural			
Cyangugu	D	lowest production	< 41% of kilocalorie requirement met through own production in 2001
Ruhengeri			

*Calculations are based on 2,100 kilocalories per day per adult
*Calculations are based on production per adult equivalent, excluding animal products and small horticultural products.
Source: Donovan et al. 2003, figure17.

The ability of households to secure the required food for its members is an essential factor in assuring good nutrition. Food can be purchased or can be produced by the household for its own consumption. In Rwanda, the vast majority of the rural population is engaged in subsistence farming. Are children better off in households with high production output?

Rwanda's 11 provinces can be grouped into four zones based on the percentage of daily adult kilocalorie requirements that the household is able to meet through their own production (based on 2,100 kilocalories per day per adult). Table 7 shows that households in some of the provinces are successful in producing sufficient amounts of calories to meet the requirements of the family, while households in other provinces experience significant shortfalls in production output. In the highest production zone (zone A), households are able to meet more than 95% of their kilocalorie requirements through their own production whereas in the lowest production zone (zone D) less than 41% of kilocalories are being met for adults in the household (excluding livestock and small horticultural products).

Table 8 calculates the prevalence of stunting (and wasting) for children living in the four different production zones presented in Table 7. Table 8 shows that in Zone A (which has the highest production in terms of ability to meet the daily calorie requirements for the adults in the household), the percentage of children wasted is only 2.1%, slightly below the rate of children wasted in the reference population. It also shows that the prevalence of stunting in zone A, although lower than in the other three zones, is still extremely high at 44.4 %. On the other hand, Zones C and D (which represents the group of provinces which do not meet even half of the required calories per adult in the household) have lower rates of stunting and lower or the same rates of wasting as those found in Zone B.

Table 8: Prevalence of Malnutrition by Production Levels

Production zone		Sample size	Stunting (HAZ score <-2)	Wasting (WHZ score <-2)
A	Highest Production	1062	44.4	2.1
B	High production	1034	50.6	3.8
C	Low production	635	46.1	3.8
D	Lowest production	686	45.8	2.9

Source: EICV database, MINECOFIN 2002.

The non-conclusive results presented in Table 8 are not surprising given the significant agro-ecological variability within each province. Furthermore, we know that household food production and food security are only one part of the equation to good nutrition. As stated in the introduction section, numerous other factors determine children's nutritional outcomes. For very young children, exclusive breastfeeding, timely introduction of adequate amounts of appropriate foods to a child's diet at 6 months of age, reducing exposure to illness, appropriate treatment and care for a sick child are essential to good nutritional outcomes. The capacity of caregivers to provide the necessary care and recommended feeding practices for young children will depend on more than the amount of food produced by the household. Caregivers need a wide range of resources such as knowledge of adequate feeding practices, time to prepare foods, resources, support, and access to adequate health care, among others, to ensure that children thrive (Engle, Menon, and Haddad 1999).

4.4. Comparison of Nutritional Status over Time

Over the last decade, the nutritional situation of Rwandan children has changed very little. Since 1991, there have been 5 national surveys that have collected anthropometric data on children under five years of age. Three of these surveys were completed prior to the 1994 conflict and the remaining two were carried out between 1999 and 2001. In addition to the EICV survey, the other surveys that collected anthropometric data include the Demographic and Health Surveys (DHS) in 1992 and in 2000, conducted by the Ministry of Health, and the National Nutrition and Food Security Surveys in 1991 – 1992 and 1992, conducted by the Ministry of Agriculture and Livestock with support from UNICEF. The DHS and Ministry of Health data sets target children 0 to 59 months old and the EIVC survey targets children 3-59 months old.

Although the time span of the surveys covers the ten years from 1992-2001, the surveys are grouped at the beginning of this period and the end. The prevalence of stunting in children less than five years ranged from 48.7 % to 56 % in 1992 when the DHS 1992 and DSA/UNICEF 1992 and 1993 surveys were completed (Table 9). Nine years later, the DHS (2000) and EICV (2001) surveys reported rates of stunting of 43% and 45% respectively.

Table 9: Reported Prevalence of Stunting from National Nutrition Surveys

	Stunting (HAZ <-2)				
Survey	DHS [a]	DSA/ UNICEF[b]	DSA/ UNICEF[c]	DHS[2d]	EICV[e]
Date of field work	1992 June-Oct	1992 Nov 91-Jan 92	1992 Aug-Sept 92	2000 June-Nov	2001 Oct 99-June 2001
Age group		n=1939	n=1642	n=6490	n=3822
0-5	11.5	4.6	29.3	9.5	*11.6*[1]
6-11	32.5	31.0	38.1	**	34.4
12-23	55.1	36.2	58.0	**	49.8
24-35	50.5	32.3	57.2	45.4	45.7
36-47	58.5	25.8	61.6	49.2	47.2
48-59	60.7	30.6	68.8	54.3	52.6
Total	48.7	52.2	56.3	42.6	45.0

[1]The EICV survey reports on children from 3 –59 months, thus, this figure includes data on children from 3 to 5 months of age.
[2] ** DHS 2000 survey as reported in The Ministry of Health 2001 presented the data by following age groups: 0-5, 6-9, 10-11, 12-15, 16-19, 20-23, 24-35, 36-47, 48-59 months.
Source: [a]Ministry of Health 1992. [b] Ministere de l'Agriculture et de l'Elevage (DSA) 1992. [c]Ministere de l'Agriculture et de l'Elevage (DSA) 1993. [d]Ministry of Health, 2001. [e]MINECOFIN 2001.

The anthropometric data presented in Table 9 would appear to suggest that there has been a slight improvement in the prevalence of stunting since the early 1990's although it is not possible to state whether the difference is significant. These differences could however be explained by sample differences. Whether the prevalence of malnutrition has decline or not, there is little argument that malnutrition is extremely high by international standards.

Changes in the prevalence of wasting are more difficult to assess over time. Low weight-for-height z-scores indicate a recent severe weight loss resulting from a decrease a child's calorie intake. This consumption shortfall could be caused by any number of factors including food shortages, feeding practices or disease. The variability in the rates reported by survey in Table 10 could also be a result of the different time during the year that each survey was carried out. For example an epidemic at the time one survey was conducted could greatly influence the results. Interruptions in food aid or other assistance could also impact nutritional outcomes for children at any given time.

All but one of the five surveys reported peak stunting and wasting rates for the 12-23 month age group. The prevalence of stunting then decreases for three and four year olds, only to peak again for five year olds. In the DSA/UNICEF surveys, the prevalence of wasting follows a similar pattern of peaking at 12-23 month age group, declining and peaking again during the fifth year. While this pattern could be due to sampling differences between the five studies or other unexplained factors, none of the survey reports offered any explanation for the peak-dip-peak behavior.

Table 10: Reported Prevalence of Wasting from National Nutrition Surveys

	Wasting (WHZ <-2)				
Survey	DHS [a]	DSA/ UNICEF[b]	DSA/ UNICEF[c]	DHS[2d]	EICV[e]
Date of field work	1992 June-Oct	1992 Nov 91-Jan 92	1992 Aug-Sept 92	2000 June-Nov	2001 Oct 99-June 2001
Age group		n=1939	n=1642	n=6490	n=3822
0-5	6.2	3.1	2.1	4.6	1.3[1]
6-11	6.7	8.3	6.2	**	4.2
12-23	7.4	9.2	5.1	**	6.7
24-35	2.9	4.9	2.5	7.5	2.4
36-47	.8	2.5	2.6	4.1	2.3
48-59	.7	5.1	5.2	4.0	2.0
Total	3.8	5.2	3.8	6.8	3.4

[1]The EICV survey reports on children from 3 –59 months, thus, this figure includes data on children from 3 to 5 months of age.
[2] **DHS 2000 survey as reported in Ministry of Health 2001 presented the data by following age groups: 0-5, 6-9, 10-11, 12-15, 16-19, 20-23, 24-35, 36-47, 48-59 months.
Source: [a]Ministry of Health 1992. [b] Ministere de l'Agriculture et de l'Elevage (DSA) 1992. [c]Ministere de l'Agriculture et de l'Elevage (DSA) 1993. [d]Ministry of Health, 2001. [e]MINECOFIN 2001.

Even if the overall prevalence of stunting and wasting seems to have declined for children under five years old over the ten-year period, these differences may also be due to survey sampling differences. It is interesting to note, however, that all five surveys show that children in the 12-23 month age group suffer the highest rate of malnutrition, indicating that certain inadequate feeding practices such as those related to weaning have changed very little over the last decade.

Low weight-for-age (which has been little discussed in this report), indicates that a child is gaining insufficient weight relative to his or her age, or that the child is losing weight. The trend in weight-for-age z-scores over the ten years covered by the five surveys (1992-2001), reveals a steady decline in the percentage of children who are underweight. In 1992, both the DHS 1992 and DSA/UNICEF data sets reported that 29% of Rwandan children are underweight. In 1993, the DSA/UNICEF survey found 26% of children to be underweight. By 2000, the prevalence of underweight children had dropped to 24% according to the DHS 2000 survey, and 22% according to the findings of the EICV survey. Thus, a decline in the prevalence of underweight children from 29% to 22% over the ten year period.

The high prevalence of malnutrition reported by these surveys is not unique to Rwanda. Other countries in the region also report high levels of malnutrition for children under five. The results of recent Demographic and Health Surveys conducted in four countries in Eastern Africa show that in these countries more than one third of children less than five years of age are stunted (Table 11). Comparing the results of the Rwanda EICV data to the DHS data of these countries shows that while wasting rates are the lowest in Rwanda, stunting rates for Rwandan children surpass those of Tanzania, Uganda and Zimbabwe.

Table 11: Malnutrition Rates by Country (Rwanda, Malawi, Tanzania, Uganda, Zimbabwe)

	Sex of child								
	Male			Female			Total		
	HAZ	WHZ	WAZ	HAZ	WHZ	WAZ	HAZ	WHZ	WAZ
	>-2SD	>-2SD	>-2SD	>-2SD	>-2SD	>-2SD	>-2SD	>-2SD	>-2SD
Rwanda 2001[1]	47.1%	3.4%	22.4%	43.1%	3.3%	21.0%	45.0 %	3.4 %	21.7 %
Malawi 2000[2]	50.5%	5.1%	25.7%	47.6%	6.0%	25.1%	49.0 %	5.5 %	25.4 %
Tanzania 1999 [2]	43.7%	5.6%	27.5%	41.5%	5.2%	30.2%	42.6 %	5.4 %	28.9 %
Uganda 2000/01[2]	40.4%	5.0%	23.7%	36.9%	3.1%	21.4%	38.6 %	4.0 %	22.5 %
Zimbabwe 1999[2]	28.0%	7.2%	13.4%	24.8%	5.7%	12.6%	26.5 %	6.4 %	13.0 %

[1] EICV database, MINECOFIN 2002.
[2] ORC Macro. 2001 Measure DHS+STAT compiler

5. CONCLUSIONS

This paper has presented the results from descriptive analysis of anthropometric data collected in the 2001 EICV survey. This analysis has shown that:

- Malnutrition rates are alarmingly high in Rwanda with close to half of children under five years experiencing a below average height-for-age score (45% with HAZ score <-2) when compared to the reference population. This high level indicates that there are significant health problems and nutrition deficiencies that plague children through their early lives, which cumulatively result in stunted growth.
- The overall prevalence of wasting (3.4%) is slightly higher than that of the reference population. When disaggregated by age, however, children between 12 and 24 months of age are close to three times the level of risk for below average weight-for-height relative to those in better-nourished reference population.
- Children between the ages of 12 and 23 months are most vulnerable to some form of malnutrition.
- Children living in urban settings are less likely to be stunted but more likely to be wasted than children living in rural areas.
- Children living in provinces characterized by a high percentage of households living in poverty are more likely to be severely stunted (HAZ score <-3).
- The prevalence of stunting appears to have decreased since 1992, however the percentage of children stunted in Rwanda is still very high by international standards.

Beyond this simple description of the nutrition situation in Rwanda, analyzing the causes of the high rates of malnutrition will require a complete data set that includes variables on the three immediate determinants of nutritional outcomes – dietary intake, health and care. Given the complexity of the malnutrition problem in Rwanda, attempting to analyze the causes without variables representing one or more of these primary factors will lead to an incomplete and biased understanding of the situation.

Numerous studies throughout the world have shown that there are high percentages of malnourished children residing in households that produce over 95% of their food needs. Availability and access to food, while a necessary input into good nutrition, do not guarantee that a child will not be malnourished. Nutritional outcomes for young children are also influenced by the quality of childcare, adequate feeding practices, and the frequency, severity, and duration of disease as well as the care and treatment sick children receive. All of these factors are strongly conditioned by poverty, which affects over 70% of the Rwandan population.

The nutritional data collected in the EICV study and the anthropometric indicators estimated in this analysis provide an important input needed for future nutritional and poverty research. The new knowledge and a new understanding of the causes of malnutrition generated by future analysis could help enable government ministries, planners, health services, communities, and parents in identifying specific priority actions needed to more effectively address problems affecting the well-being of children and their families.

ANNEX 1: SUMMARY TABLE

Stunting, Wasting, and Underweight Rates by Background Characteristics Rwanda HLCS 2001

Background Characteristic	Stunted	Wasted	Under-Weight	Background Characteristic	Stunted	Wasted	Under-Weight
Child's age In month[1]				Regions			
3-5	11.6%	1.3 %	3.0 %	Butare	48.6 %	3.3 %	26.9 %
6-9	31.7 %	3.7 %	20.4 %	Byumba	48.7 %	1.5 %	22.4 %
10-11	41.6 %	5.6 %	24.8 %	Cyangugu	49.8 %	2.8 %	24.3 %
12-15	41.0 %	6.5 %	29.8 %	Gikongoro	57.4 %	4.4 %	27.0 %
16-19	53.5 %	8.8 %	29.0 %	Gisenyi	46.6 %	5.4 %	16.0 %
20-23	60.9 %	3.9 %	21.8 %	Gitarama	49.0 %	3.6 %	27.6 %
24-35	45.7 %	2.4 %	26.4 %	Kibungo	46.2 %	1.4 %	22.3 %
36-47	47.2 %	2.3 %	20.1 %	Kibuye	49.2%	4.1 %	18.5 %
48-59	52.6 %	2.0 %	18.8 %	Kigali Ville	29.4 %	5.9 %	12.6 %
n=3822				Kigali Rurale	45.7 %	2.3 %	25.5%
				Ruhengeri	42.2 %	3.0%	21.4 %
				Umutara	37.2 %	3.4 %	18.0 %
Gender of child				Urban-rural residence			
Male	47.1 %	3.4 %	22.4 %	Urban	31.2%	4.1 %	12.6 %
Female	43.1 %	3.3 %	21.0%	Rural	48.2 %	3.2 %	23.7 %
Overall	45.0 %	3.4 %	21.7 %	Overall	45.0 %	3.4 %	21.7%

[1]For comparison, age groups were selected according to those presented in DHS 2000 survey as reported in Ministry of Health 2001.

Moderate and Severe Malnutrition by Province

Province	Number of cases	Stunted		Wasted	
		HAZ score <-2	HAZ score <-3	WHZ score <-2	WHZ score <-3
Butare	331	48.6 %	27.5 %	3.3 %	0.0 %
Byumba	388	48.7 %	22.9 %	1.5 %	0.5 %
Cyangugu	321	49.8 %	24.3 %	2.8 %	1.9 %
Gikongoro	204	57.4 %	27.9 %	4.4 %	1.0 %
Gisenyi	294	46.6 %	17.3 %	5.4 %	1.7 %
Gitarama	304	49.0 %	19.4 %	3.6 %	0.7 %
Kibungo	346	46.2 %	19.9 %	1.4 %	0.3 %
Kibuye	195	49.2 %	24.1 %	4.1 %	1.5 %
Kigali	405	29.4 %	11.1 %	5.9 %	0.5 %
Kigali Rural	341	45.7 %	19.1 %	2.3 %	0.6 %
Ruhengeri	365	42.2 %	16.7 %	3.0 %	0.3 %
Umutara	328	37.2 %	17.7 %	3.4 %	0.6 %
Total	3822	45.0 %	21.0 %	3.4 %	0.7 %

ANNEX 2: RWANDA EICV ANTHROPOMETRIC SURVEY DATA

Analytical Methods

To calculate anthropometric indices, the EICV survey collected data on the age, sex, height and weight of children 3 – 59 months of age. Children under 24 months were measured lying down (recumbent length) while those 24 months or older were measured standing up (stature). Enumerators were instructed to ask for official documentation of children's age. In the absence of official documentation, enumerators used event calendars with parents or caregivers to estimate the age of the child. [15]

EPI-Info 2000 software developed by the US Center of Disease Control, which uses the sex specific 1978 CDC/WHO reference group was used to determine the number of standard deviation (SD) units (referred to as Z-scores) that the child's measurement deviates from the mean of the reference population for the following indicators: height-for-age (HAZ), weight-for-height (WHZ), and weight-for-age (WAZ). The reference group is a normalized version of the 1977 National Center of Health Statistics (NCHS) growth reference curves developed using data from the Fels Research Institute and the US Health Examination Survey, and is recommended b the WHO for international use.

EPI-Info extreme value flags and WHO verification guidelines were used to identify Z-score values where there is a strong likelihood that some of the data items were incorrect; these data were not used in the analysis. WHO recommends using the "fixed exclusion range", height-for-age Z-score (HAZ) < -5 and > +3, weight-for-height (WHZ) < -5 and > +3, and weight-for-age (WAZ) < -5 and > +3 when the observed mean Z-score is above –1.5.[16] Cases with Z-scores falling within these ranges were treated as missing values.

The EICV survey collected anthropometric data from 4100 children 3-59 months of age. Of the 4100 cases 278 cases were flagged by EPI-Info or fell within the fix exclusion range. Only cases with Z-scores for all three anthropometric indicators (HAZ, WAZ, WHZ), falling within the acceptable range and not flagged, are used in the analysis of the report.

Calculating Malnutrition Prevalence

For each of the anthropometric indices, height-for-age, weight-for-age and weight-for-height, comparisons are reported in terms of Z-scores (also referred to as standard deviation (SD) units), using the CDC/WHO 1978 reference population median. The Z-score in the reference population has a normal distribution with a mean of zero and standard deviation of 1. The Z-score cutoff point recommended by WHO, CDC, and others to classify low anthropometric levels is 2 SD units below the reference median for the three indices. The proportion of the population that falls below a Z-score of -2 is generally compared with the reference population in which 2.3% fall below this cutoff. The cutoff for *very* low anthropometric levels is usually more than 3 SD units below the median.

[15] *Manuel d'instructions aux enquêteurs*. Enquête Intégrale sur les Conditions de Vie des ménages (EICV). Direction de la Statistique. Miistrère des Finances et de la Planification Economique. Décembre 1997.
[16] Technical Report Series (WHO). N0. 854-858. 1995.

ANNEX 3: DATA INTEGRITY AND QUALITY MEASURES

Analysis of the data to assess integrity and quality suggests that the data appears to be of fair quality.

1. Sample size

According to the HLCS survey methodology, measurements of the height and weight of all children between the ages of 3 and 59 months were to be collected to assess the nutritional situation of this age group. Eighty-seven percent of the children were measured. Of the 582 children not measured, 13% were sick, 44 % were absent and 43% chose not to participate.

2. Measure methods

Length measurements were used for children under 2 years of age and height measurements were used for children 2 to 5 years of age.

Height and weight distributions may also be affected by heaping. Excesses of recorded height or weight values ending with ".5" or ".0" are strong evidence of inadequate measurement techniques.

For height measurements, 44.1% of the measurements end in ".0".

3. Age estimates

Ideally, age should be computed to the nearest one-tenth of a month and should be based on date of birth. For the HLCS sample, it is not clear what method was used to determine the date of birth.

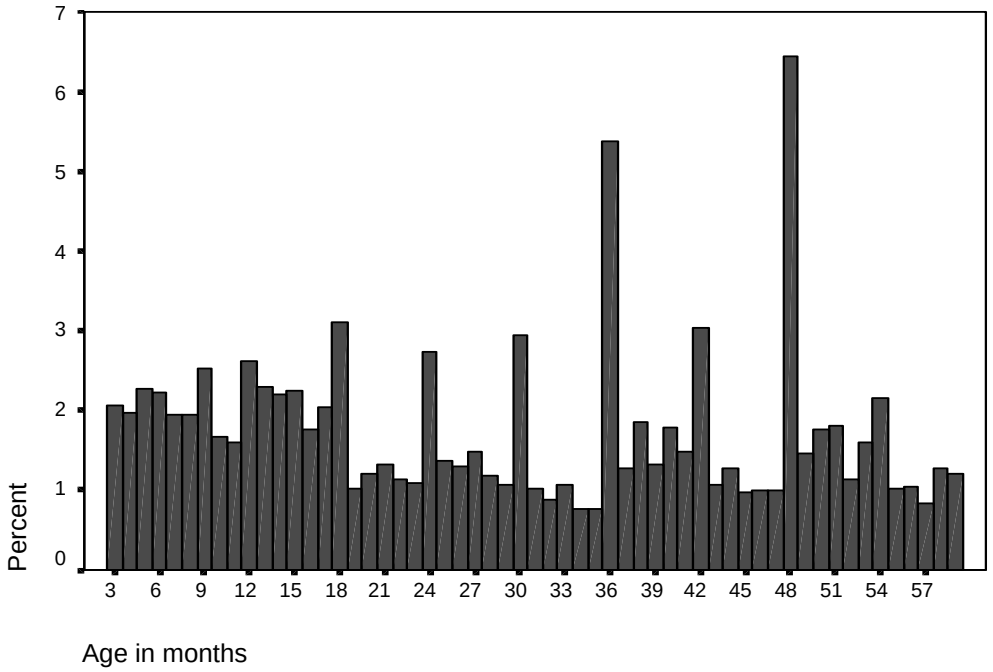
In samples of children under 5 years of age, roughly the same proportion (about 20%) would be expected in each 1-year age grouping. In addition, signs of low accuracy include strong digit preference of "heaping" at multiples of 6 and/or 12 months.

Table 2 shows the distribution of ages of sample children to be roughly proportional with a slightly lower percentage of children falling in the 24-35 age group. The lower percent of children in the 3-11 month age group is to be expected as this age group covers only a 9 month period compared to the 12 month period of the other age groups.

Age by year

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3-11 months	686	17.9	17.9	17.9
	12 - 23 months	832	21.8	21.8	39.7
	24-35 months	637	16.7	16.7	56.4
	36-47 months	830	21.7	21.7	78.1
	48 -59 months	837	21.9	21.9	100.0
	Total	3822	100.0	100.0	

When looking at the age distribution of all sample children, chart 1 shows ages below 12 months are more evenly distributed, however, for children older than 12 months, the data shows significant grouping at 6 month intervals of 18, 24, 30, 36, 42 and 48 months.



4. Flagged data

The Nutstat program of EpiInfo 2000 was used to calculate the height-for-age (HA), weight-for-age (WA) and height-for-weight (HW) Z-scores for these cases. This program creates flags to identify records were there are missing data points or a strong likelihood that some of the data items are incorrect (based on extreme Z-scores). The criteria for "flagging" an anthropometric index are as follows:

Index	Minimum	Maximum
HAZ	-6.00	+6.00
WHZ	-4.00	+6.00
WAZ	-6.00	+6.00

Two additional criteria for "flagging" a record are combinations of data items: (HAZ > 3.09 and WHZ < -3.09) *or* (HAZ < -3.09 and WHZ > 3.09).

It is recommended that all "flagged" records be verified for accuracy. Common errors include incorrect data entry, incorrect age/dates, weight or height measurements entered incorrectly or in the wrong units, and missing/blank data.

Table 2: Record flag coding scheme

Flag Code	Index Flagged			Notes
	HAZ	WHZ	WAZ	
0				No indices flagged
1	Y			Only HAZ flagged
2		Y		Only WHZ flagged
3	Y	Y		Both HAZ and WHZ flagged
4			Y	Only WAZ flagged
5	Y		Y	Both HAZ and WAZ flagged
6		Y	Y	Both WHZ and WAZ flagged
7	Y	Y	Y	All three indices flagged

Y=Index flagged, blank means index not flagged.

After correcting for data entry errors (primarily misplaced decimal point), 4 % of the anthopometric data were flagged by Nutstat program. Close to 2% of the Z-scores fall below –6% for height-for-age. If the proportion of Z-scores below –6 or above +6 exceeds 1%, the quality of the data is doubtful.

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