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NUTRITIONAL STATUS OF YOUNG CHILDREN IN AIDS-AFFECTED HOUSEHOLDS AND CONTROLS IN UGANDA

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Abstract. This study conducted in Uganda assessed the nutritional status of young children and their disease history in the 3-month period before the study. Two groups of children were randomly selected: the first group consisted of 105 children living in homes where a family member fell sick of AIDS, whereas the second group consisted of 100 children who were living in homes where nobody was affected by AIDS. Acute malnutrition (wasting) was rare. There was no difference in the severity of stunting in the two groups (Z scores, –2.1 versus –2.2, $P = 0.70$). In those children living in AIDS-affected homes, disease episodes were longer (15.7 versus 11.3 days, $P = 0.014$), but the frequency of disease occurrence was similar in both groups. Fifty-five percent of all children suffered from moderate to severe malnutrition (stunting). The high stunting rate in early childhood suggests a public nutritional intervention program is recommended.

INTRODUCTION

Infection with the virus causing AIDS has a direct profound impact on the health of children in sub-Saharan Africa directly through pediatric HIV/AIDS. However, there may also be an indirect consequence for the health of children through the impacts of HIV/AIDS on families, communities, and social and economic functioning. Children less than 5 years of age are particularly vulnerable because they are at an age where they are undergoing rapid physical and mental development. The health of children can decline because of parental AIDS because chronically ill parents may not be able to provide their children with proper care and may have fewer resources available to meet their basic needs such as food and health care.[1,2] Several authors suggest that HIV/AIDS is accelerating the deteriorating conditions of child health in sub-Saharan Africa mainly through its negative impact on families and parents.[1,2]

Few studies have looked at the impact of AIDS on family health in Africa. Some of these studies allude to the burden of care that caregivers and families face. Seeley and Kajura[3] showed that HIV/AIDS depletes family resources over time, which places families in great need of physical and material support, as well as social support, encouragement, and education. Similar findings are described by McGrath and Ankrah,[4] who emphasized the negative impact of HIV/AIDS on social family functioning and income. The relationship between the socio-economic position of individuals and populations and their health is well established.[5] Therefore, loss of income and deterioration of the economic situation at the household level will have some negative health consequences for the family, which may most likely affect the most vulnerable family members (children < 5 years). In Uganda, the child mortality rate is now 25% higher than expected because of HIV/AIDS.[6,7] However, it is not clear to what extent mortality caused by pediatric HIV/AIDS plays a role or if indirect consequences of HIV/AIDS at the household level (e.g., less time for care for children because of caregiving responsibilities of the parent or AIDS of the parents themselves) are the more important determinants.

This study measured and compared the nutritional status and the disease frequency of children between 12 and 72 months of age living in households where one adult member was affected by clinical AIDS versus those children in the same age group living in households where adult members were unaffected by AIDS. Because there is a proven association between the nutritional status of children and morbidity/mortality and child development, it is important to identify populations at increased risk for malnutrition and determine any relationship between HIV/AIDS and child welfare outside of the clinical domaine.[8] This study was conducted from September to November 2003 in Kabarole district, western Uganda.

The study had the following two objectives: to assess and compare the nutritional status of children between 12 and 72 months in AIDS-affected versus non–AIDS-affected households and to compare the number and duration of disease episodes in the past 3 months in children less than 5 years of age living in AIDS-affected versus non–AIDS-affected households.

MATERIALS AND METHODS

This study was a comparative, cross-sectional study. A survey questionnaire and anthropometric measures for children 12–72 months of age were the instruments of data collection.

Subjects and inclusion criteria included children between 12 and 72 months of age and their primary caregivers in or near Fort Portal, Uganda, living in homes where at least one parent or another adult member of the family was affected by clinical AIDS and children between 12 and 72 months of age and their primary caregivers living in homes where parents or other adults family members were not affected by AIDS. Children less than 1 year of age were excluded based on the assumption that they were likely to be breastfed and therefore less likely to be malnourished. Children with HIV/AIDS were also excluded based on clinical examination because of the fact that these children are extremely likely to be severely ill and malnourished as a result of their HIV infection and would therefore provide biased information.

One hundred five HIV/AIDS-affected households were identified through the home-based care program for AIDS patients in Kabarole district. The first 105 active cases were selected from a patient list, with a total number of households

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of 125. One hundred controls (non–AIDS-affected homes) were selected from the neighboring households, located nearest to the AIDS-affected homes sampled. These control households were identified by the home care nurses as not having an adult family member with AIDS. The sample size calculation was based on a power of 85% and a significance level of 0.05. It was calculated that, with a sample size of 200 (100 in each group), we would be able to detect a difference in the prevalence of malnutrition by ± 8.7% in the two groups. This difference was considered to be meaningful, assuming that the rate of stunting in the population was 40% based on previous studies from Uganda. If there was more than one child less than 5 years of age in the same household, the child included in this survey was randomly selected, using a simple random sampling method.

A survey questionnaire was administered to the primary caregiver of the children to collect information on 3-month disease episodes recall for his/her children and review of medical history at home if they were available, as well as demographic and socio-economic information from the household. The age of the child was obtained by caregiver recall of the month and year the child was born or by proof from birth documentation when available. Weights of children were measured by a Salter spring balance for children who were not able to stand and by a Seca Unicef Electronic Standing Scale 890 for those who could stand. The scales measured up to increments of 100 g as per World Health Organization (WHO) guidelines on recommended measurement protocols.[9] Height was measured by a vertical measuring rod and length board with a moveable head board of 100 cm with increments capable of measuring to an accuracy of 0.5 cm. The children were measured barefoot. Children who could not stand were measured by the same measuring rod but while lying on the ground. Height and weight were measured twice by two independent examiners. Children were also clinically assessed for signs of clinical malnutrition such as marasmus and kwashiorkor.

Anthropometric measures of children were analyzed by using Z score values and comparing them with the National Centre for Health Statistics/World Health Organization standard reference. The cut-off point for malnutrition was equal or below –2 SD units below the mean of the reference population according to WHO recommendations.[9] The percentage of all children with indicators at low levels (–2 Z scores) and severely low levels (–3 Z scores) was determined.

Proportions were analyzed using the Pearson χ^2 test or Fisher exact test with a significance level of 0.05. Continuous variables were tested for normality by the Shapiro-Wilk test. For normally distributed variables, an independent samples *t* test was used to detect a difference between means. Variables that were not normally distributed were analyzed by the Mann-Whitney *U* test to determine a significant difference. The Z scores of height for age (stunting) were compared using the *t* test for dichotomous variables (type of house, sex of caregiver, sex of children, education some versus none, own land, own radio, own television, own bike). We used multivariate linear regression with height for age Z scores as the dependent variable, and all the above variables as independent variables.

The study was approved by the Health Research Ethics Board at the University of Alberta and by the District Director of Health Services, Fort Portal, Uganda. Each participant was informed about the study and signed a consent form. Identification numbers were assigned to each subject to keep them anonymous. None of the selected participants refused to be part of the study.

RESULTS

Of 205 homes sampled, 105 were AIDS-affected homes and 100 were non–AIDS-affected. Of the 205 principal caregivers of children interviewed by questionnaire, 26 (12.7%) were men and 179 (87.3%) were women. In 87 (82.9%) of HIV/AIDS-affected households, the parents were the principal caregiver of the child. This figure was lower in the households not affected by HIV/AIDS, with 71 (71%) households reporting that parents were the primary caregiver of the child. Demographic and socio-economic variables of the two groups of households are summarized in Table 1.

In 96 (91.4%) households, the diagnosis of the HIV infection was based on an HIV test. In the remaining households, the diagnosis was based on clinical symptoms of AIDS by a clinician. The primary caregiver of the child was HIV infected in 74 households; in 11 (10.5%) households, it was the spouse; and in the remaining households, it was a relative. All persons infected with HIV/AIDS were in the clinical stage of AIDS. Only seven persons (6.6%) infected with HIV were on treatment with anti-retroviral drugs.

TABLE 1

Comparison of demographic and socio-economic variables in HIV/AIDS-affected households and non–HIV/AIDS-affected households

	HIV/AIDS-affected household (*n* = 105)	Non–HIV/AIDS-affected households (*n* = 100)	*P*
Age of caregiver in years	35.6 ± 1.1	32.3 ± 1.3	0.011
Sex of caregiver			0.480
Male	14.3	11.0	
Female	85.7	89.0	
Age of children in months	40.8 ± 1.5	38.1 ± 1.4	0.201
Sex of children			0.829
Male	52.4	49.0	
Female	46.7	41.0	
Education			0.007
None	37.1	20.0	
Some	62.9	80.0	
Marital status			<0.001
Single	5.7	23.0	
Married	25.7	55.0	
Widowed	61.0	18.0	
Separated	7.6	4.0	
Occupation			0.021
Subsistence farmer	47.6	31.0	
Cash crop farmer	16.2	14.0	
Others (labor, employee, etc.)	36.2	55.0	
Material house built of			0.292
Thatched roof, mud walls/floor	6.7	4.0	
Iron roof, mud walls/floor	83.8	80.0	
Iron roof, cement walls and/or floor	9.5	16.0	
Possessions of household			
Own land	77.1	82.0	0.389
Own TV	1.0	3.0	0.359*
Own radio	47.6	68.0	0.003
Own bicycle	23.8	28.0	0.493

Values are mean ± SE or percent.
* Fischers exact test.

Of the 205 children sampled in the nutritional survey, 104 children were boys and 101 were girls (50.7% and 49.3%, respectively). Their mean age was 39.5 months. More than one half of all children were stunted at a rate of 55.1% (95% confidence interval [CI]: 48.3, 61.9). Of the stunted children, 24.4% (95% CI: 18.5, 30.3) were considered severely stunted (less than –3 Z scores height for age). The prevalence of children classified as underweight was 20.5% (95% CI: 15.0, 26.0), and 2.0% (95% CI: 0.1, 3.9) were severely underweight (less than –3 Z scores weight for age). None of the children presented with "acute wasting" (less than –2 Z scores height for weight). When the anthropometric measurements were compared in the different age groups, the following results were obtained (Figure 1).

Children 12–23 months of age had the lowest mean Z scores for all three anthropometric indicators, and children 60–72 months of age had the highest mean indicators compared with all other age groups. Sixty-six percent of children 12–23 months of age were stunted (95% CI: 48.2, 82.8). The prevalence rates of stunting slightly improved with advancing age, as shown in Figure 1. Children 60–72 months of age still had a stunting prevalence of 50% (95% CI: 32.7, 67.3).

When analyzing for differences in the mean Z scores for the three anthropometric indicators, no statistically significant differences were noted when comparing boys with girls in all age groups. It was found that 56.7% (95% CI: 47.2, 66.2) of boys were stunted, whereas 53.5% (95% CI: 43.8, 63.2) of girls were stunted. Similarly, 21.2% (95% CI: 13.3, 29.1) of boys were underweight, and 19.8% (95% CI: 12.0, 27.6) of girls were underweight.

When the children were compared between those living in HIV/AIDS-affected homes and those living in non–HIV/AIDS-affected homes, the following results were obtained: The mean age for children in AIDS-affected homes was 40.8 months and was 38.1 months in non–AIDS-affected homes. There was no statistically significant difference between the mean ages of the two groups ($P = 0.20$). There was also no statistically significant difference in the proportions of children in the different age categories ($\chi^2 = 1.5$, $P = 0.83$). Anthropometric measurements in the two groups are summarized in Table 2.

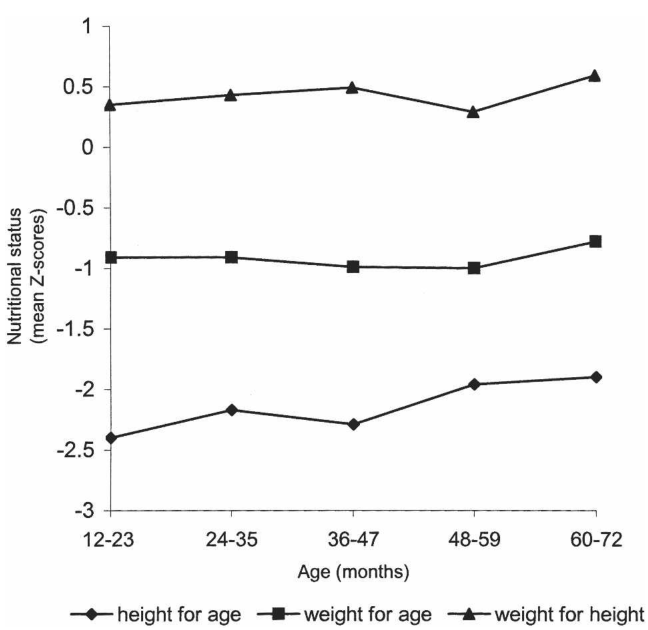

FIGURE 1. Mean Z score values for each anthropometric indicator by monthly defined groups.

As Table 2 shows, we did not observe a difference in the nutritional status of children living in AIDS and non-AIDS homes. When anthropometric measurements were examined separately for HIV status and sex, similar results were obtained (e.g., no significant difference was observed between boys and girls). Seven children (3.4%) presented with clinical malnutrition. Five lived in AIDS-affected homes and two lived in non–AIDS-affected homes. (The result of 3.4% children suffering from clinical malnutrition is similar to the Kabarole baseline health report from 1989, which indicated that the prevalence of marasmus/kwashiorkor was 4.9%.)[10]

Because chronic malnutrition (stunting) was the most prominent finding in our study, we examined the Z scores for stunting (height for age) in bivariate and multivariate analysis as shown in Tables 3 and 4.

In bivariate analysis (Table 3), only ownership of a radio and better quality of the material for building the homes were significantly associated with the Z score for stunting, whereas age and educational level of the caregiver was borderline significant. Results from the multivariate analysis (Table 4) showed that an older age and a better education of the caregivers for the children and a better quality of the material the homes were built of (which is a proxy indicator of the economic status of the household) predicted an improved nutritional status of the children in terms of chronic malnutrition (stunting).

WHO has developed a recommended range of SDs for each anthropometric indicator.[9] The SDs for weight for age and weight for height in our study are within the WHO recommended limits, whereas the SD for height for age was 1.43 and slightly above the recommended limit of 1.3. The comparisons of the SDs from our study with WHO recommendations validates our data derived from anthropometric measurements.

Caregivers of the children were also asked if their child had been sick in the last 3 months. For children in AIDS-affected homes, 81.9% had been reported sick in the last 3 months. Eighty-two percent of children in non–AIDS-affected homes had also been sick in the last 3 months. Forty-eight percent of caregivers in AIDS-affected homes sought medical treatment for their child compared with 52.3% of caregivers in non–AIDS-affected homes. There was no statistically significant difference between caregivers seeking medical treatment when comparing the two types of homes ($\chi^2 = 1.8$, $P = 0.19$).

When comparing how many times children had fallen sick

TABLE 2

Comparison of mean z score values for children living in Aids-affected and non–Aids-affected homes

Anthropometric indicators	Children in HIV/AIDS-affected homes	Children in non–HIV/AIDS-affected homes	P
Weight for height mean (95% CI)	0.37 (0.19, 0.55	0.48 (0.29, 0.67)	0.383
Height for age mean (95% CI)	−2.1 (−2.4, −1.8)	−2.2 (−2.5, −1.9)	0.705
Weight for age mean (95% CI)	−0.96 (−1.2, −0.72)	−0.89 (−1.1, −0.68)	0.673

TABLE 3
Comparison of height for age Z scores

	Height for age Z score	P
Type of house		0.70
HIV/AIDS affected	−2.10 ± 1.45	
Non–HIV/AIDS affected	−2.18 ± 1.42	
Sex of caregiver		0.51
Male	−1.91 ± 1.93	
Female	−2.17 ± 1.35	
Sex of children		0.46
Male	−2.21 ± 1.47	
Female	−2.06 ± 1.40	
Education		0.08
None	−2.42 ± 1.29	
Some	−2.03 ± 1.48	
Marital status		0.90
Single	−2.32 ± 1.57	
Married	−2.13 ± 1.47	
Divorce/separated	−2.05 ± 0.86	
Widowed	−2.10 ± 1.43	
Occupation		0.39
Subsistence farmer	−2.24 ± 1.32	
Cash crop farmer	−1.82 ± 1.53	
Others (labor, employee, etc.)	−2.16 ± 1.49	
Material house built of		0.01
Thatched roof, mud walls/floor	−2.96 ± 1.10	
Iron roof, mud walls/floor	−2.18 ± 1.42	
Iron roof, cement walls and/or floor	−1.50 ± 1.47	
Own land		0.53
Yes	−2.11 ± 1.43	
No	−2.26 ± 1.46	
Own radio		<0.01
Yes	−1.91 ± 1.37	
No	−2.45 ± 1.46	
Own bike		0.23
Yes	−1.94 ± 1.37	
No	−2.21 ± 1.45	
Age (log-transformed) of caregiver (slope ± SD)	1.22 ± 0.66	0.07
Age of children (slope ± SD)	0.01 ± 0.01	0.11

Values are means ± SD unless otherwise stated.
Only four houses owned a television.

in the last 3 months, children in AIDS-affected homes fell sick on average 1.7 times. Children in non–AIDS-affected homes fell sick an average of 1.9 times in 3 months. This difference was not significant (Mann-Whitney *U* test, $P = 0.30$). Children living in AIDS-affected homes were sick on average 15.7 days during their last illness, whereas children living in non–AIDS-affected homes were only sick for 11.3 days during their last illness. This difference was statistically significant (Mann-Whitney *U* test, $P = 0.014$), concluding that there was a longer duration of childhood illnesses in homes affected by AIDS. When the duration of children's last disease episodes was examined according to their diagnosis and the AIDS status of the household (AIDS versus non-AIDS homes), the following results were obtained: malaria with fever ($N = 151$, 13.8 versus 11.3 days, $P = 0.043$), respiratory tract infection ($N = 94$, 16.0 versus 9.1 days, $P < 0.001$), cough without fever ($N = 44$, 29.7 versus 11.8 days, $P = 0.064$), diarrhea ($N = 9$, 15.5 versus 8.8 days), and dysentery ($N = 11$, 14.4 versus 9.1 days). Other less frequent diagnoses were measles (2), general skin rash (2), and conjunctivitis (1).

DISCUSSION

There was no statistically significant difference in the nutritional status of young children in AIDS-affected homes

TABLE 4
Variables associated with height for age Z score—multivariate regression analysis

	Slope ± SE	P
Type of house		
AIDS vs non–AIDS affected	0.14 ± 0.20	0.48
Education		
No vs some education	−0.45 ± 0.22	0.04
Age (log-transformed) of caregiver	1.47 ± 0.66	0.03
Material house built of		
Thatched roof, mud walls/floor	−1.53 ± 0.14	< 0.01
Iron roof, mud walls/floor (ref: Iron roof, cement walls and/or floor)	−0.71 ± 0.30	0.02

versus non–AIDS-affected homes. This finding was different from our working hypothesis because we anticipated finding more malnourished children in the AIDS-affected households. There was also no difference in the number of disease episodes of children and the health-seeking behaviors of the principal caregiver in regard to health clinic visits in both groups. However, the duration of disease episodes in children was significantly longer in HIV/AIDS-affected homes compared with non-HIV/AIDS homes (15.7 versus 11.3 days). This may indicate limited time of the primary caregiver for child care because of the demanding time requirements for the care of an AIDS patient in the family. It may also reflect a situation where the household income has been depleted because of HIV/AIDS and not enough funds are available to buy the drugs required for the child's treatment.

Interestingly, in 1991, an earlier study was conducted in Kabarole district in the same study area where our study was done[11] and found a significantly lower nutritional status of children less than 5 years of age in those homes where at least one family member was suffering from clinical AIDS. We could hypothesize that, because there was a difference in the nutritional status of children in AIDS homes versus non-AIDS homes in 1991 but not in 2003, and that after 12 years into the HIV/AIDS epidemic, entire communities have been overwhelmed and poverty affects now all households equally. Barnett and Whiteside state that households and clusters of households will suffer most from the impacts of the AIDS epidemic. They report from Tanzania that households with an AIDS-affected individual suffered economic consequences but that their healthy neighbors were also experiencing the "ripple effect" of AIDS. The neighbors were burdened by caring for orphans, lending money, and lending food to their AIDS-affected neighbors and friends.[12] We suggest a similar study in a more economically diverse environment such as exists in more centrally located areas.

Our study revealed one major finding: the stunting rates in young children were extremely high. There is a huge concern for the growth and development of these children. Comparing the data from this study with an earlier study on the nutritional status on young children, we observed a significant increase in the stunting rates: in 1988, stunting was found in 28% of children less than 5 years of age, whereas it has increased to 54% as reported here.[10] The latest available information on the national prevalence of stunting, underweight, and wasting was 38.3%, 25.5%, and 5.3% in 1995, respectively.[13] It has also been documented that the rates of stunting in western Uganda are significantly higher than in the country as a whole (Mbarara in 1988, 35.5%[14]; west region, 42.8%[15]; Kasese in 2000, 49.8%[15]) and that they seem to be increasing.[14] Even though Uganda is well endowed with adequate food supplies, it has been reported to have one of the highest rates of childhood stunting in Africa.[16]

Trends of increased stunting of children less than 5 years of age in western Uganda, as we have documented, have also been observed in other studies from Uganda.[14] In the southwest part of Uganda, stunting in small children increased from 36.4% in 1988 to 49.8% in 2000.[15] Because western Uganda is more seriously affected by HIV/AIDS than other areas of Uganda (e.g., the northern districts), increasing trends in stunting of children in this part of Uganda may be explained, at least partly, by the impact of the HIV/AIDS epidemic, which is more severe in western Uganda compared with the north.

The negative association between stunting and the educational status of the principal caregiver, the older caregiver, and the economic status of the household found in the multivariate model were anticipated (Table 4). The findings that higher educational status of the child caregiver and better economic situation of the household contributes to better child nutrition and consequently to better child health have been described in numerous other studies; hence, we are confident about the validity of our data. The additional negative association that we found between the age of the child caregiver and an improved status in chronic malnutrition may be explained by the greater knowledge and experience that older child caregivers tend to have raising their children. Some of the child caregivers in our sample who had the least favorable nutritional outcome in their children were very young.

This study has some limitations. Because the sample size in this pilot study was small, the study may not have enough power to detect a true difference in the nutritional status in children living in AIDS and non-AIDS homes. Children were clinically examined and their history was taken. If there were suspicious signs of clinical AIDS, they were excluded from the study. It was beyond the scope of this study to carry out HIV testing of these children; therefore, we cannot exclude that some children may have been HIV positive, which would likely have affected their nutritional status. We cannot exclude some misclassification of AIDS-affected homes because they appeared on the home-based care list. However, we tried to verify the AIDS status in a home from other sources than home-based care nurses. Because we included only AIDS-affected homes whose members were using existing services, we cannot exclude a selection bias. Those persons in AIDS-affected homes not on the visitation list may have been worse off, because it is well known that nonusers of services are often different from users (usually poorer and more uninformed).

Moderate and severe chronic malnutrition rates in children less than 5 years of age are currently alarmingly high in the study area. This finding, together with the fact that chronic malnutrition in young children has increased generally in the study area (and other parts of western Uganda) in recent years, classifies chronic malnutrition in children as a public health problem of growing importance. Our pilot study did not show an association between the nutritional status of children with the presence of an adult AIDS case in a household. We can only speculate how the HIV/AIDS epidemic may have contributed to this severe nutritional situation in young children now. Because chronic malnutrition in early childhood causes short stature as well as permanent cognitive impairment of affected individuals, the long-term consequences of this problem are severe: less intellectual capacity, which diminishes chances for a satisfactory and productive life; short stature with less earning capabilities, as the INCAP study from Guatemala has shown; and significant higher birth complications for pregnant women who are short.[17] These consequences will not only affect individuals, but will negatively impact entire communities and nations in their social and economic welfare. There is an urgent need for the design and implementation of a nutritional intervention program including nutritional education, especially for mothers because they care for young children. Public health managers in Uganda should realize that solutions to this problem are both affordable and possible.

Because most parts of western Uganda, especially Kabarole district, have very fertile soil and a huge agricultural potential, there is generally no food shortage throughout the year. Chronic malnutrition in children results from lack of knowledge of mothers about good feeding practices, food taboos for children and for pregnant women (which may result in low birth weight), and time constraints of mothers for cooking because of other household chores (e.g., fire wood and water collection). Time does not allow them to prepare special weaning food for infants. A detailed systematic assessment of feeding practices of young children and food taboos for both children and pregnant women, done separately for the different ethnic and cultural groups, would be a start in the design of a district-wide feeding education program for mothers. This could be easily delivered to mothers within the existing services (e.g., child welfare clinics, ante-natal clinics, programs for reduction of HIV transmission from mother to child, pediatric outpatient clinics) and on special occasions, wherever the community meets. Specific nutritional messages to the public at large need also to be developed. Integrating nutritional services into existing primary care programs to the greatest extent possible would be our recommended option for addressing this service gap. In addition, any conveniences that could be achieved through more efficient energy use for cooking and easier access to clean water would free up time to be better spent for the required food preparation. Complacency toward these easy to implement measures is not defensible.

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