ORIGINAL RESEARCH

Mortality Rates, Prevalence of Malnutrition, and Prevalence of Lost Pregnancies among the Drought-Ravaged Population of Tete Province, Mozambique

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Abbreviations:
AIDS = acquired immunodeficiency syndrome
CMR = crude mortality rate
CSB = Corn and Soya Blend
H/A = height-for-age
HIV = human immunodeficiency virus
MCH = Maternal and Child Health
NGO = non-governmental organization
TB = tuberculosis
U5MR = under 5 mortality rate
W/A= weight-for-age
W/H = weight-for-height
WFP = World Food Programme

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Abstract

Background: Tete Province, Mozambique has experienced chronic food insecurity and a dramatic fall in livestock numbers due to the cyclic problems characterized by the floods in 2000 and severe droughts in 2002 and 2003. The Province has been a beneficiary of emergency relief programs, which have assisted >22% of the population. However, these programs were not based on sound epidemiological data, and they have not established baseline data against which to assess the impact of the programs.

Objective: The objective of this study was to document mortality rates, causes of death, the prevalence of malnutrition, and the prevalence of lost pregnancies after 2.5 years of humanitarian response to the crisis.

Methods: A two-stage, 30-cluster household survey was conducted in the Cahora Bassa and Changara districts from 22 October to 08 November 2004. A total of 838 households were surveyed, with a population size of 4,688 people.

Results: Anthropometric data were collected among children 6–59 months of age. In addition, crude mortality rates (CMRs), under five mortality rates (U5MRs), causes of deaths, and prevalence of lost pregnancies were determined among the sample population. The prevalence of malnutrition was 8.0% (95% confidence interval (CI) = 6.2–9.8%) for acute malnutrition, 26.9% (95% CI = 24.0–29.9%) for being underweight, and 37.0% (95% CI = 33.8–40.2%) for chronic malnutrition. Boys were more likely to be underweight than were girls (odds ratio (OR) = 1.34; 95% CI = 1.00, 1.82; p <0.05) after controlling for age, household size, and food aid beneficiary status. Similarly, children 30–59 months of age were significantly less likely to suffer from acute malnutrition (OR = 0.45; 95% CI = 0.26, 0.79; p <0.01) and less likely to be underweight (OR = 0.37; 95% CI = 0.27, 0.51; p <0.01) than children 6–29 months of age, after adjusting for the other, aforementioned factors. The proportion of lost pregnancies was estimated at 7.7% (95% CI = 4.5–11.0%). A total of 215 deaths were reported during the year preceding the survey. Thirty-nine (18.1%) children <5 years of age died. The CMR was 1.23/10,000/day (95% CI = 1.08–1.38), and an U5MR was 1.03/10,000/day (95% CI = 0.71–1.35). Diarrheal diseases, malaria, tuberculosis, and human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) accounted for more than two-thirds of all deaths.

Conclusions: The observed CMR in Tete Province, Mozambique is three times higher than the baseline rate for sub-Saharan Africa and 1.4 times higher than the CMR cut-off point used to define excess mortality in emergencies. The current humanitarian response in Tete Province would benefit from an improved alignment of food aid programming in conjunction with diarrheal disease control, HIV/AIDS, and malaria prevention and treatment programs. The impact of the food programs would be improved if mutually acceptable food aid program objectives, verifiable indicators relevant to each objective, and beneficiary targets and selection criteria are developed. Periodic re-assessments and evaluations of the impact of the program and evidenced-based decision-making urgently are needed to avert a chronic dependency on food aid.

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Introduction

During the last three decades, Mozambique has been the scene of multiple disasters. In 1992, following 20 years of civil war, Mozambique experienced a number of disasters caused by naturally occurring hazards. In May 1996, the Food and Agriculture Organization/World Food Programme (WFP) Crop and Food Supply Assessment Mission to Mozambique found that cyclone Bonita resulted in exceptionally heavy rains, that caused widespread flooding, destroyed 44,200 hectares of crops, and affected 83,528 people. Similarly, in 1994, cyclone Nadia left thousands of people on Mozambique's northern coast homeless and hungry for an extended period of time.[1] Cyclone Eline in February 2000 and cyclone Hudah in April 2000 left 450,000 people homeless, 160,000 displaced, and 500 dead.[2] The year 2002 was characterized by sporadic and insufficient rains in southern Mozambique. Several years of flooding and droughts combined with a loss of productivity due to the impact of human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), have left the community vulnerable to food insecurity and malnutrition.[3] By 2003, it was estimated that people in 43 of the 128 (33%) districts in the country suffered from food shortages, and the number of people needing food assistance escalated between 2002 and 2003.[2]

Large, semi-arid areas and cyclic problems associated with food insecurity have severely affected the population of Tete Province.[3] Anthropometric data indicate that in 2003, the prevalence of acute malnutrition was 9.9% for Tete Province (Figure 1), 3.4% for Manica, 3.6% for Sofala, 2.9% for Inhambane, and 2.4% for Gaza, averaging 6.4% nationally (Figure 2).[4] Since 2000, the south and central regions of Tete Province have experienced irregular and insufficient rains. Maize yields were reduced greatly, and the following season for grains and vegetables was affected adversely. Although sorghum and cassava are more resistant to drought conditions, an overall reduction in productivity from plantations due to personnel with HIV/AIDS[5] has resulted in at least four years of a meager harvest in Tete. In September 2002, World Vision and the WFP implemented nutritional support programs aimed to reduce mortality and malnutrition among the most severely affected districts of Tete Province: the Cahora Bassa, Changara, Moatise, and Mutarara districts. These programs included: (1) the Food-for-Work Program; (2) the Corn and Soya Blend (CSB) Supplementary Food Program; (3) a home-based feeding program; and (4) the Vulnerable Group Feeding Program.

1. *The Food-for-Work Program*—From October 2002 to July 2004, the average quantity of food distributed per eligible beneficiary was 10.5 kg of maize, 4 kg of sorghum, 0.9 kg of beans, 2.7 kg of rice, and 0.3 kg of oil. The work associated with this scheme resulted in the construction of >47 schools, 12 small dams, three houses for nurses, two maternity houses, and five houses for teachers. Roads were rehabilitated, and >17 farmers' associations were established to promote the multiplication of sweet potato and cassava stakes, vegetable production, and fruit tree plantations;
2. *The Corn and Soya Blend (CSB) Supplementary Food Program*—This program is intended for children >5 years of age, and pregnant and lactating mothers. From February 2003 to June 2004, the average quantity of CSB distributed per eligible beneficiary was 5.5 kg.
3. *A home-based feeding program for the chronically ill (mainly for people living with HIV/AIDS and tuberculosis)*—By 01 October 2004, the average quantity of food distributed per eligible beneficiary was 25.8 kg of maize, 3.1 kg of sorghum, and 8.2 kg of CSB.
4. *The Vulnerable Group Feeding Program*—By 01 October 2004, the average quantity of food distributed per eligible beneficiary was 8.6 kg of maize, 3.8 kg of sorghum, 0.4 kg of beans, 0.7 kg of rice, and 0.1 kg of oil. This program is intended for orphans and vulnerable children, child- or female-headed households, the elderly, and the disabled.

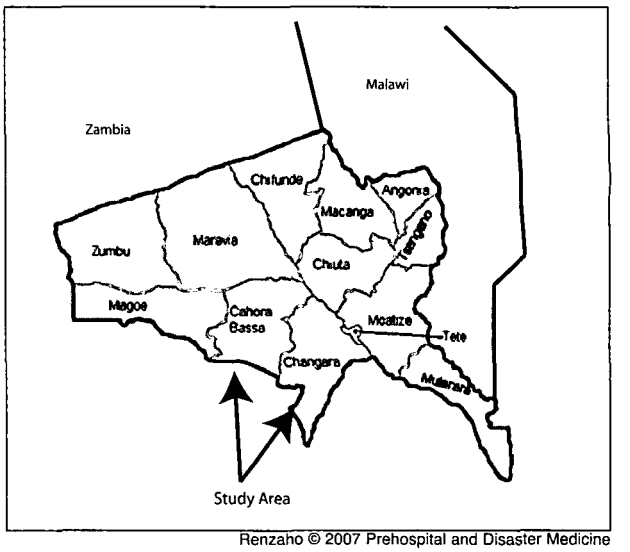

Figure 1—Tete Province showing the study area

Despite such intensive and comprehensive interventions, these programs have not been based on sound epidemiological data, nor have they established baseline data against which to assess the impact of the programs. The purpose of this study was to document the mortality rates, causes of death, prevalence of malnutrition, and prevalence of lost pregnancies after 2.5 years of ongoing humanitarian response to the crisis.

Methods

Study Design

The study design was cross-sectional, and based on a two-stage, 30-cluster household survey in the Cahora Bassa and Changara districts. When the relief programs were implemented, population-based data on mortality or nutritional status were available, and existing data had been collected on an *ad hoc* basis. Available data on malnutrition indicated that the prevalence of acute malnutrition in 2003 was 9.9% in Tete Province.[4] However, given that the Cahora Bassa and Changara districts were the most severely affected, in this study, it was assumed that the prevalence of acute malnutrition in those districts would be higher than the average of the Province. Due to a lack of data on malnutrition in these districts, a prevalence of acute malnutrition

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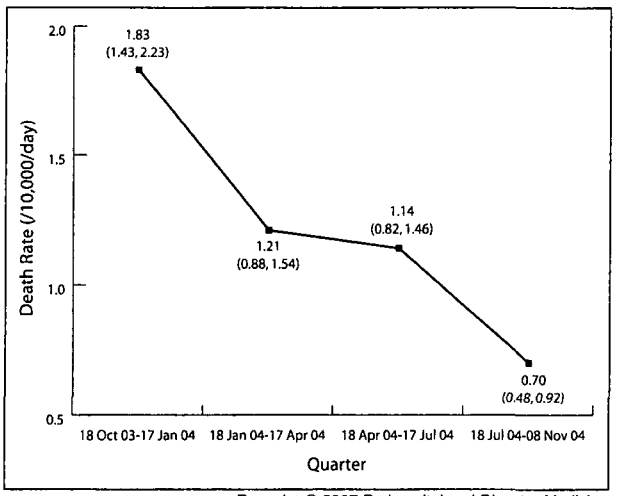

Figure 2—Death rates (10,000/day) and their 95% CI reported in Cahora Bassa and Changara districts over the recall period

was estimated as 20% for the sample size calculation so that the sample size was not under-estimated. In calculating the sample size, a design effect of two and a precision of 4% were assumed.[6–8] A sample size of 768 children was obtained. This sample size was adjusted to account for contingencies such as non-response or recording errors, and the corresponding figure was rounded to 820 children,[6,8] or 4,713 people, assuming a proportion of 17.4% children <5 years of age.[9,10] With an average household size estimated at 5.6 persons,[9,10] the total number of households that needed to be visited was estimated at 842. This sample was more than adequate to determine the crude mortality rate (CMR), when a CMR of 1.5 deaths/10,000 people/day and a recall period of 373 days, with a 95% CI of ±0.5/10,000/day, and a design effect of two were assumed (calculated n = 3,753 persons).

Procedure

During the first stage, the smallest population unit in each district (village) was determined. The total number of villages that compose the Cahora Basa and Changara districts, as well as the population size of each village, were determined using the 2003 Mozambique Demographic and Health Survey.[9,10] Thirty clusters were assigned randomly in proportion to the population of the village. During the second stage, households were selected using the standard Expanded Program on Immunization methods.[11] Data collectors went to the center of the village and chose a direction randomly (e.g., by spinning a bottle) (Step 1). They counted the total number of households (t) in the chosen direction from the center to the edge of the village. The first number surveyed was selected randomly by choosing a number between 1 and t using a table of random numbers. After the first household was identified, the next closest household was selected and the process continued until the number of children required per cluster were questioned (820/30 = 27; Step 2). A *household* was defined as an aggregate of persons who either live together under the same roof or in different units in the same compound, but eat together or share the household food.

Prior to data collection, the heads of households or guardians were told that participation in the study was voluntary, that they were free to withdraw their participation at any stage during the study, and that the data would be presented as aggregate. They were assured that all data provided would be treated with strict confidentiality. All selected households consented to participate in the study. Trained enumerators administered the questionnaire. In the event that data collectors reached the border of the village before the required number of children for a cluster was reached, they returned to the center of the village and repeated Steps 1 and 2. In Step 2, if household members ≥15 years of age were absent at the time of the interview, neighbors were asked to assist in locating the members. If the occupants could not be found, the data from the household was eliminated and replaced with data from the next closest household; this only occurred twice.

Data collectors who spoke both the local language (mainly Barwa, but also referred to as Balke or Cibalke) and English, administered the questionnaire after receiving 3.5 days of training on sampling methodology, data collection, anthropometric measurements, and data recording. The questionnaire was translated into the local language, translated back into English by a different person to validate the accuracy of translation, and field-tested prior to official data collection. Upon completion of each cluster, the group leader checked all questionnaires for completeness and accuracy.

Measurements

Weight was measured by Salter-type spring hanging scales, with a capacity of 25 kg and 100 gram increments (DK-2100 Copenhagen, Denmark). Height was measured to the nearest millimeter using a measuring board (Shorr Productions, Maryland). Three types of malnutrition were considered in this study: (1) *underweight,* measured by weight-for-age (W/A); (2) *chronic malnutrition,* measured by height-for-age (H/A); and (3) *acute malnutrition,* measured by weight-for-height (W/H). The Z-scores were used as indicators of the nutritional status of children: acute malnutrition was defined as a W/H <-2 Z-score; chronic malnutrition was defined as a H/A <-2 Z-score; and underweight was defined as a W/A <-2 Z-score.

The computation of the mid-point population assumed that deaths and births occurred at a constant rate—half of deaths and half of births did not occur by the midpoint of the recall period.[12,13] This is an accurate estimation, given that the population movement had remained stable during the five years preceding the evaluation. After the war ended in 1992, the majority of Mozambicans returned from neighboring countries, especially Zimbabwe, after years in refugee camps,[5] and were attracted by the coal mines at Moatize. By the late 1990s, the population movement was stable. Thus, three questions were asked: (1) the number of people that slept in the house the night preceding the survey; (2) the number of pregnancies and their outcomes during the recall period; and (3) the number of people living in the household who died during the recall period. For each identified death, respondents were asked to identify the cause of death or to list three symptoms the victim experienced before their death.

The proportion of lost pregnancies was calculated using the following formula:[14]

% lost pregnancies =
(abortion + stillbirths)/(abortion + stillbirths + live births)

Mortality rates were computed as follows:[12,13]

$$\text{CMR} = \frac{\text{Number of deaths}}{\text{Recall period in days x mid-point population}} \times 10{,}000$$

Where: mid-point population = number of living in the sample + 1/2 deaths in the sample − 1/2 live births in the sample.

$$\text{U5MR} = \frac{\text{Number of deaths among those <5 years of age}}{\text{Number of living <5 years of age + 1/2 deaths among those <5 years of age x recall period}}$$

Data Processing
Data were entered into SPSS for Windows, version 12.0 (SPSS Inc., Chicago, IL) and processed using Stata version 7.0 (Stata Corporation, College Station, TX). The proportion of malnutrition and its 95% confidence interval (CI) was computed while mortality data were expressed per 10,000/day and stratified by age and gender. In Stata, the "svyset command" was used to specify clustering within the household, stratification, and weight prior to analysis. When the outcome was binary, logistic regression was used. The relationship between the two categorical variables was examined using the chi-square test. The level of statistical significance was set at a probability of $p < 0.05$ for all tests.

Results

Demographics and Children Anthropometric Measurements
A total of 838 households were surveyed, resulting in a total population size of 4,688 people. The average household size was 5.53 persons (95% CI = 5.48, 5.58; minimum = 1; maximum = 14). One in three (37.1%) households surveyed had >5 family members living in the house. More than half (53.7%) of the sample was male. The median age was 14 years (range = 0–86 years). One in five people (21.2%) were children <5 years of age. Anthropometric data were obtained for 874 children (425 girls and 449 boys) aged 6–59 months, representing 18.6% of the total population. The calculated Z-score for boys and girls averaged −1.5 (95% CI = −1.7, −1.2) and −1.3 (95% CI = −1.5, −1.0) for H/A, 0.1 (95% CI = −0.1, 0.2) and 0.3 (95% CI = 0.1, 0.4) for W/H, and −1.1 (95% CI = −1.3, −0.9) and for W/A −0.9 (95% CI = −1.1, −0.7) respectively.

Malnutrition
The prevalence of malnutrition (acute malnutrition, underweight, and chronic malnutrition) is summarized in Table 1. The prevalence of acute and chronic malnutrition did not vary by sex, but boys were statistically significantly more likely to be underweight than were girls (OR = 1.34; 95% CI = 1.00, 1.82; $p < 0.05$) after controlling for age, household size, and food aid beneficiary status. Similarly, children 30–59 months of age were statistically significantly less likely to suffer from acute malnutrition (OR = 0.45; 95% CI = 0.26, 0.79; $p < 0.01$) and to be underweight (OR = 0.37; 95% CI = 0.27, 0.51; $p < 0.01$) than children aged 6–29 months after adjusting for the other factors.

Prevalence of Lost Pregnancies
A total of 339 pregnancies were reported during the recall period. Of these, 80 (23.6%) women still were pregnant, 239 (70.1%) resulted in live births, and 20 (5.9%) resulted stillbirths, miscarriages, or abortions, corresponding to a the proportion of 7.7% (95% CI = 4.5–11.0%) lost pregnancies.

Mortality
A total of 215 deaths were reported during the recall period. Of these deaths, 39 (18.1%) victims were children <5 years of age. These deaths resulted in a CMR of 1.23/10,000/day (95% CI = 1.08–1.38) and an U5MR of 1.03/10,000/day (95% CI = 0.71–1.35). The CMR and U5MR did not vary significantly by sex (Table 2). The number of deaths was higher in the last quarter of 2003, then decreased up to October 2004.

Causes of Death
Diarrheal diseases, malaria, and TB accounted for over half (61.1%) of all of the deaths (Figures 3a and 3b). Causes of death did not vary by gender, but varied considerably by age group ($p < 0.01$). For children <5 years of age, the top five main causes of deaths were: (1) diarrheal diseases; (2) malaria; (3) TB; (4) HIV/AIDS; and (5) traffic crashes. In contrast, the top five main causes of death for persons ≥5 years of age were: (1) diarrheal diseases; (2) malaria; (3) TB; (4) anemia; and (5) hypertension.

Discussion

Mortality
This study is the first to explore health and nutrition outcomes in the Cahora Bassa and Changara districts of the Tete Province. The reported CMR is 1.5 times higher than the 2003 national average, and 2.5 times higher than the 2003 rate for Tete Province.[4] It also is >3 times higher than the baseline for sub-Saharan Africa[15] and 1.4 times higher than the CMR cut-off used by the Centers for Disease Control and Prevention (CDC) to define excess mortality in emergencies.[16] Using the 2000 CMR of 0.60/10,000/day[17] as the pre-drought baseline and total population of 177,226 in Cahora Bassa and Changara districts,[18] it was estimated that about 16,301 excess deaths occurred in both of the districts between 2000 and 2004. Nevertheless, the U5MR was 41% lower than the national average.[4] The U5MR also was lower than the 1.14/10,000/day baseline for sub-Saharan Africa and the 2.23/10,000/day used to define excessive mortality in persons <5 years of age during emergencies.[15]

Although data have indicated that children <5 years of age account for the majority of deaths during emergencies,[19,20] the opposite was found in the current study with increased mortality in children >5 years of age. Such a pattern is consistent with the situation that has characterized Tete Province over the last four years. In partnership with World Vision and the Red Cross, the WFP has been providing feeding programs for children <5 years of age as well as lactating and pregnant mothers. These programs have

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		W/H Z-Score		W/A Z-Score		H/A Z-Score	
		%	Adjusted OR	%	Adjusted OR	%	Adjusted OR
	n	(95% CI)[a]	(95% CI)#	(95% CI)[b]	(95% CI)#	(95% CI)[c]	(95% CI)#
All	874	8.0%	NA	26.9%	NA	37.0	NA
		(6.2%, 9.8%)		(24.0%, 29.9%)		(33.8, 40.2)	
Sex							
Girls	425	7.6	Ref	23.8	Ref	35.1	Ref
		(5.0, 10.1)		(19.7, 27.8)		(30.5, 39.6)	
Boys	449	8.5	1.14	30.0	1.34	38.8	1.19
		(5.9, 11.0)	(0.68, 1.92)	(25.7, 34.2)	(1.00, 1.82)*	(34.4, 43.5)	(0.90, 1.58)
Age Group							
6–29 months	438	9.8	Ref	36.2	Ref	40.4	Ref
		(7.0, 12.6))		(31.7, 40.8)		(35.8, 45.0)	
30–59 months	436	4.7	0.45	17.5	0.37	34.3	0.76
		(2.7, 6.7)**	(0.26, 0.79)**	(13.9, 21.1)***	(0.27, 0.51)***	(29.8, 38.8)	(0.58, 1.00)
Beneficiary Status							
Exbeneficiary of food aid	298	9.4	Ref	27.9	Ref	34.7	Ref
		(6.1, 12.7)		(22.8, 33.1)		(29.3, 40.1)	
Current beneficiary of food aid[a]	120	6.7	0.80	30	1.21	44.2	1.57
		(2.2, 11.2)	(0.35, 1.85)	(21.8, 38.2)	(0.75, 1.96)	(35.2, 53.1)	(1.01, 2.43)*
Never been beneficiary of food aid[b]	456	7.5	0.73	25.5	0.89	36.7	1.11
		(5.1, 9.9)	(0.42, 1.27)	(21.5, 29.5)	(0.63, 1.25)	(32.3, 41.1)	(0.82, 1.51)
Household Size							
≤5 people	400	8.5	Ref	27.2	Ref	38.9	Ref
		(5.8, 11.2)		(22.8, 31.5)		(34.1, 43.7)	
≥6 people	474	7.6	0.85	26.8	0.94	35.5	0.84
		(5.2, 10.0)	(0.50, 1.42)	(22.7, 30.8)	(0.69, 1.28)	(31.1, 39.8)	(0.63, 1.11)

Table 1—Prevalence of chronic malnutrition, underweight, and acute malnutrition and adjusted odd ratios (OR) as a function of demographic variables (H/A = height-for-age; Ref = reference; W/A = weight-for-age; W/H = weight-for-height)

Model adjusted for factors in the table; [a] Prevalence of Acute malnutrition (WHZ <-2); [b] Prevalence of underweight (WAZ <-2) [c] Prevalence of chronic malnutrition (HAZ<-2); *p <0.05; **p <0.01; ***p <0.001

[a]Beneficiary at the time of the survey; [b]Discharged from the program

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	Male	Female	Total
CMR			
Number of people living in the sample	2,519	2,169	4,688
Number of deaths during recall period	105	110	215
Number of live-births during recall period	192	47	239
Mid-point population	2,476	2,201	4,676
Deaths/10,000/day	1.14	1.34	1.23
	(95%CI) (0.93, 1.35)	(1.10, 1.58)	(1.08, 1.38)
U5MR			
Number of deaths during recall period	18	21	39
Total <5 years	509	486	995
Mid-point population	518	497	1,015
Deaths/10,000/day	0.93	1.13	1.03
	(95% CI) (0.51, 1.35)	(0.66, 1.61)	(0.71, 1.35)

Table 2—Crude (CMR) and under five mortality rate (U5MR) and (95%) confidence interval by gender

included supplementary feeding programs providing free CSB, school lunches, and vulnerable group feeding, targeting orphans, the elderly, and child- and female-headed households. Therefore, findings of a CMR above the emergency threshold and the U5MR below the threshold for this sub-group, suggest that there is an urgent need to improve and target life-saving interventions, specifically among the adult population.

While various studies have identified malnutrition to be a major cause of death during emergencies,[16,19,21–24] this was not the case in the current study. However, there is no doubt that the consequences of the drought on the people and the economy have been far-reaching. The drought has limited access to water and sanitation facilities, has impacted the economy negatively, has reduced household purchasing power, and has restricted access to health care. The findings that diarrheal diseases and malaria as major causes of death are consistent with the current literature.[16,19,25–27] Despite the high prevalence of HIV/AIDS,[3] the proportion of deaths caused by HIV/AIDS was estimated at 6.3% in adults and 9.2% in children <5 years of age, placing this cause fifth and fourth, respectively, after diarrheal diseases, malaria, and TB. It is possible that TB, acute respiratory diseases, and the non-specificity of "diarrheal diseases" are likely to be linked to HIV/AIDS infection, and that the mortality due to HIV/AIDS was underestimated. This may have been exacerbated by the stigma, isolation, and discrimination the family would experience if they would have identified one of their members as having died from HIV/AIDS; it also may be due to the lack of HIV testing. Thus, many people may be dying from HIV/AIDS before being aware of their HIV status. Further studies to explore the impact of HIV/AIDS are required.

In this study, the proportion of lost pregnancies is similar to that reported in countries experiencing chronic emergencies.[14] Since 3.2% of deaths are due to pregnancy termination/abortion/miscarriage (Figure 3a), it is possible that the poverty and hunger-induced sex trade is used as a survival strategy. This social and public health issue leads to unwanted or unplanned pregnancies. However, other factors have been shown to increase the risk of miscarriage or stillbirth. These include the age of the mother, pregnancy order, pregnancy history, and the mother's social characteristics and environment.[28] In addition, the current literature suggests that an environment characterized by famine and malnutrition significantly increases the risk of miscarriage and stillbirths,[28,29] so the effect of famine and starvation cannot be ruled out in explaining the observed prevalence of lost pregnancies. Further studies are required to elucidate this theory.

Malnutrition

By applying the cut-off points for assessing the severity of malnutrition of the World Health Organization,[30] the observed malnutrition prevalence could be said to be medium for acute malnutrition, but very high for underweight

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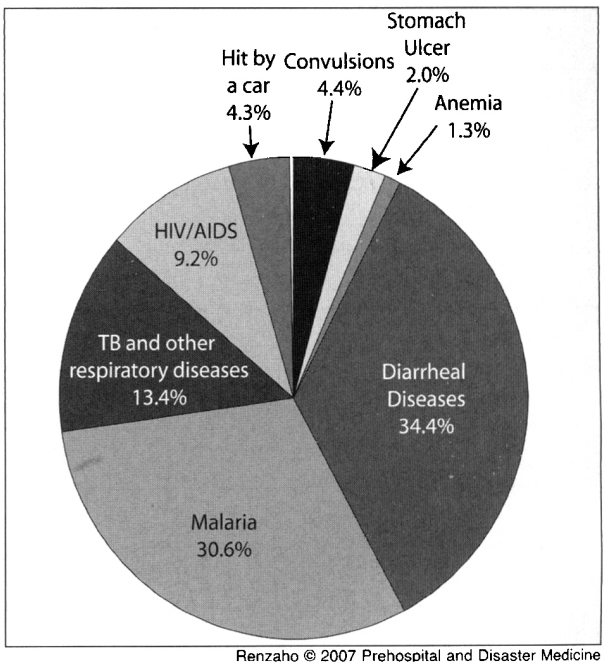

Figure 3a—Proportionate casuse-specific mortality for all ages

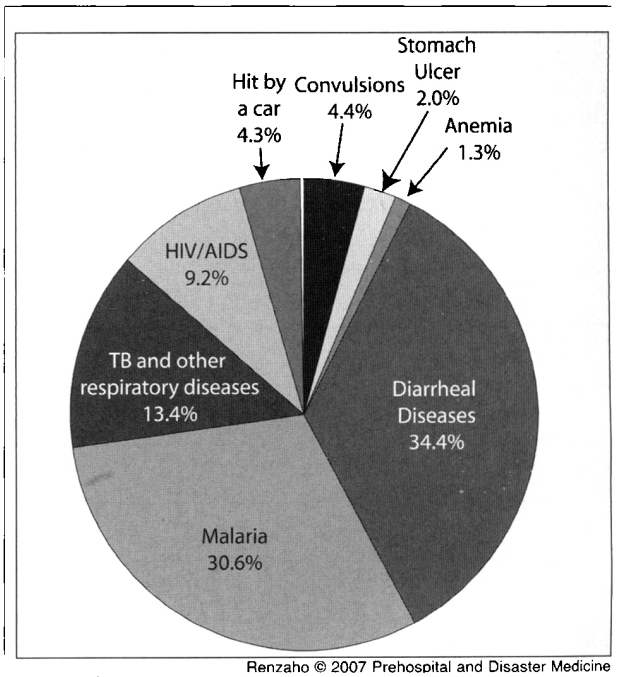

Figure 3b—Proportionate cause-specific mortality for >5 years of age (TB = tuberculosis)

and chronic malnutrition. However, a long time period is needed to observe changes in chronic malnutrition and underweight while humanitarian responses are geared toward addressing acute malnutrition. Thus, this discussion will focus on acute malnutrition.

The prevalence of acute malnutrition in Cahora Bassa and Changara remains similar to the average for all of Tete Province, but higher than the prevalence reported in the neighboring provinces. The prevalence of acute malnutrition for this Province has remained static since 2002, estimated at 7.8% in 2002[4] versus 8.0% reported in the current study. Many factors could explain why the prevalence of acute malnutrition in the Cahora Bassa and Changara districts of Tete Province has not declined, despite the intensive humanitarian responses to the crisis. First, there were frequent delays in food delivery that were attributable mainly to the ineffectiveness or irregularity of the food pipeline; this resulted in the reduction of food entitlements. The situation was exacerbated by poor targeting strategies that led to chronic mismatching between the actual and proposed beneficiaries, which resulted in a less than adequate coverage rate (Table 3).

Second, use of the World Vision Commodity Tracking System indicated that a large number of beneficiaries did not receive their entitlements and actually received less maize than they were entitled to receive. This was more pronounced between October 2002 and September 2003. In contrast, from October 2003 to September 2004 (a period within the recall period of the current study), the number of actual beneficiaries increased in linear fashion and they received a ration that provided more energy than they were entitled to receive due to back-payment of rations that were overdue. In addition, the agricultural outlook for 2004 was encouraging, with cereal production increasing by 11% from 2003, and an increase in formal and informal maize exports as well as the expansion of cassava cultivation. This could explain why the number of deaths was very high during the last quarter of 2003, but fell in a stepwise fashion in 2004. However, given the long recall period, it also is possible that a recall bias might have been more evident for deaths occurring at the beginning of the October 2003 to January 2004 quarter.

Third, food distributed to eligible households was calculated on the basis of an average of five persons per household, but 37.1% of the surveyed households had >5 family members living in the house. Two implications are associated with this criterion: (1) more than one-third of beneficiary households received an inadequate ration; and (2) the high likelihood that beneficiary households shared their often inadequate and irregular food rations with non-beneficiary families and neighbors. Despite the initial reduction in food for the beneficiary families, the act of sharing food builds reciprocity of support among a community in times of stress,[5] and this practice can result in significant, short-term nutritional security gain for beneficiary households. That is, when these families are confronted with a food pipeline problem, neighbors return the favor, and share their food. Thus, the impact of food sharing and reciprocity should be included in the indicators of any evaluation of the impact of food aid programs in Tete Province. The pattern observed could help explain why no difference was found in the prevalence of malnutrition between children from small versus large families.

Finally, the prevalence of HIV/AIDS and the number of orphans in the various communities in Tete Province remains high.[3] Those with symptoms of AIDS may fail to gain weight because of opportunistic infections.[31] Food aid programs in Tete Province have not been proactive in designing strategies geared toward mitigating the effect of complications due to HIV/AIDS.

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	Phase I[a] Oct 02-Mar 03	Phase II[b] Apr 03-Sept 03	Phase III[c] Oct 03-Mar 04	Phase IV[d] Apr 04-Sept 04
Total number of proposed beneficiaries	316,800	484,800	484,800	258,000
Energy profile of pledged ration				
Energy (Kcal/beneficiary/day)	2,139	12,139	2,139	1,754
% of energy from protein	11.4	11.4	11.2	11.2
% of energy from fat	19.3	19.3	19.3	10.4
Total number of actual beneficiaries	196,162	470,356	376,420	465,644
Energy profile of distributed ration				
Energy	1,871	1,925	2,408	1,871
% of energy from protein	12.8	9.9	12.6	13.3
% of energy from fat	10.0	9.5	11.0	9.5
Coverage (%)	61.9	97.0	77.6	180.5
Fulfillment of energy pledges (%)	87.5	90.0	112.6	106.7

Table 3—Number of proposed food program beneficiaries vs. actual beneficiaries and quantity of food beneficiaries received (g/beneficiary/day) vs. pledged ration by period offer[a]Pledged ration (g/beneficiary/day): maize: 500 g, beans: 50 g, oil: 25 g. *Received (g/beneficiary/day):* maize: 473 g, beans: 40 g, corn-soya blend (CSB): 22 g. [b]Pledged ration (g/beneficiary day): maize: 500 g, beans: 50 g, oil: 25 g. *Received (g/beneficiary/day):* maize: 135 g, beans: 21 g, CSB: 41 g, oil: 11 g, rice 314 g. [c]Pledged ration (g/beneficiary day): maize: 500 g, beans: 20 g, oil: 25 g. *Received (g/beneficiary/day):* maize: 376 g, beans: 20 g, CSB: 108 g, oil: 5 g, rice: 90 g, sorghum: 267 g. [d]Pledged ration (g/beneficiary day): maize: 1,200 g, beans: 200 g, CSB: 600 g, oil: 100 g. *Received (g/beneficiary/day):* maize: 214 g, beans: 10 g; CSB: 51 g, oil: 5 g, sorghum: 267 g
Source: Summarized from World Vision Commodity Tracking System

Limitations

The reported prevalence of acute malnutrition did not include bilateral leg edema (indicating severe malnutrition irrespective of W/H). Data on bilateral edema were not collected due to the lack of skilled data collectors to detect edema. This is due to the educational level of the data collectors, and the high likelihood of bias and misclassification. Thus, the prevalence of acute malnutrition may have been under-estimated.

In the absence of an epidemiological surveillance system, a "verbal autopsy" was used to determine morbidity and causes of death through in-depth interviews with the head of the household or next of kin;[12] this may have led to misclassification. However, the risk of misclassification was reduced by developing focus-tested traditional terms used to describe causes of death and by asking respondents to validate their answer by providing 1–3 symptoms that the person experienced in the week before the death. Finally, to account for the effect of the fluctuation in food supply, mortality was estimated over a period of 373 days. Such a long recall period may have affected the accuracy of the estimates. In order to improve the accuracy of mortality data, the use of a calendar of events and the use of an immunization card (given the adequate Maternal and Child Health (MCH) observed in the region) were adopted to check the last date the child attended the MCH center prior to death to validate the reported date of birth.

Conclusions

In spite of the different food aid programs in Tete Province, the observed mortality rates and prevalence of malnutrition remain high when compared to accepted international cut-off points. Relief programs in Tete Province are not based on sound epidemiological data. The decision to intervene and the type of intervention often are determined politically. Thus, the government potentially is relieved from fulfilling its responsibility to provide much-needed services to its constituency. In order to avoid these problems, it is advised that non-governmental organizations (NGOs) be granted permission and the opportunity by the relevant stakeholders in Mozambique, including the WFP to:

1. develop, from inception, food aid programming objectives with verifiable indicators relevant to each context, beneficiary targets, and selection criteria;

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2. collect baseline data; and
3. give due consideration and support to improving monitoring and reporting, periodic re-assessments and evaluations to confirm progress, and the impact of the project.

Unless current food aid program selection criteria are reviewed and made more objective, the project's impact on malnutrition will remain nullified and a surge in the reliance, if not dependency, on food aid will be evident. The findings of this study suggest that relief programs in Tete Province would benefit from an improved alignment of food aid programming with diarrheal disease control and HIV/AIDS and malaria programs. One example of a potentially high impact, preventive intervention is the distribution of treated mosquito nets. The extent to which the WFP or NGOs may finance and implement improved complementary programs may depend on their capacities to marshal support from their respective donors and/or other partners.

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