

Mortality, Nutrition and Health in Lofa County Liberia Five Years Post-Conflict

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Abstract

Liberia remains in transition from a state of humanitarian emergency to development, and Lofa County was the epicentre of recent conflict. This study aimed to estimate mortality and malnutrition and evaluate access to health services, water and sanitation. The survey was conducted in April 2009 and employed a 46 cluster × 20 design (n = 920 households) with probability proportional to size sampling. The crude mortality rate was 24.3/1000/year (CI: 19.0 to 29.6) or 0.67/10,000/day (CI: 0.52 to 0.81). The global acute malnutrition rate was 7.9% (CI: 5.4 to 8.9), and the severe acute malnutrition rate was 4.5% (CI: 2.9 to 6.7). Access to basic health services was relatively good according to a variety of indicators; however, access to sanitation was low, with 39.5% of households reporting access to toilets or latrines. Despite high rates of displacement and infrastructure destruction, population health appears to be relatively stable five years post-conflict, though a continued focus on reconstruction and development is needed.

Introduction

Liberia remains in transition from a state of humanitarian emergency to development. After suffering 14 years of civil war (1989–2003), Liberians are still recovering from the systematic violence and atrocities that were commonplace. From Liberia's pre-war population of approximately 2.8 million, an estimated 200,000 to 300,000 people were killed, around 800,000 fled the country and 1.1 million became internally displaced (Williams 2002). The health system was left in ruins; an estimated 95% of health facilities were destroyed in the conflict, and from an initial level of 400 trained government doctors, fewer than 20 remained by the end of the war in 2003 (United Nations Development Program [UNDP] 2006). The epicentre of conflict between 1999 and 2003 was Lofa County, which is located in Northwestern Liberia, bordering Guinea and Sierra Leone. Lofa County experienced almost total destruction of basic infrastructure during the war.

Although resettlement and return to Lofa County have increased in recent years, health service availability has remained relatively constant. Health services for the growing population are insufficient and a major concern. In 2006, Lofa County's estimated population was 276,347; however, that number is in flux because of post-conflict reintegration and migration. At present, facility-level health statistics reflect only the health status of the population seeking care, and a lack of population-level health data inhibits health policy and program decision making (Blanton 2008). We undertook this study to describe basic demographic indicators for the Lofa County population, child nutrition status and measures of health access in Lofa County, and to provide information to support policies and programs that address the returning population's health needs. Mortality and nutrition were the primary focus of the assessment because the basic indicators for assessing the severity of a crisis are the death rate and the nutritional status of the population (SMART 2005).

Methods

We used the Standardized Monitoring and Assessment for Relief and Transition (SMART) Methodology as a basis for the survey design because it is considered best practice for assessing mortality and nutrition in emergency-affected populations. It incorporates sample size and study design considerations that are relevant for emergency-affected populations (The SMART Initiative 2005). Sample size calculations assumed 80% power ($1-\beta$), significance level of $\alpha = 0.05$ and a design effect of 1.5 (Kaiser 2006). National crude mortality rate estimates (12 deaths/1000/year in 2007) are below the emergency threshold of 1.0 death/10,000/day. However, the crude mortality in Lofa County was anticipated to exceed the national rate. It was the epicentre of recent conflict that resulted in higher levels of displacement and infrastructure destruction than in other areas (US Census Bureau International Database 2008; Centers for Disease Control and Prevention 1992; The Sphere Project 2004). Mortality sample size calculations were based on a conservative average household size of 5.0 and a hypothesized death rate of 0.5/10,000/day or 18 deaths/1000/year (precision level of 0.3/10,000/day, 90-day recall period). This yielded a minimum sample size of 492 households, which was increased to 708 households based on a hypothesized design effect of 1.5. For the nutrition component, sample size calculations were based on the detection of a $\geq 3\%$ difference between the global acute malnutrition rate for Lofa County and the national prevalence rate of 8% (Liberia Institute of Statistics and Geo-Information Services [LISGIS] 2008). This yielded a minimum sample size of 1054 children 6 to 59 months of age. Children under 5 years of age constitute approximately 19.6% of the rural Liberian population. The average household size in Lofa County is 5.9, yielding a target sample of 911 households (Tomczyk 2007; LISGIS 2008). The planned sample targeted 920 households, including an estimated 5,520 individuals and 1,100 children under five years of age.

A 46 cluster \times 20 household design was identified because it allowed for better geographic coverage and a potentially lower design effect than the standard 30 \times 30 cluster EPI-based design. The 46 clusters were allocated at the district level within Lofa County using probability proportional to size methods based on the 2008 Liberian census data (Government of Liberia [GOL] 2008). A similar process was used to select communities within each district using place codes (p-codes) for

Lofa County settlements, which is the only available post-war population estimate (Humanitarian Information Centre [HIC] 2005). Once a community was selected, the centre was identified and a random direction was chosen. The residences along the transect from the central start point and the community edge were counted, and one house was randomly selected as the starting point for the cluster. From this house, the nearest residence was selected until the cluster of 20 households was completed; if the residents of the nearest house were not in the vicinity, the next house was visited.

Once a household was identified, the survey was described to an adult household member, preferably the primary caretaker of the children or the household head. If this individual consented, the interview and anthropometric assessment for children followed. Household members were defined as people who had slept in the dwelling most nights during the past month, including those with no biological relation. All children between six and 59 months who were physically at the home or in the vicinity of the home at the time of the interview were included in the anthropometric assessment. Interviews took place during daylight hours; in some cases, more than one village was visited by a survey team during a day, so the timing of household visits varied.

Interviewers received three days of training on interview techniques and anthropometric assessment prior to the survey. The questionnaire focused on demographics. However, additional questions on access and use of health services and water and sanitation were included with the aim of informing future program planning. The hybrid household census method was used to account for both in- and out-migration, with a 1-year recall period for changes in household composition, including mortality and the reported cause of death. The questionnaire was developed in English. Following the pilot test, a local seasonal calendar was developed to aid in estimating unknown dates and ages. Interviews ranged from 15 to 30 minutes in length; when required the questionnaire was translated orally into local languages including Lorma, Mandingo, Kissi and Kpelleh (Blanton 2008).

Standard anthropometric assessment methods were applied (Cogill 2003). If the age of a child was not known and could not be approximated using a seasonal calendar, height was used as a criterion for inclusion. Children with unknown ages who were less than 100 cm in height were included in the assessment and presumed to be less than five years of age. Recumbent length was measured on children less than two years of age (or those less than 80 cm in height if age was unknown) and older children were measured while standing; length/height was measured to the nearest 0.1 cm. Weight was measured to the nearest 0.1 kg using Salter scales (hanging infant scales) for children of all ages because only bathroom scales were available for older children and were not considered sufficiently accurate. Edema was assessed by applying pressure on the top of the child's foot for two seconds; children were classified as having edema only if it was observed in both feet. Mid-upper arm circumference (MUAC) was measured for rapid screening, and if a child was identified as malnourished by MUAC (<12.5 cm) he or she was referred to a health centre for treatment.

Data entry was completed in Microsoft Excel, and 10% of all questionnaires were randomly checked to ensure acceptable levels of accuracy and quality. Forms were deemed accurate if they were completely filled out and household size was consistently reported. Data analysis was conducted primarily in SPSS. Anthropometric data was analyzed using Anthro Version 3, which incorporates the new World Health Organization (WHO) international reference population. Nutrition data were analyzed using both the new WHO international reference population and the National Center for Health Statistics (NCHS) reference population for comparative purposes (WHO 2009). Plausibility checks were run on the anthropometric data, and extreme values (beyond ± 5 or 6 SD, depending on the parameter) were excluded when prevalence rates were calculated. Confidence intervals were adjusted to account for the design effect associated with cluster sampling. A child was categorized as stunted, underweight or wasted if he or she fell below -2 z-scores when compared to an age and sex-specific reference population; severe stunting, underweight and wasting was defined as below -3 z-scores when compared to the reference population. Demographic rates for the year preceding the survey (April 2008 to April 2009) were calculated using standard demographic methods with a mid-interval population as the rate denominator. Cluster-level analysis was used to obtain the mortality rate to ensure confidence intervals were appropriate given the cluster design.

The study was reviewed and approved by the Institutional Review Board at Johns Hopkins School of Public Health and the Liberian Ministry of Health and Social Welfare.

Results

The survey was conducted in April 2009. To obtain the target sample size of 920 households, 922 households were invited to participate in the survey, yielding a refusal rate of 0.2%. Basic demographic characteristics of the sample population ($n = 6055$ current household members) are presented in Table 1. The population was young, with 36.8% falling in the 0 to 9 year age group and 19.1% in the 10 to 19 year age group. Of households surveyed, 91.4% reported having left Lofa County during the conflict. Urban populations had a higher displacement rate at 96.9%, compared with 90.7% among the rural population ($p = .007$); displacement rates also varied significantly by district, as illustrated in Table 1.

Table 1. Study population characteristics

Indicator	Point estimate
Average household size	6.6 (SD = 2.9)
Males	46.4%
Females	53.3%
Average age	21 (SD = 19)
Displacement rate	91.4%
Foya District	98.8%
Vahun District	98.3%
Salayea District	96.2%
Quadu Gboni District	93.8%
Kolahun District	82.5%
Zoror District	82.1%

Nutrition

A total of 1,178 children six to 59 months of age were reported as current household members, and 931 (79.0%) participated in the anthropometric assessment. Of children who did not participate, the majority were not in the house or immediate community when the survey was conducted. Prevalence of stunting, underweight and wasting by age are summarized in Table 2 for both the NCHS and WHO reference populations. NCHS data are presented to better allow for comparison of findings with historic data; however, subsequent analysis and discussion is based on the newer WHO standards. Prevalence of moderate and severe malnutrition rates for stunting, underweight and wasting were similar by sex. The prevalence of stunting, which increased with age, was 31.3% (CI: 27.0 to 35.9), and the prevalence of severe stunting was 14.3% (CI: 11.6 to 17.5). Overall, the prevalence of underweight was 13.3% (CI: 10.3 to 17.0) and the prevalence of severe underweight was 5.4% (CI: 3.9 to 7.6); underweight prevalence was highest among younger children. The prevalence of wasting, which decreased with age, was 6.8% (CI: 4.7 to 9.7) and severe wasting 3.5% (CI: 2.3 to 7.5). A total of 10 children were found to have edema, yielding an edema prevalence rate of 1.1% (CI: 0.5 to 1.9).

The rate of global acute malnutrition (GAM), which includes children falling below -2 z-scores on the weight-for-height distribution and children with edema, was 7.9% (CI: 5.4 to 8.9). The severe acute malnutrition (SAM) rate, which includes children falling below -3 z-scores on the weight-for-height distribution and those with edema, was 4.5% (CI: 2.9 to 6.7). The GAM and SAM rates presented were determined using the WHO reference population.

Table 2. Prevalence of malnutrition by age group

	Reference population			
		WHO (%; 95 CI)		NCHS (%; 95 CI)
Prevalence of stunting				
6–11 months (<i>n</i> = 111)	12.6	7.1–21.5		9.6 5.3–17.0
12–23 months (<i>n</i> = 215)	26.5	19.6–34.8		23.7 17.1–31.9
24–35 months (<i>n</i> = 201)	36.8	31.4–42.6		27.6 22.7–33.0
36–47 months (<i>n</i> = 169)	33.7	25.2–43.5		28.4 21.1–37.1
48–59 months (<i>n</i> = 158)	41.1	32.0–50.9		39.2 30.3–48.9
TOTAL (<i>n</i> = 854)	31.3	27.0–35.9		26.5 22.5–31.0
Prevalence of underweight				
6–11 months (<i>n</i> = 113)	15.0	7.9–26.9		15.0 8.2–26.1
12–23 months (<i>n</i> = 222)	13.1	8.2–20.2		19.4 13.7–26.6
24–35 months (<i>n</i> = 208)	16.8	11.7–23.5		20.1 14.4–27.3
36–47 months (<i>n</i> = 175)	10.3	6.5–15.9		10.3 6.5–15.9
48–59 months (<i>n</i> = 163)	10.4	5.9–17.8		13.5 7.8–22.4
TOTAL (<i>n</i> = 882)	13.3	10.3–17.0		16.2 12.5–20.7
Prevalence of wasting				
6–11 months (<i>n</i> = 107)	13.1	6.6–24.3		11.2 5.3–22.1
12–23 months (<i>n</i> = 210)	7.6	4.4–12.9		8.6 5.2–13.9
24–35 months (<i>n</i> = 197)	8.1	4.8–13.5		7.5 4.4–12.6
36–47 months (<i>n</i> = 165)	3.6	1.5–8.5		3.0 1.3–6.7
48–59 months (<i>n</i> = 154)	0.6	0.1–4.8		0.6 0.1–4.8
TOTAL (<i>n</i> = 859)	6.8	4.7–9.7		6.7 4.7–9.4

Vital Events

A total of 286 births were reported in the year preceding the survey, which translates to a crude birth rate of 46.1/1,000/year. In the 12 months preceding the survey, 147 deaths were reported, resulting in a crude mortality rate of 24.3/1,000/year (CI: 19.0 to 29.6) or 0.67/10,000/day (CI: 0.52 to 0.81). No significant difference in the mortality rate was observed by sex, district or urban/rural location. Mortality rates between the wet and dry seasons were relatively similar; however, a seasonal trend was observed (Figure 1). The leading causes of death, as reported by surviving household members, were malaria, old age, maternal deaths and diarrhea (Figure 2).

Health Services

Households reported seeking health services an average of 3.5 times (median = 3.0) within the past six months, with only 13.7% of households reporting that they did not seek medical care when they needed it. When asked about the last time a household member sought care, the majority of house-

Figure 1. Deaths reported by month in the year preceding the survey

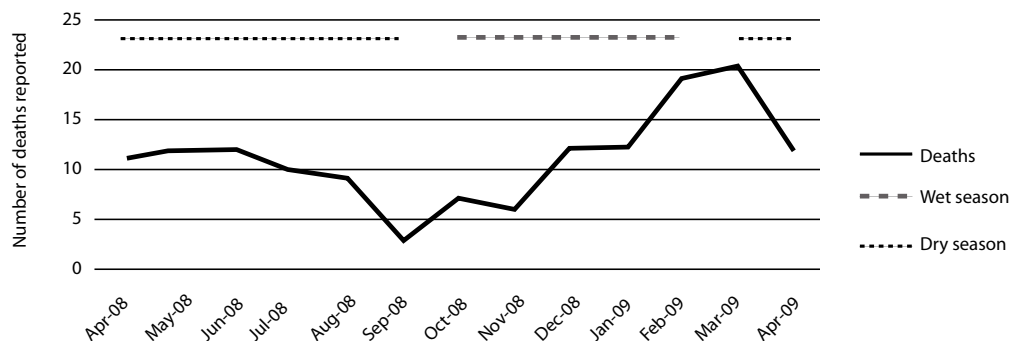
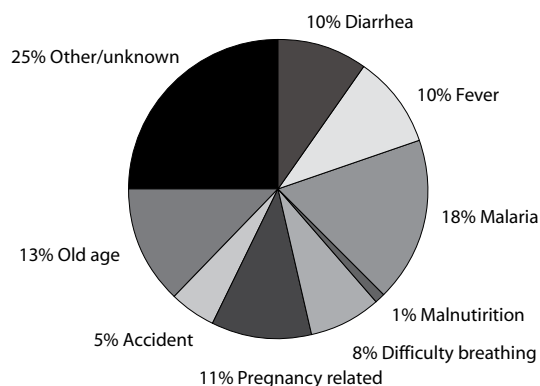


Figure 2. Causes of mortality



holds (71.7%) reported seeking care at a health clinic or centre; other locations included hospitals (12.7%), community health workers (5.1%), private clinics (4.0%), health posts (3.2%), pharmacies (2.3%), mobile medication vendors (0.6%) and private providers (0.4%). Time travelled to seek care varied greatly, with travel times of up to a day (travel during daylight hours). Mean and median travel times were 115 minutes and 45 minutes, respectively; significant differences were observed by district and between urban and rural areas ($p < .001$ for both comparisons). When asked about payment for health services at the household's last care-seeking visit, 80% of households reported services were received free of charge. The proportion of households reporting an out-of-pocket payment varied significantly by district ($p < .001$) but was similar between urban and rural populations ($p = .543$). Among the 20% reporting out-of-pocket expenses, the average payment was 380 Liberian dollars (LRD), or 5.61 US dollars; payments ranged from 0 to 3000 LRD (0 to 44.40 US dollars), with a median value of 200 LRD (2.96 US dollars). Payment amount¹ differed significantly by urban and rural residence location ($p = .045$) and by district ($p < .001$) (Table 3).

As would be anticipated, payment frequency and amount varied greatly by provider. The vast majority of households reported most recently seeking care at a health centre or clinic. Of these, 11% reported out-of-pocket expenditures; the mean expenditure among this group was 217 LRD (3.21 US dollars), and the median expenditure was 100 LRD (1.46 US dollars). Hospitals and community health workers were the next most common sources of care, accounting for 13% and 5% of visits, respectively. The average payment at hospitals was considerably higher than that charged by other providers, at 825 LRD (12.21 US dollars), with a median payment of 550 LRD (8.14 US dollars), presumably because more complex cases presented at these facilities. Among those who sought care from community health workers, the average payment was 128 LRD (1.89 US dollars),

with a median payment of 100 LRD (1.46 US dollars). Fewer households reported seeking care at private clinics or providers, pharmacies and mobile medication vendors; the requirement for payment among these sources of care was substantially higher and was reported in 80% to 100% of visits. Mean and median payments to private clinics, pharmacies and mobile medication vendors were greater than payments to health clinics and community health workers, though less than the average payment reported by care seekers at hospitals.

Table 3. Travel time, payments and satisfaction at health facilities by district

	Travel time (minutes)		Payments (LRD)			Satisfaction with services (%)
	Mean	Median	% paying (n)	Mean ^a	Median ^a	
Foya	72	60	25 (60)	187	50	79.7
Kolahun	78	60	4 (7)	70	70	83.8
Salayea	33	5	5 (4)	869	650	89.6
Vahun	105	120	2 (1)	20	20	71.2
Voinjama	29	60	37 (15)	483	315	76.1
Zorzor	131	25	54 (77)	529	350	69.6
Quadu Gboni	86			298	275	79.5
Urban areas	33	60	20 (33)	532	350	79.4
Rural areas	83	30	22 (149)	346	200	75.2
Total	115	45	20 (182)	380	200	78.7

^a Among households reporting any payment only.

Overall, 78.7% of households reported being satisfied with services they received at their last visit. Satisfaction levels varied significantly by district of residence ($p = .009$) and provider type ($p < .001$) but were statistically similar between urban and rural populations ($p = .477$). Among the 78.7% of households that reported being satisfied with the services they received, the primary reason for satisfaction was the quality of services or doctor (39.5%), followed by the quality of medication (34.6%), the availability of medication (19.0%) and other reasons (6.9%). The 19.9% of households that indicated they were unhappy or dissatisfied with the services they received reported a greater variety of responses. The primary complaints concerned the availability and cost of medication, cost of services, wait time and distance. A total of 13.7% of households reported one or more instances where they had needed but not sought medical care in the 6 months preceding the survey. The primary reasons reported for not seeking care included distance (30.3%), that the illness was not serious enough (23.2%), a dislike of available services or service quality (15.2%), cost (10.1%), transportation difficulties (7.1%), limited medication availability at health facilities (6.1%) and that it was not a household priority (5.1%).

Water and Sanitation

The primary water source was hand pumps, which were used by 68% of households; also common were open wells without pumps (11%) and unimproved water sources (21%). Two out of three households reported that it took less than five minutes to reach their primary water source, and only 4% reported travelling 30 minutes or more. In urban areas, 76% of households reported efforts

to improve water quality, including 70% that treated drinking water with chlorine or bleach. In contrast, 55% of rural households reported water quality improvement activities, including 38% that treated water with chlorine or bleach ($p < .001$ for both comparisons). Household water use averaged 7.5 L/person/day (median = 6.0 L/person/day) in the dry season and 8.4 L/person/day (median = 6.7 L/person/day) in the wet season. However, perceived access to water varied significantly between the wet and dry season, with 31% and 84% of households, respectively, reporting adequate access to water in each season. The lowest levels of water consumption were observed in Salayea, where median water consumption (at home) in both the dry and wet seasons was 5 L/person/day; only 10% of Salayea households reported adequate access to water in the dry season.

In total, 39.5% of households reported having access to improved sanitation, with 27.9% having a shared latrine, 11.1% a private latrine and 0.4% indoor flush toilets. Access to latrines in urban areas (70%) was significantly greater than in rural areas (33%) ($p < .001$). When asked about defecation location, 65.1% of households defecated outside (not in latrine) almost always, with only 22.2% reporting they always used a toilet or latrine.

Discussion

In general, the nutrition status of children in Lofa County was favourable in comparison with recent national figures – a positive finding considering the massive displacement and disruption that occurred in Lofa County. It is also possible that nutrition status has improved nationally among the population over the post-conflict and post-displacement time period. The observed stunting prevalence of 31.3% compares to a national stunting rate of 39.4% and a rate of 44.5% for North Central Liberia, which includes Lofa County, as reported by the 2007 Liberian Demographic Health Survey (DHS) (LISGIS, 2008). The observed underweight prevalence of 13.3% compares to a national prevalence of 19.2% and a rate of 20.0% in North Central Liberia. Wasting prevalence, at 6.8%, compares with a national prevalence of 7.5% and a prevalence of 6.5% in North Central Liberia (LISGIS 2008). Our findings and the DHS findings are similar in their mean z-score by age group for wasting, which are both only negative among children in the 6- to 11-month age range. These data and the comparatively high rates of moderate and severe acute malnutrition found in children aged six to 35 months suggest weaning is an especially problematic period. Education for caregivers and nutrition counselling during ante- and post-natal care, coupled with community-based nutrition programs, would be beneficial, contributing to immediate reductions in wasting and to improved future growth.

The observed crude birth rate of 46.1/1,000/year in Lofa county compares to national crude birth rates of 37.4/1,000/year as estimated in the Liberian DHS and 43/1,000/year as estimated by the US Census Bureau (LISGIS 2008; US Census Bureau 2008). The Liberian DHS estimated the total fertility rate at 6.0 in North Central Liberia (including Lofa County), compared to a national total fertility rate of 5.2, suggesting that the crude birth rate in Lofa County would be anticipated to exceed the national average. There were a total of 1,526 women of reproductive age (15 to 49 years) at the time of the survey, suggesting that approximately 18.7% of women of reproductive age give birth each year. Preliminary results from the 2008 Liberian census indicate the population of Lofa County was 270,114 in early 2008 (GOL 2008). When the crude birth rate is applied, this translates to an estimated 12,776 births per year in Lofa County, although the actual figure is likely higher as a result of increases in population size from returning individuals.

The observed crude mortality rate of 24.3/1,000/year or 0.67/1,000/day falls well below the emergency threshold of 1/10,000/day and was slightly above recent national mortality estimates of 21/1,000/year. This suggests that mortality rates in Lofa County may be similar or elevated when compared with other areas of Liberia (LISGIS 2008; US Census Bureau 2009). Malaria was reported as the leading cause of death among the entire population, accounting for 16% of deaths; old age, maternal deaths and diarrhea were other commonly reported causes of death. Malaria is endemic in Liberia, with year round transmission in most parts of the country (Mapping Malaria Risk in Africa 2002). While mortality rates in the dry and wet seasons were statistically similar, a clear trend in seasonal mortality was observed (Figure 1). Few published studies are available on mortality

patterns in Liberia, and no data are available for populations that have returned and resettled in rural communities following the civil war (Ahmad 1991; Becker 1993; Doocy 2004). However, seasonal mortality patterns observed in Lofa County are similar to patterns in rural Burkina Faso, where malaria is also endemic. In Burkina Faso, lower mortality rates were observed from June to October and higher rates from November to May; peak mortality occurred early in the dry season, and for young children, excess mortality was greatest at the end of the rainy season and was attributed to malaria deaths (Knyast-Wolf 2006). Reduced access to health services in the rainy season, resulting from impassable roads, is a common problem in Liberia and is also a potential contributor to increased mortality during the rainy season (Allen 2009).

Morbidity and mortality surveillance data for 2008 from 14 Lofa County clinics were analyzed to compare causes of death reported in the survey with deaths among clinic patients. The clinics were run by the International Medical Corps (IMC); data was available for 65,800 visits and 31 deaths. Among care seekers at the IMC clinics, primary causes of death included diarrhea (29%), malaria (23%) and anemia (13%). No deaths due to old age or related to pregnancy were reported at IMC clinics, in contrast to the population-based survey data where these categories together accounted for 24% of reported deaths. Many deaths, if not a majority, occur in communities in less-developed settings such as Lofa County. It is especially likely that deaths from old age would be under-reported at health facilities because they would likely occur in the community, with no attempt to seek care. Emergency obstetric cases and trauma-related deaths are also likely to be under-reported at primary care facilities because if care was sought, it would likely be at a referral facility with greater capacity to provide emergency services. Despite relatively good access to basic health services, a substantial number of pregnancy-related deaths were reported, suggesting that more should be done to improve access to quality maternal health services, including increased availability of skilled attendants at birth (De Bernis 2003; Kwast 1996).

Children under five accounted for 15% of deaths. It is possible that this proportion is an underestimate, either because of differential reporting by age group, or as a result of under-reporting of infant deaths. Among children, malaria was reported as the cause of mortality in 44% of deaths, followed by fever (22%), which may have resulted from malaria. Among children under five at IMC clinics, malaria was also the primary cause of death, accounting for seven of 17 (41%) of child deaths; other reported causes included diarrhea ($n = 4$; 24%), anemia ($n = 3$; 18%), malnutrition ($n = 1$; 6%) and others ($n = 2$; 12%). The high proportion of malaria-related mortality suggests that additional malaria prevention and treatment efforts would substantially benefit the population.

That over 90% of households indicated it took less than 15 minutes to reach their primary water source is a relatively positive finding, considering the rural nature of Lofa County. Residents of Voinjama district appeared to travel the longest times to fetch water, which is somewhat surprising considering that the city of Voinjama is the capital of Lofa County. Household access to adequate sanitation was exceptionally low, a minority of households (39.5%) reporting access to toilets or latrines. Diarrhea was second most commonly reported infectious cause of death, accounting for 11.9% of deaths. Access to hand pumps (a protected water source) was relatively high at 67%, and a similar proportion (68%) of households reported treating their drinking water, both of which would contribute to a lower incidence of diarrhea. Better access to sanitation would be of substantial benefit to the population of Lofa County. That 60% of households have no access to a latrine or toilet is a major public health concern. Improved access to basic sanitation is clearly needed throughout Lofa County. Basic sanitation programs such as latrine construction should be a priority, particularly in rural areas where only one third of households had any latrine access and where less than one in ten families had access to a private latrine.

Limitations

A major challenge was developing representative sampling frames in the absence of recent population data. While recent census data was available at the district level, community-level information was several years old and had not been updated to reflect the return of displaced populations. This

could have resulted in sampling bias if there were differential returns among communities in the same district. Another concern was the number of languages within Lofa County and oral questionnaire translation. Common local languages were identified for each community that was sampled, and interviewers with appropriate language skills were subsequently selected. No apparent issues in oral translation were observed; however, it is possible that translation issues may have contributed to increased reporting errors. Cause of death was reported by surviving household members. This may also have contributed to misreporting, especially in cases where deaths occurred without medical attention and no diagnosis was reported. Consequently, data on cause of death should be interpreted with caution.

Another challenge was obtaining accurate ages for children in the anthropometric assessment. Most caretakers appeared able to accurately report their child's age; however, this was impossible to verify without birth certificates. A local calendar including holidays, sentinel events and growing season was used to improve reporting quality, although it is possible that some dates were reported inaccurately. Anthropometric data was not gathered for 21% of children between six to 59 months of age because they were not at home at the time of the assessment. Because of the difficulties in reaching many communities, some of which were several hours' walk from the main road, it was impossible to wait for children to return or to revisit households. This may have resulted in bias if these children were different from those who participated in the assessment, and could have resulted in under- or overestimation of malnutrition. Feeding programs were not ongoing at the time of the assessment, eliminating the possibility that the children differed in terms of benefiting from food distribution. Variation in household food production or income generation activities is a potential source of bias that was not accounted for in the survey. Lastly, if the type of illness and/or services sought at the most recent health facility visit had been collected, a more in-depth analysis of health expenditures by facility type and health condition would have been possible.

Conclusions

The study aimed to provide current mortality and nutrition data on the population in Lofa County, Liberia, and to inform health programming provided by both the government and international nonprofit organizations. Existing population-based health and demographic data for Lofa County was gathered prior to the conflict and to the return of the displaced population, which peaked from 2004 to 2006. Other data sources, such as facility-based data and national surveys, are either unrepresentative of the Lofa County population as whole or do not have information specific to Lofa County. Data from the current assessment is important for comparing Lofa County with national figures for Liberia. It is also important as a baseline from which gains in health, demographic and development indicators such as access to water and sanitation can be measured as reconstruction efforts continue. The nutrition status of children Lofa County was comparable to national figures from the 2007 DHS, a positive finding considering that Lofa County was the epicentre of the civil war. Mass population displacement, estimated at 91%, coupled with destruction of basic infrastructure and the remote landscape are all factors that suggest health statistics for Lofa County would be worse than national averages. However, study findings indicate that population health in Lofa County, as measured by the crude mortality and child malnutrition rates, is comparable to other areas of Liberia. Despite high rates of displacement and infrastructure destruction, population health appears to be relatively stable five years after the conflict, though clearly a continued investment in reconstruction and development is needed.

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Endnotes

¹ Liberian dollars were converted to US dollars using an exchange rate of 1 US dollar equals approximately 67.575 LRD.

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