Child mortality in a collapsing African society

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A cohort study of mortality among under-5-year-olds was carried out in two Somali villages in 1987–89, a period of economic and political collapse in the rural parts of the country. Analysed was the relative importance of the social characteristics for under-5-year-old mortality against a background of deteriorating political and economic conditions.

Mortality increased among under-5-year-olds from 1987 (211 per 1000) to 1988 (323 per 1000) to 1989 (414 per 1000). The mortality risk was more pronounced for boys than girls and was more so for infants than children aged 1–4 years. The major signs prior to death were respiratory infections, diarrhoeal diseases, fever/malaria and tetanus in the neonatal period. Over the 3-year study period mortality rates for diarrhoeal diseases increased significantly, while those for respiratory infections and diseases preventable by immunization increased more slowly. The increasing trend in under-5-year-old mortality was more pronounced in instances when the mother derived her major income from sources other than farming and in larger households.

Introduction

A number of African countries have experienced socioeconomic difficulties and civil war over the past few decades, including Somalia, Ethiopia, Sudan, Chad, Liberia, Uganda, Angola, and Mozambique. The consequences of such disasters for the health of infants and under-5-year-olds are well known (*1, 2*). Reports from some of these countries mention high mortality rates during infancy and childhood in times of war (*3, 4*). However, there have been few studies that have reported longitudinal data on child mortality for a society that is undergoing social and economic collapse, and have analysed the social stratification of such mortality trends (*5*).

Epidemiological studies offer good possibilities for examining the impact on health of socioeconomic and political changes in society. Various characteristics can be used to identify communities at high risk. However, population-based data on mortality are not readily available in countries where health services do not cover all segments of the population and where information about vital events is incom-

plete (*6*). Thus, active epidemiological surveillance of infant and under-5-year-old mortality remains a valuable and sensitive indicator of socioeconomic changes and is particularly useful for distinguishing between subgroups of the population (*6*).

In Somalia, the political and social situation deteriorated during the 1980s prior to the onset of the civil war in 1990. In two villages situated 40 km from the capital, Mogadishu, a demographic surveillance study was carried out over the period 1987–89. The results provided us with an opportunity to study child health development prior to the onset of the civil war.

The present article assesses infant and under-5-year-old mortality in this rural Somali community, analyses the relative importance of socioeconomic characteristics on mortality, discusses the preventability of mortality, and analyses the mortality trends against a background of deteriorating socioeconomic conditions.

Materials and methods

Study area

The study was performed in two Somali villages, Lama-Doonka and Buulalow, situated approximately 10 km from the Shabeelle river and 40 km from Mogadishu. In these villages, chosen as representative of the semi-arid agricultural area between the Somali rivers, a Somali–Swedish collaborative research project had been in progress aimed at using epidemiological methods in the planning of public health activities. A field study base was established,

where socioanthropological data constituted the background for a series of specific studies mainly focusing on women's and child health (7, 8).[a,b] The inhabitants were subsistence farmers, and did not represent a wealthy segment of Somali society. A small proportion of the population practised nomadic pastoralism part of the year and a large number bred cattle and earned a surplus from milk production.

In these two villages, community health workers were trained, traditional midwives were given additional training, simple health centres were built by the villagers, and basic health care was provided. The primary health care activities at the regional and district level were gradually breaking down over the period 1987–89, with an accompanying lack of essential drugs and collapse of preventive activities, including immunization programmes. Reports of the political and social unrest in the central and northern regions of the country occurred on a daily basis. Commodities such as fuel and food, if available, were sold at high prices, and were hardly affordable for the ordinary villager. Internal refugees moved south from the northern part of Somalia, where the fighting intensified in 1988.

Study methods

A demographic surveillance system was in place from January 1987 to December 1989 in the two study villages. After an inital census (2456 inhabitants), all births, deaths, and in- and out-migrations were registered through intensive collaboration with village leaders, village health workers, and traditional birth attendants. The demographic data were regularly cross-checked by one of the researchers on weekly-to-fortnightly visits. The symptoms prior to death were registered through a structured interview with relatives (9), usually the mother. A total of 15 108 person-months of follow-up of under-5-year-olds form the basis for the estimates of under-5-year-old mortality.

The following study definitions were employed.

— Literacy was defined as the ability to read and write, regardless of formal education. Many adults were trained to read and write during a

literacy campaign in the 1970s. To validate this information, a local newspaper written in Somali was used to test the ability to read.

— A household was defined as a group of people living in the same compound and eating from the same pot.

— Maternal occupation referred to activities outside the household carried out by the mother in order to improve the economy of the household. Specifically, a farming mother cultivated the land, while nonfarming mothers belonged to an economically homogeneous group engaged in commerce and craftsmanship.

Statistical methods

Under-5-year-old mortality was calculated by life-table analysis using the density method, where cases of death are related to the person-months of follow-up. Mortality rates were directly standardized for age in analyses of trends over time. In the analyses of possible associations between family characteristics and survival of under-5-year-olds, a Cox's regression analysis was performed using EGRET software (Epidemiological Graphics Estimation Testing, Statistical and Epidemiological Research Corporation, Seattle, WA, USA).

Results

A total of 88 deaths occurred among under-5-year-olds during the 3-year observation period (Table 1). When related to the person-months of follow up, they correspond to a high mortality rate during the neonatal and post-neonatal periods (48 and 29 deaths per 1000 months, resp.). From the age-specific mortality rates, we derived the probabilities of dying during infancy and before 5 years of age. Thus, the infant mortality rate was 142 per 1000 (155 and 129 per 1000, resp., among boys and girls) and the cumulative under-5-year-old mortality rate was 303 per 1000 (336 per 1000, among boys and 271 per 1000 among girls).

The major causes of death were respiratory infections and diarrhoeal diseases, accounting for almost 50% of the total. Fever, possibly indicating malaria, was responsible for another 17%, while relatively large numbers of cases of malnutrition were noted among the deaths. During the neonatal period, tetanus was indicated as the underlying cause of 8 of 10 deaths (Table 1).

The cumulative mortality rates among under-5-year-olds were 211 per 1000 (95% confidence inter-

Table 1: **Deaths among under-5-year-olds, by age and symptom categories, in the two Somali study villages, 1987–89**[a]

Symptom prior to death	Age group (months)			
	0	1–11	12–59	0–59
Respiratory	0	7	13	20
Diarrhoea	0	7	13	20
Fever/malaria	0	5	10	15
Malnutrition	0	3	11	14
Tetanus	8	0	0	8
Other infection	0	3	6	9
Other	2	0	0	2
Total number of deaths	10	25	53	88
Person-months of follow up	207	876	14 025	15 108
Mortality rate (per 1000 per month)	48.2	28.5	3.8	5.8

[a] Cumulative infant mortality rate = 142 per 1000 (95% confidence limits, 63–221); cumulative under-5-year-old mortality rate = 303 per 1000 (95% confidence limits, 259–347).

Fig. 1. **Mortality rates for infants, 1–4-year-olds, and 5–14-year-olds, 1987–89, in the two rural Somali study villages.**

infections (78 per 1000) and another quarter to diarrhoeal diseases (79 per 1000).

The trends in cause-specific under-5-year-old mortality rates are shown in Fig. 3. Mortality rates from diarrhoeal diseases increased significantly, while those from respiratory infections and vaccine-preventable diseases increased more slowly.
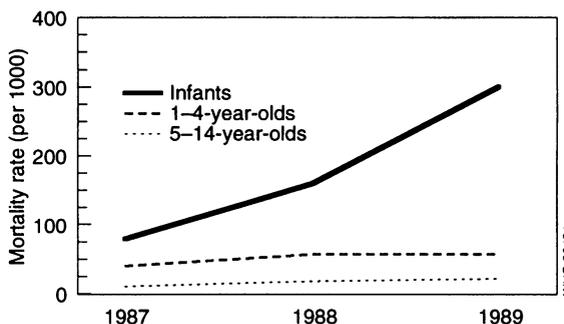
val (CI), 174–248), 323 per 1000 (95% CI, 279–367), and 414 per 1000 (95% CI, 363–465) for 1987, 1988, and 1989, respectively. This statistically significant ($P < 0.01$) increasing trend was entirely accounted for by the infants (Fig. 1), being especially pronounced among boys.

There was a tendency towards higher under-5-year-old mortality in illiterate households (Fig. 2). This was, however, not significant in bivariate or multivariate analyses, when adjustment was made for the sex of the child, occupation of the mother, and household size (Table 2).

The under-5-year-old mortality in subgroups displayed seemingly different trends over the 3-year study period. Thus, while in households with farming mothers, the under-5-year-old mortality in 1987 was twice that in literate households, a more dramatic increase was noted among children of nonfarming mothers. Similar increasing trends were observed among children in larger households (Table 2), with boys showing a much more pronounced increase in under-5-year-old mortality risk than girls.

The total cumulative under-5-year-old mortality rate over the period 1987–89 and the corresponding rate for vaccine-preventable diseases showed that one-third was caused by neonatal tetanus, whooping cough, and measles. The observed under-5-year-old mortality rate over the whole period could have been reduced from 303 per 1000 to 207 per 1000 by vaccinations. One-quarter was attributed to respiratory

Fig. 2. **Cumulative infant and under-5-year-old mortality rates for boys and girls in the two study villages for the period 1987–89, by literacy level of the head of household.**
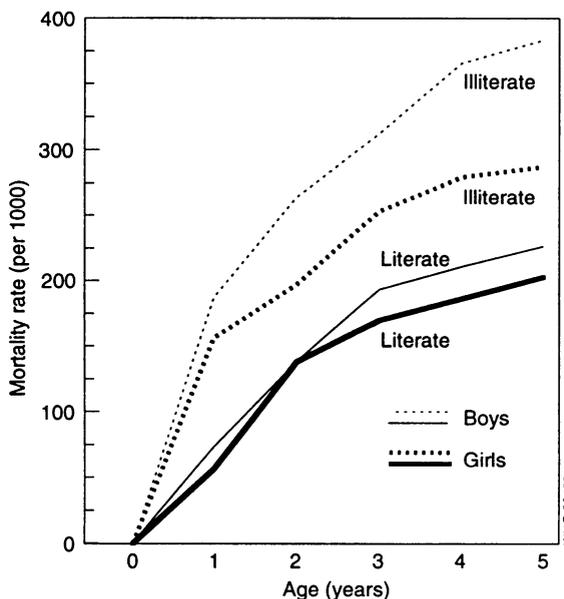
Table 2: Under-5-year-old mortality risk and time trends in relative mortality in the two Somali study villages, 1987–89

Background factor	Category	n	Bivariate RR[a]	Multivariate RR[a]	RR time trend:[a] 1987	1988	1989	Test for trend P-value
Sex	Female	261	1.00	1.00	1.6	2.0	2.0	0.70
	Male	247	1.27 (0.85–1.89)[b]	1.37 (0.90–2.1)	1.0	2.4	4.3	0
Literacy, head of household	Literate	167	1.00	1.00	1.0	1.6	3.6	0.10
	Illiterate	341	1.51 (0.94–2.42)	1.58 (0.97–2.6)	2.1	2.9	3.6	0.09
Occupation, mother	Farmer	401	1.00	1.00	1.9	2.8	4.1	0.02
	Non-farmer	107	0.78 (0.46–1.32)	0.71 (0.41–1.24)	1.0	3.0	4.1	0.02
Household, size	1–6	245	1.00	1.00	2.0	3.2	3.2	0.29
	7–19	263	0.73 (0.49–1.09)	0.79 (0.52–1.2)	1.0	1.9	3.5	0

[a] RR = risk ratio.
[b] Figures in parentheses are the 95% confidence interval.

Discussion

Our results reveal a dramatic increase in under-5-year-old mortality, indicating the public health consequences of the economic and welfare constraints imposed by the socioeconomic and political collapse of Somalia. Thus, unlike long-term epidemiological studies, the present study detected an effect on mortality even before the onset of the war (5). In addition, the results illustrate that national or even global "exposures" manifest themselves at the village level, where they also take human rather than only economic forms.

The trends in infant and under-5-year-old mortality rates at 1-year intervals revealed a significant increase in mortality during the study period. This increase was due to the deaths of infants rather than

Fig. 3. Time trends for various cause-specific, under-5-year-old mortality rates in the two study villages for the period 1987–89. Vaccine-preventable diseases include neonatal tetanus, pertussis, and measles.

children, and boys rather than girls. However, there was no evidence among the study population that boys and girls were treated differently. These differences in infant and childhood mortality can probably be explained by differences in biological factors that make males more susceptible than females to environmental stress (10).

Although it is conventional to assign a single underlying cause of death, mortality among infants and children in developing countries is often due to the effects of multiple acute and chronic illnesses (11). The major symptoms prior to death, as reported by the mothers in the verbal autopsies in this study, were respiratory infections, diarrhoeal diseases, fever and/or malaria, malnutrition, and other infections. In this rural Somali setting, neonatal tetanus was also the major cause of death among neonates in the first week of life; a similar finding was reported in Somalia in a study conducted in Mogadishu and Balad in 1977 (12). These health problems are closely related to inadequate health care and low levels of socioeconomic development (13). During the period when we conducted our study, the country experienced organizational and administrative upheaval at different levels. Primary health care at the regional and district levels almost collapsed because of lack of drugs and supervision, and at the village level vaccines were no longer available and simple drugs for the treatment of common diseases were difficult to obtain. Also, inflation affected the ability of the ordinary citizen to purchase food and other necessities.

The time trends in under-5-year-old mortality in relation to various background factors showed a somewhat surprising pattern. Some of the these factors, e.g., a nonfarming mother, seemed to be associated with a lower under-5-year-old mortality risk at
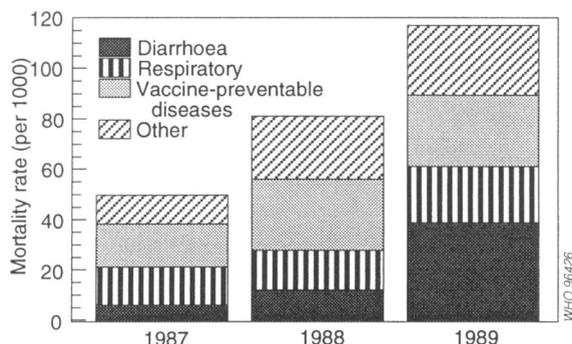
the beginning of the study period but not during 1989, the last observation year. Similarly, a larger household size was associated with a lower risk during the first part of the observation period but not during the last. Conceivably, those households that were more integrated into the market economy (linked to nonfarming occupation and household size) suffered more in a socioeconomic crisis than subsistence farmers. This may also have had a more pronounced negative impact on the survival of the most vulnerable sector of the population — the infants.

During this period of successive social and economic collapse in Somalia, much of the mortality could still have been prevented by basic treatment such as oral rehydration therapy or vaccinations. As has been discussed previously, mortality in this crisis was more preventable than elsewhere and potentially treatable by simple means (1, 5). Who can vaccinate, however, when the district health services disintegrate, and who can provide the necessary care when the safety net of the extended family is broken? Our data therefore emphasize the increased mortality risks and the need for health care assistance, especially for infants, in a society undergoing collapse, even before armed conflict or similar acute crises arise.

Acknowledgements

Résumé

Mortalité infantile dans une société africaine en cours d'effondrement

Une surveillance démographique effectuée en 1987–1989 dans une communauté rurale de Somalie, avant le début de la guerre civile, a montré une augmentation de la mortalité chez les nourrissons et les enfants de moins de cinq ans.

L'étude a été réalisée dans deux villages, Lama-Doonka et Buulalow, situés à environ 10 km de la rivière Shabeelle et à 40 km de la capitale, Mogadiscio. Un projet de recherche en collaboration entre la Somalie et la Suède, portant sur l'utilisation des méthodes épidémiologiques pour planifier les interventions de santé publique, était en cours dans ces villages. La situation politique du pays était alors en détérioration complète et cette étude a donné l'occasion d'examiner l'évolution de la santé infantile dans la période précédant le début de la guerre civile en 1990.

Un système de surveillance démographique a fonctionné dans le cadre du projet de recherche de janvier 1987 à décembre 1989. Le présent article évalue la mortalité chez les nourrissons et les enfants de moins de 5 ans dans une société rurale de Somalie dans une période de pré-guerre civile, analyse l'influence relative des caractéristiques socio-économiques sur la mortalité, et évalue les tendances de la mortalité et sa prévention possible dans un contexte socio-économique en détérioration.

L'étude est basée sur le suivi de 15 108 personnes-mois chez les moins de 5 ans. La mortalité de ce groupe d'âge a été calculée par analyse des courbes de survie avec la méthode qui lie le décès de chaque personne à la durée du suivi. Les taux de mortalité ont été directement standardisés sur l'âge pour l'analyse des tendances séculaires.

L'étude a révélé une augmentation de la mortalité chez les moins de cinq ans entre 1987 et 1989 (211 pour 1000 en 1987, 323 en 1988 et 414 en 1989). Le risque de mortalité était plus marqué chez les garçons que chez les filles, et chez les nourrissons que chez les enfants de 1–4 ans. Les principaux symptômes précédant le décès étaient les infections respiratoires, les maladies diarrhéiques, la fièvre et/ou le paludisme, et le tétanos néonatal. Pendant la période étudiée, les taux de mortalité par maladie diarrhéique ont fortement augmenté alors que ceux dus aux infections respiratoires et aux maladies évitables par la vaccination augmentaient plus lentement. La tendance à l'augmentation chez les moins de cinq ans était plus marquée chez les enfants dont la mère tirait son revenu principal d'activités autres que l'agriculture, et chez ceux issus de familles nombreuses. Ces résultats mettent en évidence l'augmentation du risque de mortalité et la nécessité d'une assistance sanitaire, en particulier pour les nourrissons, dans une société en cours d'effondrement.

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