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Over the last 20 years, billions of dollars have been spent in attempting to prevent famine deaths in Africa. It is surprising that relative to this vast expenditure, very little is known about African famine mortality, and there remains much confusion of view about its scale and importance. These differences are perhaps partly a reaction to exaggerations by the operational agencies of the risks of mass starvation in Africa: but may also arise from the growing understanding of African rural economy and the extraordinary ability of rural Africans to avoid starvation even in the face of protracted drought and other economic insults.

A recent tendency has been to minimize the scale and importance of famine mortality and to emphasize its economic and social causes and effects. Africans who live in famine prone areas are clearly often more concerned with the risk of destitution than the risk of death. In current development jargon, Africans do not starve, they 'cope'. In parallel with this, views of the immediate cause of mortality in famine have also shifted, away from an earlier and obvious truth that the immediate cause of famine deaths is starvation, towards the view that disease is the primary, or perhaps the only, major factor involved.

This article briefly reviews the available literature on the rates and immediate causes of famine mortality in recent African famine and touches on some of the problems of measurement and interpretation involved.

1 THE 'CAUSE' OF FAMINE DEATHS

In discussion of the causes of famine deaths two concepts are often confused: death by starvation and the risk of death from other causes. The concept of 'death by starvation' has long been disputed by nutritionists, largely on the grounds that even if an individual is known to have been starved and is emaciated, starvation cannot clearly be given as the immediate cause of death. Death is generally from infection, electrolyte imbalance or a range of other biological events, see e.g. Kleiber (1981).

But although there may be no accepted biological definition of starvation, it is indisputable that, if deprived of food for a sufficient period, all people die: and that in lay if not scientific terms, death by starvation is a reality. Discussion of the biology of starvation is beyond the scope of this note but current evidence, (admittedly no more than an epidemiological association, for example see Chen 1980) broadly supports the idea of a relationship at a population level between 'thinness' and the risk of death, the relationship being roughly parabolic in shape. There is also evidence for a relationship between relative deficiency of some micronutrients (short of florid deficiency disease) and increased mortality, independent of body mass.

Secondly, levels of risk vary. Because of food shortage, people may take actions which change their exposure to other risks, most importantly to an increased risk of death from disease. Protein-energy malnutrition may, of course, be caused, or aggravated by, a reduction in food intake consequent on disease; and the risks of infectious disease may be increased by changes in food and nutrient intake.

The relative importance of nutritional and disease factors are difficult to separate as in most practical situations neither can be assessed sufficiently accurately, and there is little theory on which to base interpretation. Nutritional measurement is possible only at a very approximate level, e.g. using nutritional anthropometry and approximate statistics on disease; and many populations facing food crisis cannot realistically be estimated at all.

2 FAMINE MORTALITY

Famine in rural agricultural societies often leads to the division and displacement of populations. A local deficit of food supply from agricultural failure or the interruption of trade from war can often be made up only by the movement of people to sell property or to find work or relief. The population movements associated with famine are often selective, generally complex and always incompletely recorded. For instance, younger men may move to

find agricultural work, the rest of the population remaining behind to survive on remaining food supplies; women and children may move to work, beg or find relief; populations may move wholesale; men and women may go to different destinations; poorer people, or some poor people may move, the better-off remaining in place. Movement may be 'successful', in that people may find work and food, or more-or-less unsuccessful where, for example, people move to urban areas and cannot find work, or to camps of displaced people or refugees in the hope of receiving relief. People may of course choose to remain *in situ*, even if this involves some reduction in food intake.

The risk of death in each of these situations is clearly different, and an estimate made for one group e.g. the displaced, cannot be taken as representative of the whole.

3 THE LITERATURE ON AFRICAN FAMINE MORTALITY

As with much of the literature on emergencies, the literature on famine mortality is biased (i) between a smaller published literature and a larger unpublished 'fugitive' literature largely produced by the international operational agencies; (ii) towards the most severely affected (and in some locations to the more accessible, or more highly publicized) populations of operational interest and (iii) towards situations where it is more practical to collect data on mortality and where there is a compelling operational reason to do so.

The result is that a great deal of high quality information is available on mortality in refugee camps (where there is an international interest through the UNHCR and the international NGOs and it is generally practical to collect data), and rather less information on camps of people displaced within countries (where international interest varies). Very little is known about mortality in populations who are displaced 'successfully', and about populations who do not engage international interest (e.g. perhaps 500,000 people displaced from the highlands to the south-west of Ethiopia in the mid-1980s), notwithstanding the fact that such movements often cause great privation and probably increased mortality. And over a period of 20 years of intermittent food crisis and famine, there is only fragmentary information on mortality in 'undisplaced' populations facing food crisis. The comment by Caldwell (1975) after the 1973 Sahel famine, that 'the statistical systems

did not meet the challenge and demographers using survey methods did not fill the breach' is still apt.

Some general themes may be drawn from this literature:

1 **The movement of population** may increase mortality. The risks associated with movement may include physical risks, for example from banditry, risks associated with removal from the physical and social environment of the home and from the risk of disease. The risks of removal from the home, particularly for the young include exposure (even at the temperatures of Africa), a reduction in the quantity or quality of food (due to difficulties in procuring adequate supplies and preparation without easy access to fuel and utensils). Disease risks vary widely. Epidemics, e.g. of cholera, may occur where there are few sources of water and migrants concentrate around these; where migrants entering an area are exposed to a new disease or disease vector; or where migrants introduce a disease to an area.

The evidence for such effects is copious, if largely anecdotal in quality, e.g. typhus and relapsing fever in Ethiopian migrants to the Sudan in 1985, which went largely unrecognized, causing some excess mortality, and the movement of cholera from the lowlands of Ethiopia to highland camps in 1985. The conditions for some epidemics have probably been created by movement of population over years of drought, war and displacement. For example, in the Sudan visceral leishmaniasis has probably killed tens of thousands of people, although its relationship to famine is largely unrecognized.

The only systematically documented case of mortality amongst migrants which we have found relates to western Sudan in 1984/5. In one pastoral village in Darfur, de Waal (1989) recorded a large excess mortality in boys aged between five and nine years. This was attributed to their responsibility for herding over long distances, which brought them in contact with other communities and exposed them to the risk of disease at water sources.

2 **Concentrations of displaced people.** Mortality in many refugee and displaced person camps is very high - so high in many cases as to be evident even to the casual observer. The circumstances which lead to this mortality are clear. In the short run,

typically the first two to three months of a camp, mortality probably increases in all concentrated populations for a combination of reasons. The fact of concentrating a population increases the risk of disease transmission from person-to-person and by some vectors and poor sanitation and water supply through faecal-oral spread. In many locations these effects are increased by temporary social disruption. Most mortality in camps is from measles and respiratory infections and from diseases of insanitation (diarrhoea, dysenteries and hepatitis) and from vector-borne diseases (e.g. malaria, typhus, relapsing fever). In many cases the risk is compounded by high rates of protein-energy malnutrition and other nutrient deficiencies. Both scurvy and pellagra have been epidemic in refugee/famine camps in parts of Africa in recent years (Seaman and Rivers 1989; WHO 1989).

Mortality in camps may reach very high levels, so high in some cases that it is convenient to express mortality as a daily rate. For example, in the period 29 October 1984 to January 1985, 2,612 people are reported to have died from a population of 7,200 in Harbu famine camp in Ethiopia (Jansson, Harriss and Penrose 1987). The crude mortality rate (CMR) in the Wad Kowli refugee camp of Tigrayan refugees in Sudan reached 8.2/10,000/day and rates for children under five of 30/10,000/day (Yates 1986). For comparison, a normal CMR might be of the order of 200/10,000/year. Even where a camp is well organized from the outset, and food supply is good, some excess mortality may be inevitable. In 1985 Umballa camp in Darfur, a prepared well-supplied site, reached a peak CMR of 7/10,000/day and in the under five age group a rate of 18/10,000/day (Yates 1986). Toole and Waldeman (1990) give a good summary account of camp health.

3 Mortality in undisplaced populations facing food crisis. Reliable information on mortality in general populations facing food crisis in Africa is sparse. Almost no information is available on mortality which can be reliably related to changes in the quantity or quality of food available, to changes in nutritional status or even in many cases even to an adequate description of the economy of the population concerned.

Data on particular recent African famines are equally sparse:

Sahel, 1973/74. The 1968-73 drought in the West African Sahel affected in differing degrees approximately 25 million people of diverse economy in an area of approximately one million square miles. An extensive review of the available demographic information (Caldwell 1975) found that it was impossible to establish reliable baseline figures for mortality before the drought: even less possible to establish a useful estimate of famine mortality. Evidence from surveys (Centers for Disease Control 1973) conducted primarily to collect information on nutritional status, gave some mortality data. This suggested an extreme mortality of approximately 7 per cent (over an assumed 'normal' mortality for West Africa of 2.4 per cent) in a group of nomad clusters in Niger. The proportion of the population exposed to this extreme mortality is unknown but was certainly small. For the greater part of the sedentary population (minus 'nomads'), 16 million people, CDC reported that 'sedentary deaths are the same as in normal years'.

A village study in Niger (Faulkingham 1977) found a high but stable death rate in the drought years 1969-1973 (CMR of 21.4, 17.2, 19.5, 16.4, 15.4 in successive years) followed by an abrupt increase in 1974 (CMR 43.3). This increase reflected 'the death of scores of children, particularly those born during the drought years, as many succumbed to an epidemic of spinal meningitis between October 1974 and March 1975. The worst year was 1974, when 68 per cent of all deaths were of children between the ages of 0 and 4 years'.

Ethiopia, 1973. The area and population affected by drought and famine in Ethiopia in the early 1970s, were, relative to that affected in the famine of the mid-1980s, comparatively small, being confined to an area of the north-east highlands and the Eastern lowland. For the general population, the only data collected by a reasonably representative survey was in part of Raya and Kobbo district of Wollo province (Seaman and Holt 1975). This suggested a CMR in the year of the famine of 70/1,000/year implying an total excess mortality of approximately 4 per cent of the population, taking no account of migrants who had not, at the time of the survey, returned. Raya and Kobbo was neither the worst nor the least affected area, suggesting a total excess mortality of approximately 40,000 from a total drought affected population of perhaps a million people, an unknown proportion of which occurred in famine camps.

Ethiopian Ogaden 1973/1974. The pastoral population of this area, estimated at approximately 250,000 people, was affected by several years of drought ending with the general and severe failure of the 1973 autumn rains. An attempt to estimate mortality as part of a survey (Seaman, Holt and Rivers 1978) conducted in 1974 indicated that in the year prior to the survey, mortality in infants under one year of age was 485-414/1,000 and for children aged one to four years was 278-267/1,000/year, for the populations of the North and South Ogaden respectively. No comparative data were available from more normal years, but these rates are clearly abnormally high. No clear difference in mortality was found between the sexes, although there was a suggestion in the South Ogaden of a greater mortality in adult males, probably from increased conflict.

Karamoja 1981. Famine in Karamoja District, north-east Uganda resulted from a combination of drought, and a breakdown in livestock trade on which the people depend to obtain grain in drought years and was aggravated by a breakdown in civil order. A survey by Beillik and Henderson (1980) estimated CMR at 212/1,000/year, compared with a normal of 23/1,000/year. The worst affected age groups were those under one year of age (607/1,000) and those aged one to four years (305/1,000/year). Mortality was significantly greater for males than for females. The cause of death in 78 per cent of deaths was given as starvation.

Darfur, Western Sudan 1984/85. An extensive and detailed survey of the drought affected population of Darfur has been published by de Waal (1989). Only a brief summary is given here. The survey sample was of 1,182 people in eight villages and two peri-urban areas. Normal mortality was taken from the 1973 census which gave an infant mortality rate of 124.6/1,000, and child mortality (one to four years) at 63/1,000/year. There was evidence of a fall in birth rate in the years prior to famine, giving a relatively small cohort of children and a relative absence of young men in the sample population. A crude mortality of 56.2/1,000 was found for the two years June 1984-June 1986, an average of 28.2/1,000 for each year. This suggests, assuming a population of 3.149 million, an excess number of 95,000 deaths over the two year period.

The pattern of mortality was of a gross exaggeration of normal seasonal mortality, being signifi-

cantly higher only in the dry season. Mortality was higher for men than for women, although with the exception of the five to nine year group, which was distorted by one site (mentioned above) the difference was not significant. A close relationship was found with age: infants were protected (probably by the habit of late weaning) although infant deaths may have been underenumerated. Mortality of women of child bearing age was also low. Most of the excess mortality - over half of all recorded deaths - was of children aged one to four years (an increase in annual age-specific mortality from 63/1,000 to 282/1,000). Mortality in this group tended to remain high during rains, although as with mortality in other age groups, was higher in the dry season. The increase in the risk of death for adults was small.

Interestingly, de Waal found no relationship between income and the risk of death. Destitute households faced no greater risk than did the better-off. Mortality was linked to livestock ownership, the risk falling above a threshold of one milk-producing animal. Location was found to be important, mortality in different places being related to the quality of water supply and the risk of malaria.

The causes of death were found to be chiefly disease, and particularly diarrhoea, reflecting many problems with water supply. Malaria, social disruption, and poisoning from badly prepared wild foods were also given as causes of death. Starvation was not given as a cause.

Ethiopia 1984/1985. This famine resulted from several years of drought, affecting a progressively larger and higher altitude area. The population affected was of the order of seven million, within which there is wide variation in economy and severity of economic effect. In the general population only one unpublished survey has been found (Otten 1986). This employed seven and thirty day recall from 51,274 families, from a district population of 382,385. A CMR equivalent to 91.6/1,000/year on seven day recall and 106.1/1,000/year on thirty day recall was found. The causes of death were given as diarrhoea, measles and 'lack of food'. No basic demographic information is given, but on the assumption that the population structure was reasonably representative of the usual structure of the area the pattern of mortality suggests an exaggeration of normal mortality patterns. In the same district estimates were also

obtained by three-month recall, giving a CMR of 68.2/1,000/year. Cutler (1985) interviewed families in the Sudan and inferred a CMR of 70/1,000 in the year prior to migration.

Somalia 1992. The preliminary results of retrospective (covering 1992/93, 'between the two Ramadans') surveys in Mogadishu and Belet Weyn suggest that in that period in Mogadishu infant mortality was 319/1,000 live births and under five years mortality 587/1,000. In Belet Weyn the figures were 199/1,000 and 581/1,000 respectively (Ministry of Health, Mogadishu/Regional Health Authority, Belet Weyn/SCF (UK) 1993).

4 CONCLUSIONS

On the current weak evidence:

- 1 It is not possible to draw confident conclusions about the immediate cause of excess mortality in most African populations facing food crisis. It is clear that the enormous excess mortality observed in many camps of displaced people is primarily the result of epidemics; but even here there is a strong, if circumstantial case that changes in food quantity and quality have contributed substantially to the effect.
- 2 The evidence for populations facing food crisis who have not moved and whose exposure to disease has probably not changed - or at least unusual epidemics have not been convincingly observed - is slight. But with the caveat that, in most cases, little is known about the nature of the dietary changes which have occurred, it seems *a priori* reasonable on biological grounds to attribute the increased mortality to a failure of food availability. This would tend to be supported by the case observed by de Waal of the relationship between mortality and access to milk.
- 3 The pattern of age-specific mortality which has been observed is essentially an exaggeration of normal patterns of age-specific mortality, i.e. affecting the young proportionally more, although the breast-fed infant may be relatively protected. It must, however, be allowed that there are exceptions to this pattern. Although the statistical evidence is lacking it seems clear from observation that adolescents have sometimes suffered disproportionate mortality; and that although the evi-

dence is largely anecdotal there is evidence for an increase in adult mortality in some locations from a range of causes from gun-shot to specific diseases.

- 4 To the slight extent that there is evidence for sex-specific differences in mortality this would suggest a pattern resulting from local circumstances, which favours females in some cases, males in others and different risks in different age groups.
- 5 The approximate nature of many statistics on famine, and poor current biological understanding would suggest extreme caution in separating 'famine' from other causes of mortality in Africa. Small measured changes in mortality in large populations will suggest impressive total numbers of deaths. But a rather arbitrarily defined 'famine mortality' can deflect interest from the major epidemic diseases which are statistically more important and in which there is much less international interest and investment. As Caldwell (1975) puts it, 'One can easily play a numbers game - a rise in one point in the death rate over the four years of the Sahelian drought in the six Sahelian countries would have meant a hundred thousand extra deaths. Such exercises are futile, they merely prove what large numbers are being considered and they fail to show how long the dead would have survived without the drought.'

Finally, is famine mortality important? In purely statistical terms relative to other causes of mortality in Africa the answer must be 'no'. The chance of an African dying in a famine are not known but must be vanishingly small. But we should not lose sight of the enormous variation in mortality between and within famines. In some locations the estimated rise in mortality has been so small that the average person in the affected area might not notice it; in others, mortality has been at levels so high as to demand action. It seems doubtful of generalizations that are of any practical use can be made.

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