immune-complex-dissociated HIV p24 antigen for early detection of HIV in neonates. *N Engl J Med* 1993; **328:** 297–302.
39 Schüpbach J, Wunderli W, Kind C, et al. Frequent detection of HIV- and IgG-specific IgM and IgA antibodies in HIV-positive cord-blood sera: fine analysis by western blot. *AIDS* 1989; **3:** 583–89.
40 Amadori A, De Rossi A, Giaquinto C, Faulkner-Valle G, Zocchello F, Chiecto-Brianchi L. In-vitro production of HIV-specific antibodies in children at risk of AIDS. *Lancet* 1988; i: 852–54.
41 Scott GB, Hutto C, Makuch RW, et al. Survival in children with perinatally acquired human immunodeficiency virus type 1 infection. *N Engl J Med* 1989; **321:** 1791–96.
42 Tovo PA, DeMartino M, Gabiano C, et al. Prognostic factors and survival in children with perinatal HIV-1 infection. *Lancet* 1992; **339:** 1249–53.
43 European Collaborative Study. Natural history of vertically acquired human immunodeficiency virus. *Pediatrics* 1994; **94:** 815–19.
44 Galli L, de Martino M, Tovo P-A, et al. Onset of clinical signs in children with HIV-1 perinatal infection. *AIDS* 1995; **9:** 445–61.
45 Centers for Disease Control and Prevention. Revised guidelines for prophylaxis against *Pneumocystis carinii* pneumonia for children infected with human immunodeficiency virus. *Morbid Mortal Wkly Rep* 1995; **44:** 1–11.
46 Working Group on Antiretroviral Therapy, National Pediatric HIV Resource Center. Antiretroviral therapy and medical management of the human immunodeficiency virus-infected child. *Pediatr Infect Dis J* 1993; **12:** 13–22.
47 Centers for Disease Control. 1994 Revised Classification System for Human Immunodeficiency Virus Infection in Children Less Than 13 years of Age. *Morbid Mortal Wkly Rep* 1994; **43:** 1–10.
48 De Rossi A, Giaquinto C, Ometto L, et al. Replication and tropism of human immunodeficiency virus type 1 as predictors of disease outcome in infants with vertically acquired infection. *J Pediatr* 1993; **123:** 929–36.
49 Palumbo PE, Kwok S, Waters S, et al. Viral measurement by polymerase chain reaction-based assays in human immunodeficiency virus-infected infants. *J Pediatr* 1995; **126:** 592–95.
50 Robert-Guroff M, Oleske JM, O'Connor EM, Epstein LG, Minnefor AB, Gallo RC. Relationship between HTLV-III neutralising antibodies and clinical status of pediatric acquired immunodeficiency syndrome (AIDS) and AIDS-related complex cases. *Pediatr Res* 1987; **21:** 547–50.

Public health

Targeting the vulnerable in emergency situations: who is vulnerable?

Austen P Davis

Summary

Background Emergencies such as wars and natural disasters increase the vulnerability of affected populations and expose these populations to risks such as disease, violence, and hunger. Emergency public health interventions aim to mitigate these effects by providing basic minimum requirements, reducing vulnerability, and reducing exposure to risk. Targeted services are generally aimed at children under 5. Mortality rates among young children are higher than the crude mortality rate (CMR) among the whole population in emergency settings, so attention is focused on this age group. However, even under normal conditions mortality is higher in young children. This analysis compared the relative risk of death for young children with that for older children and adults under normal conditions and in emergency settings.

Methods Mortality data from refugee camps set up in response to three different emergencies were examined. Baseline mortality rates in the refugees' countries of origin were calculated from published data. Relative risks between normal and emergency conditions were calculated and compared.

Findings Mortality rates were higher among children under 5 than among older children and adults both under normal circumstances and in the emergency setting in camps in Tanzania, Uganda, and Zaire. However, the relative risk for under-5 versus over-5 mortality was smaller under emergency conditions than under normal circumstances. Thus, children over 5 and adults are disproportionately more affected by exposure to emergency risks than are younger children.

Interpretation If the objective of intervention, to reduce mortality, is to be achieved, the population over the age of 5 cannot be ignored. Emergency public health needs to develop specific tools to investigate risk in other age groups (as well as children under 5), to identify causes, and to design programmes to address such needs.

Lancet 1996; **348:** 868–71

See Commentary page 840

Médecins Sans Frontières Holland, Nairobi, Kenya
(A P Davis MSc)

Correspondence to: 7 Bishops Road, London N6 4HP, UK

Introduction

Emergency public health interventions aim to mitigate the adverse health effects of natural and man-made disasters by providing the basic minimum requirements for healthy life (food, shelter, water, a sanitary environment, and access to health care), by trying to reduce exposure to health threats, and by treating the sick.

Because of the sudden onset of emergency situations and the scale and urgency, intervention within a very short time is often essential.[1] Information is generally scarce, and planning and intervention capacity is limited. The initial intervention decisions must rely partly on experience from previous disasters. The health problems created are fairly consistent, differing only in terms of the severity of the event and the coping capacity of the affected population.[2] A survey of senior relief agency staff[3] indicated that the commonest causes of death in children in emergency settings were malnutrition, diarrhoeal diseases, measles, and acute respiratory-tract infections.

Emergency public health interventions generally take one of two forms—non-targeted programmes in which

the entire population is entitled to benefit, and targeted programmes in which scarce resources are directed to those most in need, on the basis of degree of illness, degree of risk exposure, and physical or social vulnerability. A wide range of potentially vulnerable groups have been defined including children under 5 years old, pregnant and lactating women, elderly people, orphans, the chronically ill and infirm, and the mentally ill. Despite the recognition that a variety of social groups are physically or socially vulnerable, almost all targeted assistance is provided to children under the age of 5 (some programmes include pregnant and lactating women). This approach results from the fact that survey techniques and intervention technologies have been adopted from experience in the context of social and economic development aid.

Mortality rates are believed to be one of the best indicators of overall population well-being. UNICEF and the United Nations High Commission on Refugees (UNHCR) advocate the collection of mortality data and use of mortality rates for monitoring changes in population well-being over time.[4] The crude mortality rate (CMR) has also become the primary means of assessing the scale and urgency of an emergency. Emergency mortality rates are commonly expressed as deaths per 10 000 people per day. A CMR of more than 1 indicates a very serious situation and a CMR of more than 2 indicates an emergency out of control.[5] In addition to the CMR, emergency epidemiological surveillance often reports mortality rates among children under 5 (<5MR). Cut-offs for the interpretation of <5MRs are approximately twice the CMR cut-off points.[5] This doubling of cut-off points for children under 5 is based on the observation that a baseline CMR in a developing country under normal conditions is about 0·4 per 10 000 per day whereas the baseline <5MR is about 1·0 per 10 000 per day. The assumption in doubling reference cut-off points is that the relative risk between age groups is the same in all emergency situations, no matter what the form of emergency. The use of set cut-off points implies that mortality rates are interpreted as static indicators, indicating absolute levels of distress in an emergency situation.

I have looked at risk during emergency situations to identify the groups who are really at risk and to find out whether we have sufficient previous experience to take standardised programming approaches.

Methods

This analysis is based on three different mortality data-sets from refugee camps (Benaco, Tanzania; Koboko, Uganda; Katale, Zaire), collected in 1994. The collection of mortality data is fraught with difficulties. However, these data were collected through specifically designed mortality-reporting systems. Their validity was corroborated through mortality reports from health service reporting systems, death shroud distributions, cross-sectional surveys estimating retrospective mortality experiences, or a combination of these methods. In each case the mortality data were highly concordant with data collected through complementary surveillance systems.

In the analysis, baseline mortality rates were estimated from data collected in countries of residence during times of stability. The baseline mortality rates were then subtracted from the actual mortality rates estimated in the camps to estimate the emergency-related mortality. Baseline and emergency-related mortality rates were estimated separately for children under 5 and for adults and children older than 5. The relative risks of death under baseline conditions were calculated by comparing under-5 and over-5 baseline mortality. The same procedure was followed to calculate the relative risks of death under emergency conditions. The relative risks of death under baseline and emergency conditions were then compared. Thus, the change in the mortality experience of different age groups in changing conditions can be discerned rather than the usual and incorrect comparison of mortality experiences across different age groups under the same conditions.

Data are also presented from a cross-sectional retrospective survey in Katale camp; they allow a more complete comparison between age groups—children under 5, older children (5–15), adults (15–45), and elderly people (>45).

	CMR (per 10 000 per day)	<5MR (per 10 000 per day)	Reporting period
Estimated baseline rates			
Rwanda	0·48	1·4	. .
Sudan	0·42	1·0	. .
Rates in refugee camps			
Benaco, Tanzania	1·81	4·87	May–Dec, 1994
Kaboko, Uganda	0·51	1·16	Jan 1994–Jan 1995
Katale, Zaire	7·43	12·43	July–Nov, 1994

*Mortality rates exceeded cut-offs indicating an emergency during some periods.

Table 1: **Estimated baseline mortality rates and reported mortality rates in three refugee camps**

Results

Estimated baseline CMR and <5MR in Rwanda and Sudan[6] and average mortality rates during the reporting periods in the three refugee camps are given in table 1. The relative risks of death calculated from baseline mortality rates show that children under 4 years old were 3·6–5·6 times more likely to die than the remainder of the population (figure). The risk of specific emergency-related death was also higher for children under 5 than for the remainder of the population, young children being 1·8–4·4 times more likely to die. However, in all three camps, the relative risk of death specifically due to emergencies was substantially lower than that for death under baseline conditions. Thus, the increased risk of death caused by emergencies does not affect all age groups equally. All three case studies showed that populations over the age of 5 suffered disproportionately from increased risk during emergencies.

The figure also shows that relative risks differ between emergencies. Relative risks were not stable within a particular emergency setting. In Koboko camp, mortality rates for children under 5 and for the remainder of the

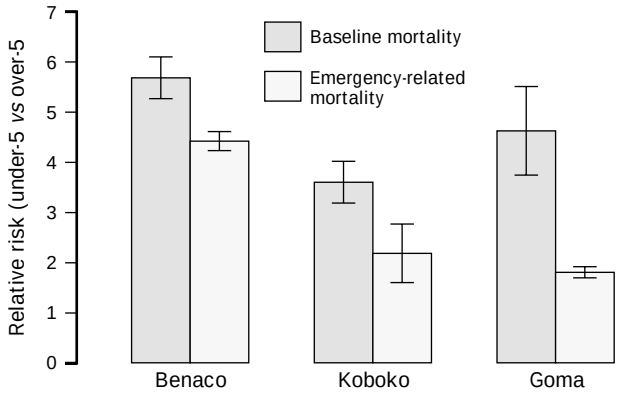

Figure: **Relative risk of death for children under 5 and population older than 5 under baseline conditions, and emergency-related excess mortality in three refugee camps**
Bars show 95% CI.

Age group (years)	Diarrhoea deaths	Mortality rate (per 10 000 per day)	Other-cause deaths	Mortality rate (per 10 000 per day)
<5 (n=684)	47	33·2	11	7·8
5·15 (n=1137)	78	31·5	6	2·9
15·45 (n=1825)	147	38·5	12	3·4
>45 (n=173)	38	97·6	6	17·7

Reporting period July 17 to Aug 5, 1994.

Table 2: **Mortality rates by age and cause, Katale Camp, Zaire**

population peaked at different times; the maximum rate for young children occurred before that for older children and adults. The relative risk during June and July was 8·9 (95% CI 7·0–11·4). During that period, the risk was much higher for children under 5 than for the older population and was higher than under baseline conditions. However, in August and September the relative risk was only 1·1 (0·9–1·4), which shows the risks in the two age groups to be similar. In Katale camp, the relative risk during the first 3 weeks of the emergency was 1·3 (1·2–1·4), but during August to November, the relative risk was 3·6 (3·4–3·9). This finding suggests that during the first 3 weeks there was an emergency risk that disproportionately affected the population over the age of 5. After August, risks of death remained extremely high, but the relative risks began to fall to values expected under baseline conditions.

MSF-H/Epicentre conducted a two-stage 30-cluster household survey in Katale camp, selecting a sample of 3819 people. The survey retrospectively reported on mortality during the first 20 days of the emergency, covering the most acute period of the diarrhoeal disease epidemic.[7] During this period <5MRs were similar to mortality rates in other age groups except for the elderly (table 2). Diarrhoeal disease was the main cause of death (cholera and shigella dysentery). The high mortality rate in the elderly group was due partly to increased susceptibility to diarrhoeal disease, but the mortality rate from other causes was also highest for people over 45. Although children under 5 may be at higher risk than the rest of the population overall, there are certain vulnerable groups within the rest of the population who may be at even higher risk.

Although rates of mortality were similar for all age groups below age 45, the greatest number of deaths was among people aged 15–45 since this is the largest population group. In Benaco camp, 48% of all excess deaths were among people older than 5, compared with 65% in Koboko camp and 73% in Katale camp. Mortality rates may indicate the population groups at highest absolute risk, but they do not necessarily indicate the age groups in which there are the greatest numbers of avoidable deaths.

Discussion

The doubling rule for interpretation of <5MRs in relation to CMRs is based on different risks for different age groups under normal circumstances and assumes that the same relative risk applies in emergency situations. Mortality rates are interpreted absolutely in classification of the severity of an emergency. Patterns of mortality are expected to be similar (except in magnitude) for the population over the age of 5 and for children under 5, whatever the disaster.

This analysis indicates that the relative risks between age groups change with circumstances and over time within one setting. Although it is essential to respond quickly and with the capacity to tackle the most pressing and devastating risks, all emergencies are not the same and we have not yet understood all the main causes of excess mortality.

The Benaco camp data show a pattern similar to that expected under the doubling rule; <5MR and CMR rose at similar rates but at different absolute levels. However, even in this case the population aged 5 and over was affected to a greater extent than would be expected from baseline relative risks.

Koboko camp provides a different picture. Peak mortality among young children and among the general population occurred at different times; this finding suggests that older children and adults were vulnerable to the risks but were more resilient and so suffered later. This pattern of displaced risk has also been reported by MSF-Holland and Concern in Baidoa, Somalia (mid-1993) and Melange, Angola (early 1994) in nutritional emergencies. In these settings the <5MR was initially high then declined rapidly, whereas the CMR remained high for long periods of time. Such mortality patterns show different profiles of vulnerability across age ranges rather than just differences in magnitude of risk. The changes in pattern may have several causes. One possibility is that there are differences in risk between members of an age group owing to social factors. First, the children of the poor are affected, later the less vulnerable poor (adults). Wealthy adults and their children remain relatively well protected. Another possibility is that targeted services to children under 5 were effective in reducing <5MRs, but had no effect on mortality among the remainder of the population. Thus, although children would normally be at higher risk, they were protected by emergency assistance. Finally, it is possible that vulnerability differs between age groups, adults taking longer to succumb or forms of risk changing over the period.

The data from Katale camp show yet another pattern—massive risk, largely associated with diarrhoeal diseases, affected the under-5 age group and the remainder of the population equally. The implications are that all groups required assistance; if any group required special targeting, it was the elderly.

An emergency situation has adverse health consequences for the affected population because it increases vulnerability and susceptibility to risk and in many cases increases frequency and severity of exposure to risk. In a normal setting the population over the age of 5 are often regarded as having been selected by the environment; these people are deemed to have developed some kind of resistance to many of the risks to which they are exposed. When the situation changes and there are newer and more acute risks, however, all age groups are affected.

Individuals and groups within a population have different degrees and types of vulnerability. On exposure to different risks, the various groups will suffer differently, depending on their susceptibility and level of exposure. Relative risk between different age, sex, and ethnic groups will depend on who is vulnerable, how, and the types of risk to which these groups are exposed. Risk may be physical (certain groups are particularly vulnerable to micronutrient deficiencies or infection); it may be related to degrees of trauma suffered during the emergency event (rape, torture, loss of family); it may be related to social and political factors and the amount of influence an individual has (ie, ethnic origin, religion, poverty); or it

may be related to how groups are differentially serviced by national and international assistance programmes (ie, adults may receive food from general food distribution only, whereas children may have multiple food income sources).

The kind of programming and response and the need to target response should depend on the types of risk to which the population is exposed and the degree of vulnerability of different groups to such risks. Risk exposure is not uniform or constant, and different groups are more or less vulnerable to different forms of risk. The three examples show that relative risks change over time, and that over-5s are often disproportionately more susceptible to emergency risk than under-5s. This indicates the need to adapt resource targeting and programming over time.

Children under 5 form a small proportion of the total population. Vast numbers of people over the age of 5 die because of emergency conditions. In attempts to reduce mortality, targeting of all resources on children under 5 is misguided, because a large proportion of the excess mortality will be unaffected.

Tools and strategies used in emergency public health intervention have been adopted from the context of development and are oriented at assessing vulnerability in children. Development intervention focuses on improving the assets of a community (human, economic, and social) in the context of chronic and constant structural difficulties. Intervention is planned over the long term and to have a long-term effect. Developmental tools assess whether there are vulnerable groups of children (the target group for development approaches) and help decide whether to implement child-focused (development) strategies. Emergency intervention, by contrast, aims to preserve the assets of a community during times of acute, unusual, and short-lived high risk. The objectives are not the same, and the differences should be reflected in the use of different tools and technologies.

For example, the prevalence of malnutrition among young children is regarded as an indicator of community nutritional stress.[8] A high prevalence of malnutrition usually results in calls for improved general food distribution and targeted supplementary and therapeutic feeding programmes for children under 5. No studies have shown that use of under-5 malnutrition rates as a consistent indicator of community nutritional stress is effective, and current thought might challenge this belief.[9] There are no reliable tools to measure adult and adolescent malnutrition in people of 5 and over. In some programmes adults are admitted on an ad-hoc basis into child feeding centres, but the scale and causes of adult malnutrition in emergency situations are rarely recognised. The risk among the over-5 population is not investigated, it is not acknowledged, and it is not effectively addressed.

The objectives of emergency intervention must be differentiated from other forms of intervention, specific tools should be developed, and a more context-specific and flexible appreciation of vulnerability should be evolved. Efforts to reduce morbidity and mortality in children under 5 must continue but tools to investigate levels and causes of risk in other age groups, and technologies to minimise these risks must be developed. A recognition of different risks, affecting the full community and broad context-specific analysis is the only means for developing new and more effective modes of intervention to address the full range of needs and risks.[10]

I thank MSF-H and EPICENTRE, for access to the data and for supporting this analysis, and Saskia Van De Kaam, Jeremy Shoham, and Mary Marlow, for encouragement, support, and comments.

References

1 Tailhades M, Toole MJ. Disasters: what are the needs? How can they be assessed? *Trop Doct* 1991; **21** (suppl 1): 18–23.
2 Dick B, Olavio E. Disaster preparedness and response. *Trop Doct* 1991; **21** (suppl 1): 9–14.
3 Nieburg P, Toole MJ, Waldman RJ. Prevantable causes of child mortality in refugee emergencies. Refugee Participation Network, June 1989, no 5.
4 Nieburg P, Person-Karell B, Toole MJ. Malnutrition-mortality relationships among refugees. *J Refugee Stud* 1992; **5**.
5 Hakewill PA, Moren A. Monitoring and evaluation of relief programmes. *Trop Doct* 1991; **21** (suppl 1): 24–28.
6 World Bank. World Development Report 1993: investing in health. New York: Oxford University Press, 1993.
7 Paquet C, Van Soest M. Demography, mortality and nutrition survey, Katale camp. EPICENTRE/MSF-H, 1994.
8 Rivers JPW. Women and children last: an essay on sex discrimination in disasters. *Disasters* 1982; **6:** 256–67.
9 FAO. Body mass index: a measure of chronic energy deficiency in adults. FAO: Food and Nutrition paper No 56, 1994.
10 Marlow M. Malnutrition in elderly people—challenging the childhood bias. *International Health Exchange Magazine*, Dec 1992/Jan 1993 edition.