HOW MANY ADDITIONAL LIVES COULD HAVE BEEN SAVED?

Had relief assistance been implemented more wisely, most Somali deaths could have been averted. But, how many? The answer depends heavily on how many resources could have been available for an earlier, larger, and more difficult set of interventions. This, in turn, depends on how political will might developed earlier. This line of questions increasingly touches on politics more than on health science.

Preciously little literature reports or validates efforts to measure the extent of deaths in health emergencies in large populations But, most of the required concepts have been in place for some time. For example, epidemiological science uses the concept of "preventable fraction,"[131] meaning the proportion of health events known to be preventable This ratio tends to be used in reference to a single procedure or preventive program. There are no intermediary terms that denote the proportion of deaths that would be averted in emergency circumstances where coverage is partial.

Under theoretically ideal conditions, virtually all of the excess mortality in Somalia could have been mitigated [132] With sufficient food aid, vaccinations, and other primary care, little excess mortality should occur, even in emergencies Based on past experience with displaced populations, one could predict malnutrition and infectious diseases would lead to high case-fatality rates in Somalia. In large-scale emergencies, diseases like malaria, shigellosis, and pneumonia frequently are associated with high, 20 percent fatality rates if untreated.[133]

The cost of creating ideal conditions inside Somalia, however, may have exceeded resources available from the international community. Compared to after-the-fact curative or therapeutic interventions (wet feeding centers, chemotherapy, medical care), preventive measures prove more cost-efficient and more effective as a strategy for protecting a large population.[134]

There was little likelihood that the medical infrastructure could have been put into place under realistic conditions to fully treat the health problems of rural Somalis during the famine. But public health and primary care measures -- food, water supply, immunizations, wise camp siting, vitamin A capsule distributions, recruitment of sanitation workers -- could have saved most of the lives lost.

The question therefore depends on the level of effort available over and above normal relief interventions. In fact, the resources, political will and effort were not

available when needed Relief aid in the form of timely immunizations, food safety nets, surveillance, could, in theory, have reduced or prevented:

- 95 percent of the severe malnutrition -- and therefore almost all starvation deaths,[135]
- at least three-quarters of measles deaths,[136]
- and 40 percent of other infection-related or rehydration-related, non-starvation, excess deaths.[137]

Thus, approximately 70 percent of famine-related deaths could have been averted during 1992. 154,000 lives were lost that, from a public health viewpoint, could have been saved.

Food and public health interventions should have been implemented at earlier stages of the crisis. Surveillance systems needed to be reporting from sentinel sites and monitoring malnutrition in the general population (not just camps) by August 1991 [138]

Automatic immunizations campaigns should have reached all large displaced populations receiving assistance beginning in 1991. The provision of dry food aid in a diffuse manner throughout the countryside would have mitigated the need for comparatively more expensive on-site (wet) feeding programs.

In all, the necessary assistance programs could have been implemented for infinitely less than the $2 billion that was eventually spent on the international interventions.

Roughly twice the level of effort, as was provided, would have been necessary for primary care and public health work in the displaced camps and cities. Ten times the level of effort that occurred would have been minimally appropriate for rural areas in the Juba, Shabelle and Bay regions.[139] Had these programs been instituted in early instead of late 1992, it would have required additional financial resources (between $50 and $100 million), over and above the expenditures implementing relief agencies did inevitably incur, and some novel means of providing physical security for these resources and the implementing staff. The result, however, would have been approximately twice the payoff from the investment that did occur, and the airlift and military intervention might have been avoided, saving billions of dollars.

To sum up:

- The estimated population of Somalia during 1991-1993 was 5.1 million;
- Of this total population, some four million Somalis lived in famine-afflicted regions in southern Somalia, where they faced extreme food insecurity and heightened risk infectious disease;
- Of these four million, some 330,000 Somalis were at imminent risk of death during 1992 and 1993;[140]
- Of those at imminent risk, 110,000 lives were sustained (deaths averted), due to health, food, and other interventions that reached over 1 million Somalis; and,
- Of the 202,000 to 238,000 famine-related deaths that did occur in 1992, at *least* 70 percent (154,000) could have been prevented, had proven primary health strategies been implemented earlier and more widely.

Preventable diseases caused most of the deaths that occurred during the 1991-1993 crisis. One of the most disturbing findings of this study, therefore, is that simple health care interventions could have saved most of the lives lost during the crisis.

ENDNOTES

1 For example, see Dennis Gallagher, Susan Forbes Martin 1992 *The Many Faces of the Somali Crisis. Humanitarian Issues in Somalia, Kenya and Ethiopia* Washington, DC: RPG.

2 Throughout the emergency, surveys were conducted and reported by Save the Children, the U.N , MSF, CARE, UNICEF, USAID and CDC.

3 Immunization levels in Somalia were already among the lowest in Africa, certainly no higher than 20% of under-fives.

4 Rural agropastoralists suffered from the looting of assets, particularly livestock and cereal stores.

5 Food sharing is common within not only extended families but within the clan itself.

6 Even in normal times, Metz reasons that "In the potential urban labor force of 300,000 - 360,000 there were only 90,000 wage earners, which suggested . .employment was only ...part of a family survival strategy." pg. 146 1992 *Somalia Country Study* Washington DC: Library of Congress

7 Many Somalis work in the Gulf, the U.S. and Canada.

8 Evidence comes from interviews with Somali health workers and from the studies of family histories conducted in the Bay and Bakool regions

9 Particularly among agropastoralists, coping strategies require that the family split - some to seek relief in refugee camps while others guard herds or the homestead.

10 According to AMREF, the regional capital city of Luuq depopulated to just 600 people. See 1994 *Updates from Luuq* Nairobi. AMREF International.

11 The number or rate of deaths in a time period that exceeds the baseline crude death rate for that population in a "normal" year.

12 Morbidity Mortality Weekly Report 1992 *Famine-Affected, Refugee and Displaced Populations: Recommendations for Public Health Issues* Atlanta: CDC.

13 This finding was reported many times by many agencies. See for example Center for Public Health Surveillance January 1993 *Results of Morbidity, Mortality, Nutritional, and Vaccine Assessment Cluster Survey of North-Mogadishu, Somalia.*

14 Synergism refers to interaction between risks when the combined impact of risks is greater than adding the separate impacts: the whole is greater than the sum of the parts. Extreme synergism occurs between diarrhea and malnutrition; see R Guerrant et al 1992 "Diarrhea As a Cause and an Effect of Malnutrition: Diarrhea Prevents Catch-up Growth and Malnutrition Increases Diarrhea Frequency and Duration" *Am J Trop Med Hyg* 47(1) Supplement pp 28-35.

15 With the exception of heightened severe undernutrition and Shigella, it is not possible to say, based on the data, that the *comparative pattern* of diseases during the famine differed from the pattern of diseases that predominate in most underdeveloped countries as discussed in J Walsh 1992 "The Burden of Illness" *Tropical and Geographical Medicine* K Warren, A Mahmoud eds NY: McGraw Hill

16 Over one-third of suspected hepatitis cases examined among patients in Mogadishu, Afgoi, Bardera, Baidoa and Merca tested positive for hepatitis E IgM antibody.

17 See UNICEF 1988 *Somalia Situation Analysis* Mogadishu: UNICEF.

18 See John Rogge 1992 *The Displaced Population in South and Central Somalia and Preliminary Proposals for their Reintegration and Rehabilitation* Manitoba: Disaster Research Unit.

19 Selected endemic infectious diseases of Somalia which may be rapidly fatal: malaria (including chloroquine resistant strains), plague, typhus (epidemic louse-borne, African tick borne, murine), meningococcal disease (meningitis), congo-crimean hemorrhagic fever, relapsing fever, rabies, enteric fever, viral hepatitis, arboviral illness (dengue, rift valley fever, sandfly fever), brucellosis, Q fever, leishmaniasis, leptospirosis, and cholera. See 1993 "Extraordinary Epidemiologic, Environmental Health Experience Emerges from Operation Restore Hope" *JAMA* 269(22):2833-34

20 Evidence of geographical concentration of Dengue comes largely from the experience of expatriates. Half of US military cases of Dengue were among the few troops in Bardera Three of the five IRC staff in Bardera were infected as well

21 A child is judged to be severely acute malnourished if his/her weight is less than 70% of the weight for height average for a "well-nourished" population. This is a measure of the population severity of short-term nutritional stress.

22 D Pelletier, E Frongillo, D Shoreder, and J Habicht 1994 *A Methodology for Estimating the Contribution of Malnutrition To Child Mortality in Developing Countries* Report to UNICEF.

23 M Toole 1992 "Protecting Refugees' Nutrition with Food Aid" Presentation to the ACC/SCN.

24 See J Palmer 1993 "The Hidden Crisis in Somalia" *Monday Developments* Feb 1.

25 Several reports during the 1980s and early 1990s noted the very high prevalence of micronutrient deficiencies among displaced persons in camps housing Ogadenis, Ethiopians and Somalis. It appears that most of the population in these camps, and possibly local Somalis, as well, had very low hemoglobin levels; see R Yip, S Gove, B Farah, HM Mursal 1990 "Rapid Assessment of Hematological Status of Refugees in Somalia: The Potential Value of Hemoglobin Distribution Curves in Assessing Iron Nutrition Status" *Colloque INSERM* 197: 193-196

26 The high prevalence of malaria, schistosomiasis, and hookworm infections, in turn, led to malabsorption and increased nutrient requirements, thus to higher rates of nutrient deficiencies See D Calloway 1982 "Nutritional Requirements in Parasitic Diseases" *Reviews of Infectious Diseases* pp 891-895.

27 See for example J Kelsey 1986 *Methods in Observational Epidemiology* Oxford U Press.

28 This has been elaborated in the case of Sudan by Alex de Waal 1989 *Famine that Kills* Oxford: Clarendon.

29 In addition to introducing infectious diseases, the higher population densities increase the microbial densities to which people are exposed, increasing everyone's risk of illness.

30 Much of the killing in late 1991 was a form of ethnic cleansing, aimed at the Rahanweyn who were believed to be tacitly allied with the Hawiye clan.

31 Based on key informants, graveyard statistics and retrospective mortality surveys.

32 Famine victims from western Bay fled to Bardera; those from Bakool fled to Hiraan.

33 A survey among the internally displaced in Merca and Quorioley by Epicentre found that of persons in households surveyed for the May 1991 to April 1192, over half had died in the immediately preceding three months. See S Manoncourt, B Doppler, F Enten, A Nur, A O Mohamed, P Vial and A Moren 1992 "Public Health Consequences of the Civil War in Somalia, April , 1992" *The Lancet* 340, July 18.

34 The authors of this report conducted household surveys to asses past mortality through interviews with families in the Bay and Bakool regions. Questions tracked all cohabitating family members forward in time beginning from January 1990.

35 Infants usually account for a high proportion of excess deaths. See for instance R Yip, T Sharp 1993 "Acute Malnutrition and High Childhood Mortality Related to Diarrhea: Lessons from the 1991 Kurdish Refugee Crisis" *JAMA* 270(5).587-590.

36 J Drysdale 1994 *Whatever Happened to Somalia* London: Haan Associates.

37 The surveys conducted by the study team found that at least half of famine deaths reported by persons in the Bay region happened in rural villages.

38 Estimated overall to have exceeded 80,000

39 In addition to measles immunization, UNICEF and NGOs distributed vitamin A capsules, known to significantly protect children from mortality due to measles. See P Nieburg, R Waldman, R Leavell, A Sommer, EM DeMaeyer 1988 "Vitamin A Supplementation for Refugees And Famine Victims" *Bulletin of the World Health Organization* 66(6): 689-697.

40 Apparent improvements in nutrition status should be examined with caution First, nutritional status of the living will seem improved if the a preponderance of the worst off all die off. Second, nutritional status of whole populations fluctuate naturally, often seasonally. Even without intervention, many of those most malnourished ("outliers") will improve over time, a statistical tendency described in some situations as "regression to the mean." In any case, changes in nutritional status can not all be attributed to the benefits of assistance.

41 Frequently, net death estimates are cobbled together using a panoply of heresay estimates, which are fraught with reporting bias, and observational and rounding errors (e.g., M Burr 1993 *Quantifying Genocide in Southern Sudan 1983-1993* Washington, DC. US Committee for Refugees.

42 See for example B Gessner 1994 "Mortality Rates, Causes of Death, and Health Status Among Displaced and Resident Populations of Kabul, Afghanistan" *JAMA* 272(5):382-385.

43 See L Boss, M Toole, R Yip 1994 "Assessments of Mortality, Morbidity, and Nutritional Status in Somalia During the 1991-1992 Famine" *JAMA* 272(5) 371-376

44 Some believe the population to be nine million, some closer to three million. Most published estimates range from 4 million to 7 million.

45 WFP 1993 *Demography and Distress Survey of Somalia* Nairobi: WFP.

46 Total numbers appear to be inflated, as various subnational groups jockeyed for apparent predominance. Much of the discrepancy relates to the "missing nomad" issue.

47 U.N. officials working in nearby Uganda remarked that a local refugee population of 10,000 Somalis is as "noticeable," vocal and active as 50,000 refugees from another country such as Ethiopia.

48 Agreed to at the Somalia donor coordinating council meeting in May, 1994, Nairobi, Kenya.

49 Pastoralists tended to move far and fast. Most of the refugees in Dadob, Ifo, Mandera and Ethiopia were pastoralists.

50 This estimate is fed back from the conclusions of this paper.

51 This figure looms large in analyses of the overall crisis, such as S Makinda 1993 *Seeking Peace From Chaos: Humanitarian Intervention in Somalia* Boulder: Lynn Reinner Pub. Ocassional Paper Series of the Intl Peace Academy pg 43.

52 1992 OFDA Situation Reports cite estimates of populations displaced to cities are 400,000 in Mogadishu, 60,000 in Kismayu, 50,000 in Baidoa, and 60,000 in Kismayo In each case this doubled the population size of the city, replacing the fleeing portions of the pre-war city populations.

53 Based on UNICEF 1989 Somalia Situation Report and on rates in comparable populations in neighboring countries.

54 A monthly CMR of 1 6 per 1,000 population (with is more than that in nearby Kenya, but greater than the CMR in nearby Ethiopia) translates to 24 annual deaths per 1,000. For a population of 5.1 million this suggests a total annual mortality of 97,000

55 Perhaps done by an ICRC worker in response to a query from a journalist, or by a UN staffer in preparing the DHA consolidated appeal.

56 In 1994 *Somalia: The Missed Opportunities* Washington, DC: U S. Institute of Peace Press.

57 Sahnoun relies on the 1992 UN document, *The Situation in Somalia, Report of the Secretary General,* S/24480.

58 *Levels* of mortality, but not exact rates, are correlated with malnutrition and therefore predictable from malnutrition data. See M Toole 1993 "Protecting Refugees' Nutrition With Food Aid" in ACC/SCN (U.N., Geneva) *Nutritional Issues in Food Aid*

59 Verbal autopsies have been largely a means to identify *cause* of death in recent studies, not death *rates.* (see RH Gray 1990 *The Use of Verbal Autopsy Method to Determine Selected Causes of Death in Children* Baltimore, MD: Johns Hopkins, School of Hygiene and Public Health, Ocassional Paper #10, 1990 S Pacque-Margolis et al 1990 "Application of Verbal Autopsy During a Clinical Trial" *Social Science and Medicine* 31 585-591). The accuracy and reliability of this method for comparing mortality across time blocks remains largely unexplored

60 Summarized in Patrick Moore et al. 1993 "Mortality Rates in Displaced and Resident Populations of Central Somalia During 1992 Famine" *Lancet* 341(April 10) 935-938

61 Two basic forms of survey methods were utilized in the mortality assessments conducted in Somalia between 1991 and early 1993: the two stage random cluster method, and the sentinel site method. Two stage random cluster method involved mapping and dividing the survey area into zones and defining the number of clusters to be sampled from each zone dependent upon the relative population density of each zone (stage one), and the process of selecting households within each cluster (stage two) The cluster sampling requires information on the population

density and relative differences in the population density over the area to be surveyed. During emergency situations, with highly fluctuating population movements into and out of the area of interest, ensuring an appropriate sampling protocol becomes problematic. In the second stage, the first household within each cluster is selected randomly and a systematic process is used to select the additional households within each cluster area. Most studies selected 30 clusters of 7 or more households in each cluster. During emergency situations, however, especially those involving the safety of public health workers, a systematic and random sampling of households may become unrealistic.

The other method used was the sentinel community surveillance method. This method involved taking large samples in each sampling area. Unfortunately, little documentation exists on the method used, thus it is not clear how clusters are defined or how households are selected.

62 For instance, the Afgoi survey suggested that, among the displaced, 23/10,000/day had died in the month preceding the survey, while 9.4/10,000/day died in the earlier seven months.

63 Given the a priori assumption that death rates did vary by region, as testified by virtually all key informants.

64 In effect a Glassian meta-analysis was conducted assessing effect sizes rather than significance levels.

65 Effect size, here meaning the amount of increase in mortality over the baseline rates, is a term epidemiologists use, and not to be confused with the closeness of correlation of variables, or the "significance" of an observed relationship.

66 The "construct validity" of the various studies makes it difficult to merge or compare results. In different situations, respondents may consider "family" members to include different people. In some instances, respondents may consider missing (displaced) persons to have died. It is also debatable whether different interviewers framed the calendar periods differently for the respondents. It is clear that the clumping of reported deaths toward the more recent time periods (those that occurred closest to the time of the interview) throws the results of many of the surveys into question.

67 This is known as "selection bias" error due to systematic differences between subjects included in a study and those who are not included. Another form of selection bias is often occurs in research when those who are living are compared to those who have died.

68 The majority of surveys did not state whether they asked about live births and deaths during the recall period, and in the event that a livebirth, which resulted in death, was identified during the interview, it is not clear how this information was handled in the data collection process. Most studies fail to mention how analysis accounts for individuals who left the household during the recall period. Also, studies differ in how they define the household or family unit differently. These issues occur regularly in epidemiological studies and have much in common with general non-response bias. Statistical methods exist for imputing to fill these gaps, but these methods are weak where the bias is systematic in one direction, but but the direction is unknown. See J Lessler, W Kalsbeek 1992 *Nonsampling Errors in Surveys* New York. John Wiley & Sons.

Not all studies reported on the cause of death, but those that did used a verbal autopsy method where interviewees were questioned about the probable causes of deaths, and about the specific symptoms prior to a death. The method in which the verbal autopsy was conducted was either not mentioned or was a structured approach where respondents were asked about trauma, measles, diarrhea, respiratory disease and malaria in this order.

69 Surveys used varying lengths of follow-up and reported results in a number of different ways, such as mortality rate per 1,000 per year, deaths per 10,000 per day, or percent deceased. In order to compare the results, data were reviewed and whenever possible converted into deaths per 10,000 per day. For example, mortality rates presented per 1,000 per year were converted to rates per 10,000 per day by multiplying the rate by a factor of 10 and by dividing this number by the length of follow-up in days. For example, a crude mortality rate of 116 per 1,000 per year becomes 3.2 deaths per 10,000 per day (1160 per 10,000 per year/365 days). Similarly, data presented as percent deceased was converted by multiplying by a factor of 100 and dividing by the length of follow-up in days. For example, 13% deceased over a 304 day period becomes 4.3 deaths per 10,000 per day (1300 deaths per 10,000/304 days).

70 J Hunter, F Schmidt 1990 *Methods of Meta-Analysis. Correcting Error and Bias in Research Findings* Newbury Park: Sage Publications.

71 From UNICEF, MSF and Save the Children surveys.

72 J Exner, G Buckwalter 1993 *Southwest Bay Region Baseline Health Assessment Survey* Nairobi: CARE

73 World Vision 1993 *Bur Hakaba District Bay Region Somalia: Baseline Health and Nutrition Survey* Nairobi. World Vision.

74 When death rates are so high, the biases introduced become enormous. Many social and illness-related factors contribute to high selection bias, for instance. Tens of thousands of displaced persons flowing from the Bay and Bakool regions came to Baidoa for food from March 1992 onward; some continued on, traveling to other towns, or to the region or to Kenya. Those who remained behind at the time of the retrospective survey and continued to live in the displaced camps may have been more likely to (a) have been too weak to proceed on to other destinations, (b) too weak to return home, (c) have lost family members in the camps themselves and have fewer kin elsewhere whom they could return to, (d) to be incapacitated by grief. In addition, because death rates were so high, the proportion of whole families that died is likely to have been very high; thus the error introduced by this survivorship bias is higher than in other instances. In the end, the results provide a floor for knowing the minimum number of people dying in Baidoa itself. Other evidence is needed to estimate the mortality rates of the larger (sending) population of the predominantly rural region. Such evidence came later from NGO surveys.

75 In other words, death rates per 10,000 were higher among the displaced. However, given that most Somalis were not displaced, they accounted for at least half of all deaths.

76 RPG rural surveys in Baidoa

77 In other words, the ratio of famine adult deaths to baseline adult deaths was higher than the ratio of famine child deaths to baseline child deaths. This was the major observation of ICRC headquarters staff, of Irish Goal, of Concern, and other persons conducting site visits.

78 Documented by Irish Concern, the Red Cross, IMC, Trocaire, and Save the Children, U.K. Death count data from the Somali Red Crescent Society appeared in CDC 1992 *Morbidity and Mortality Weekly Report* 41(49):913-916

79 Documented by AICF, ICRC, corroborated by CARE and IRC

80 Best estimates for Mogadishu came from Save the Children, UK.

81 Reference to MSF/Spain, UNICEF.

82 Witnessed by World Concern.

83 B Doppler, F Enten, S Manoncourt 1992 *Demography, Nutrition, Mortality, Water and Sanitation Assessment of Merca- Quoioley Areas* Paris: Medecins Sans Frontieres.

84 Team leaders from Save the Children U.S. and MSF provided these figures.

85 The sum of 200,000 (Bay) plus 50,000 each for Lower Juba, Lower Shabelle, Bakool, Middle Juba, Mogadishu, Middle Shabelle, Hirran, Gedo, Central and Northern Regions, and Mogadishu and its environs.

86 The median estimate is derived from the list of collected single-estimate crude mortality rates. 7 per 10,000 was reported, for instance, by Epicentre as the Merca/Quorioley CMR in November of 1992 based on MSF data: *Health and Mortality Assessment in Merca-Quorioley Areas, Somalia 11/92- 12/1992.*

87 Based on extrapolations from the 1975 government census and adjusted according to the advice of UN and NGO officials in each region For example, the Bay region population is estimated by some at 500,000 and by others at 1 million. Those working in a range of rural disticts -- i.e. IMC, CRS -- believe that the lower-end is the more realistic estimate.

88 Though not using tests of significance in arriving at these estimates, "plausible" includes a wide enough range that there is approximately 95% confidence that the true proportion falls within this range.

89 Based on sample surveys, it is the total effect size (proportions dying) that is of interest, not the statistical tests of variation It is expected a priori that mortality experience should vary enormously between districts, regions, clans, and urban/rural areas.

90 Granted, evidence from individuals and from reports were not systematic, referring to various points in time, basing on different sets of observations of varying quality and representativeness Generally speaking, it was rare that informants or surveyors gained a good picture of rural health conditions -- except in the Bay and lower Juba regions.

91 Though retrospectively assessed crude mortality rates among displaced families were elevated several-fold, indicating some excess mortality -- see Serge Manoncourt, Jean-Harve Bradol, Elizabeth Lary *Health, Nutrition and Health Information System: Assessment of Bari and Mudug Regions: NorthEast Somalia* Paris. Epicentre; also, L Colijn "Survey of Water Points in Hiran and Galgadud Provinces" Nairobi: ICRC.

92 Oftentimes unsystematically.

93 The probable range has a confidence equivalent of approximately 80%

94 In fact, death rate data in early 1993 indicates that mortality was still on the order of 100 to 200 per day during the month of January, 1993. However, this data became more suspect as the "counting" game became more evident to local counterparts who saw that when deaths decreased, their jobs and income would be soon phased out

95 In addition to another 10,000 to 30,000 killed in fighting during that period.

96 i.e baseline deaths are treated as non-starvation. In other words starvation-related is another manner of referring to excess deaths

97 See Helen Metz 1992 *Somalia a Country Study* Washington DC: Library of Congress.

98 Quite commonly, food aid will reach over 60% of the population in an affected, targeted region. Yet only in the most extreme circumstances will more than 10% of a local population die in a period of extreme food insecurity.

99 One recent effort at modelling mortality in high-morbidity situations such as Somalia notes, "*The results from the model clearly show that fairly large increases in intervention coverage do not necessarily lead to large decreases in mortality. For example, in West Africa and South Asia where Oral Rehydration Therapy coverage levels are initially quite low, increasing them to 60% has very little effect even on diarrheal mortality. ...This speaks for the need to implement a complementary set of preventive and therapeutic interventions.*" S Becker, R Black 1994 *A Model of Child Morbidity, Mortality and Health Interventions* (unpublished manuscript) Hopkins School of Hygiene and Public Health.

100 Each form of illness can be thought of as an "effect modifier" when looking at the incidence, prevalence, duration and case-fatality of each other form of illness. In most instances, illness increase the likelihood of incurring and manifesting another disease. In some, one illness may actually reduce the likelihood of another developing. Severe anemia, for example, is believed to reduce the incidence of malaria infection

101 Competing risk analyses of high-illness circumstances such as famines are few. The study team was unable to take advantage of previously developed and validated methods for adjusting for the interaction among diseases in calculating their course and case fatality One effort is W Mosley 1984 "An Analytical Framework for the Study of Child Survival in Developing Countries" in *Child Survival. Strategies for Research* W Moselly and L Chen (Eds.) ia special issue of *Population and Development Review* Vol 10 (Supplement).

102 T McKeown 1979 *The Role of Medicine* NJ: Princeton Univ. Press pgs. 9 & 49.

103 The overall reduction in deaths in many countries today is also clearly attributable to improvements in sanitation, hygiene, and nutrition

104 J Caldwell 1986 "Routes to Low Morality in Poor Countries" *Population and Development Review* 12(2): 171-220.

105 D Keen 1994 *The Benefits of Famine: A Political Economy of Famine and Relief in SouthWestern Sudan, 1983-1989* Princeton University Press Princeton, New Jersey pg 134.

106 It is a statistical effect that the levels of severe malnutrition can rise to only a certain level among those who are surveyed. Because the death rate increases exponentially with severe malnutrition, people die off. Thus, only the *more* well nourished survive to be included in surveys.

107 A Tomkins 1991 "Nutritional Deficiencies During Famine" *Tropical Doctor* 21 (Supplement 1), 43-46

108 See B Burkhalter, E Abel, M Parlato 1994 "The Structure and Models Used in Profiles 2.0 With Application to Bangladesh" Washington, D.C.. Academy for Educational Development

109 Vertical health interventions that respond to one cause of death may leave individuals highly vulnerable to other causes of death. The concept of "frailty" is an important component of the current competing risks literature. See WH Mosley, S Becker 1991 "Demographic Models for Child Survival and Implications for Health Intervention Programs" *Health Policy and Planning* 6(3) 218-233.

110 These agencies focused on what they knew best, and what they felt could be accomplished given physical insecurity (robbery and violence).

111 Food aid can be harmful in terms of creating dependence, favoring food trade networks that encourage more imports to urban areas as opposed to encouraging rural-urban linkages and thereby discouraging domestic food production by lowering prices below production costs. There is no evidence that the depressed food prices in fact discouraged agricultural production. But analysts Alex de Waal and Michael Marin separately claim that too much food was delivered to Somalia and that unseen discincentive effects did occur. Indeed, the market was saturated in the sense that the January 1993 price of staple grains (e g. maize) was lower in Mogadishu than anywhere in the world Food sales in Kenya are based on interviews with market researchers and food aid officers.

112 With the support of Lutheran World Federation, USAID, the European Community Humanitarian Office.

113 See for example F Vautier 1993 *Kismayo-Somalia Medical Report* Nairobi: Medicins Sans Frontieres (Belgium), noting that in late 1992 and early 1993 approximately 200 to 400 casualty cases per month were seen requiring some 50 surgical interventions.

114 Based on extrapolation from project documents.

115 Iatrogenic (medical problems related to intervention) consequences of relief have been documented in many circumstances. Some conditions are created or exacerbated by the form of assistance (drugs that precipitate nutrional deficiencies) while others occur because of indirect consequences of relief (such as overcrowding in relief camps).

116 Though NGOs and the UN did not create relief camps, the nature of relief delivery, particularly ICRC's during the phase of on-site feeding programs, necessarily pulls people to extended delivery points. The relief community sought ways to decentralize these delivery points as much as possible Nevertheless, when feeding an entire population, a finite number of delivery points are inevitable.

117 It is a familiar phenomena that measles becomes a post-disaster risk simply because people become displaced in a manner which raises their contacts with other people.

118 Peter Aaby argues that intercountry comparisons of measles infection do not justify an emphasis on malnutrition as a predisposing factor Instead, he argues, it is the level of exposure, and the extent of past exposure that affect the severity of infection and mortality: see 1992 *Health Transition Review* Vol. 2 (Supplementary Issue) pp 155 - 184. By his argument, immunization is far more effective at preventing deaths due to measles than general feeding Others argue that, indeed, measles deaths among the malnourished are prevented by immunization, but most who may have died may yet die of other causes: see Kasongo Project Team 1981 "Influences of Measles Vaccination on Survival Pattern of 7 - 35 Month Old Children in Kasongo, Zaire" *Lancet* 1:764-7. Final death is attributable to measles risk, malnutrition, overcrowding, diarrhea, etc: see P Nieburg, M Dibley 1986 "Risk Factors for Fatal Measles Infections" *International Journal of Epidemiology* 15(3): 309-311.

119 D Pelletier, E Frongillo, J Habicht 1993 "Epidemiologic Evidence for a Potentiating Effect of Malnutrition on Child Mortality" *American Journal of Public Health* 83(8):1130-1133.

120 In some camps (Baidoa, Bardera) more than half of all who came may have died; in others (camps in Kenya, those around Mogadishu, those around Belet Huen), mostly clearly did not die.

In Bardera for example, ICRC gravedigger data indicate that as many people died during the Fall of 1992 as were alive in the displaced camp at any one time Thus, approximately half those coming to those camps died during that period. In Kenya, excess mortality in the camps, as reported by MSF and AICF to UNHCR, was much lower.

121 In later 1992 rehabilitation of water systems for large populations expanded.

122 Based on malnutrition/mortality correlations across many countries, See B Person-Karrel 1992, M Toole 1993 (opp citation).

123 Some debate when the famine was "burning" itself out. Some (UNICEF) retrospective mortality surveys suggest that mortality rates were not significantly different in late 1992 compared to mid-1992. However, these surveys were conducted among self-selected camp populations, many of whom had arrived in the feeding camps recent to the surveys, while others had left or died prior to the survey, and were not counted. Rural surveys, more representative of the broad at-risk population, indicate that mortality was steeply declining by November 1992.

124 See S Hansch 1993 *Monetizing Food Aid, 1993* Washington, DC: Food Aid Management.

125 Adding up the graveyard counts at sentinel sites, the numbers dying in January in each of ten major relief centers was between 150 to 600. The numbers dying in rural villages of course remains the big mystery; assuming it was as large as the numbers dying in cities and camps implies a total of at least 6,000 per month.

126 CARE field staff report that in Bardera the gravediggers were aware of the link between mortality and their continued employment and were likely to over-report during this late period. Most other field observers agree that both mortality and severe malnutrition were much lower in key project sites by February 1993. Pockets of food insecurity and malnutrition were believed at that time to be between Jilib and Bardera where convoys were still unable to travel.

127 Though there was an upsurge in malaria in January 1993.

128 As argued by Alex de Waal. The winter harvest contributed not only to bringing more food on to local markets, but also in helping to pull people back to their places of origin. Even though the Deyr harvest is the smaller of the two annual harvests, the difference in supplies was sufficient to renormalize markets and reduce the desperation killings that kept farmers, traders and consumers alike out of normal trade routes.

129 The successful Deyr harvest of the winter of 1992/1993 can in part be credited to the relief effort. World Vision, CARE, CRS and others distributed seeds and tools during the Fall of 1992. ICRC in particular focused on this Deyr harvest beginning in April 1992, through extension work, provision of maize, sorghum, vegetable, and cowpea seeds: see E Koenig 1992 *Agricultural Assistance Somalia* Nairobi: ICRC

130 Vehicles with mounted guns that were instrumental in much of the looting during 1992.

131 Technically defined, with reference to a population *without* an intervention, as the hypothetical mortality spared (following the appropriate intervention) divided by the observed mortality.

132 Without the development of any novel cures or implementation schemes., but using ORS, food aid, proper case-management.

133 P Bres 1986 *Public Health Action in Emergencies Caused by Epidemics: A Practical Guide* Geneva: World Health Organization.

134 See G Rose 1993 *The Strategy of Preventive Medicine* Oxford Medical Publications.

135 Timely food aid has been successful in preventing almost all starvation deaths if the effort is really massive and well timed, as occurred in the 1992 southern African drought relief. Here "starvation" deaths -- uncomplicated by infection or war -- are treated as only one third of all deaths. The premise in the 95% calculation is that "timely" food aid would have prevented the occurrence of malnutrition, not merely treated it. Treatment of severe malnutrition would have a much lower rate of death prevention; instead of 95% well-targeted but late food aid might spare only half of otherwise-occurring deaths.

136 As in other famines, severe malnutrition can be prevented through adequate provision of food. Even when given, measles vaccines do not all "take," some are spoiled, some of those receiving injections are too malnourished to mount an effective antibody response. But some 90% will be effectively immunized It is rare and unrealistic that an immunization program can reach more than 80% of a population in a short period of time Thus, even ideally, 70% of the population would be effectively immunized.

However, trying to address a predominantly rural population in a conflict situation, vaccination coverage probably could not have reached more than 50% of the population without incurring unheard of costs. Assuming that 50% were reached, at 90% efficacy, then some 45% of persons would be immunized effectively against measles, directly reducing infection and deaths. With this much protection, it is likely that transmission would have been reduced. Thus it is possible that the entire epidemic would be avoided. Thus, even at a lower rate of immunization, over two-thirds of measles incidence might have been spared.

137 The protective value of food and primary care lessens when targeting those who are not dying from severe malnutrition. At the one extreme, oral rehydration therapy has a high protective value for the severely dehydrated. At the other extreme, primary care has little to offer a victim of dengue fever, a landmine, or ambush.

138 Knowing the diseases that disable and afflict is one thing. Knowing which diseases were associated with Somali deaths is an extra piece of information that was not tracked in real time, but should have been See N Hirschhorn, M Grabowsky, R Houston, R Steinglass 1989 "Are We Ignoring Different Levels of Mortality in the Primary Health Care Debate?" *Health Policy and Planning* 4(4):343-353.

139 In addition to *earlier*, more *targeted*, and more expansive relief interventions, relief should have been tailored to address more root causes of the health crisis Some examples are: reconnaissance to rural villages and targeting resources only to villages not to cities, avoiding camp situations; transport of already-displaced to their final destinations, sparing them 500 mile walks in weakened physically vulnerable conditions; protection and relocation of pastoralists who lost their herds (these had the highest mortality rates); negotiation of corridors of tranquillity for small farmers to bring food to market, crop insurance programs (insured against theft); and, local purchase of food inside Somalia, working through local merchants and wholesalers for local purchase, import, and transport.

140 Here, "imminent risk of death" is defined operationally: the total number of Somalis who either did die or *would have* died, had there been no relief.