THE COURSE OF THE FAMINE

Deaths occurred in what might be described as three famine "waves." The visual image of a "wave" conveys several relevant concepts: 1) incidence· a curve of severity over time as well as space; 2) transmission: the rolling, spreading, evolving nature of severity and causality across the geographic landscape, as the shock of famine is carried from place to place by displaced populations competing for food, water, and work; and, 3) causality. The three waves are distinguished by different trends in precipitating events: in the first wave, economic collapse and warfare; in the second case, food insecurity; and, in the final wave, epidemics.

Epidemiologists characterize infectious disease epidemics as "common source" (arising from a common contaminated water supply), or "propagated"[27] (communicated from person to person). Field workers often can identify the cause of an epidemic by noting the curve over time of when people are affected. Propagated epidemics have a more complicated pattern, spaced over a greater period of time. Famines can have characteristics of both types of temporal curves. First, famine can result from a common natural event (harvest failure). Second, famine can be propagated, as afflicted populations impose new stresses on the areas to which they move.[28] As rural populations move to towns, for instance, they draw down on the local food stocks and water supplies, compete for space and relief supplies, and introduce infectious diseases.[29] Despite these interacting social and biological effects, famines nevertheless tend to ebb and wane over time The concept of a "wave" helps to depict the dynamic of these processes

The First Wave: Famine Conditions

The first famine wave began in April 1991, as General Siad Barre's government troops retreated from Mogadishu. It hit hardest in mid to late 1991 Starting between Mogadishu and Kismayo, the wave affected the Lower Shabelle and Lower Juba regions and the cities themselves. Hundreds of thousands were caught in conflict zones; hundreds of thousands more became displaced. Fighting and insecurity led directly to 10,000 deaths and indirectly to economic collapse and dispossessions of assets. Large movements of displaced people gravitated toward cities and relief centers, forming squatter settlements around the emergency feeding programs in north and south Mogadishu. While unemployment was pervasive in Mogadishu, few of the original inhabitants of Mogadishu died in Mogadishu; many migrated south into Kenya. Thus, this famine wave carried

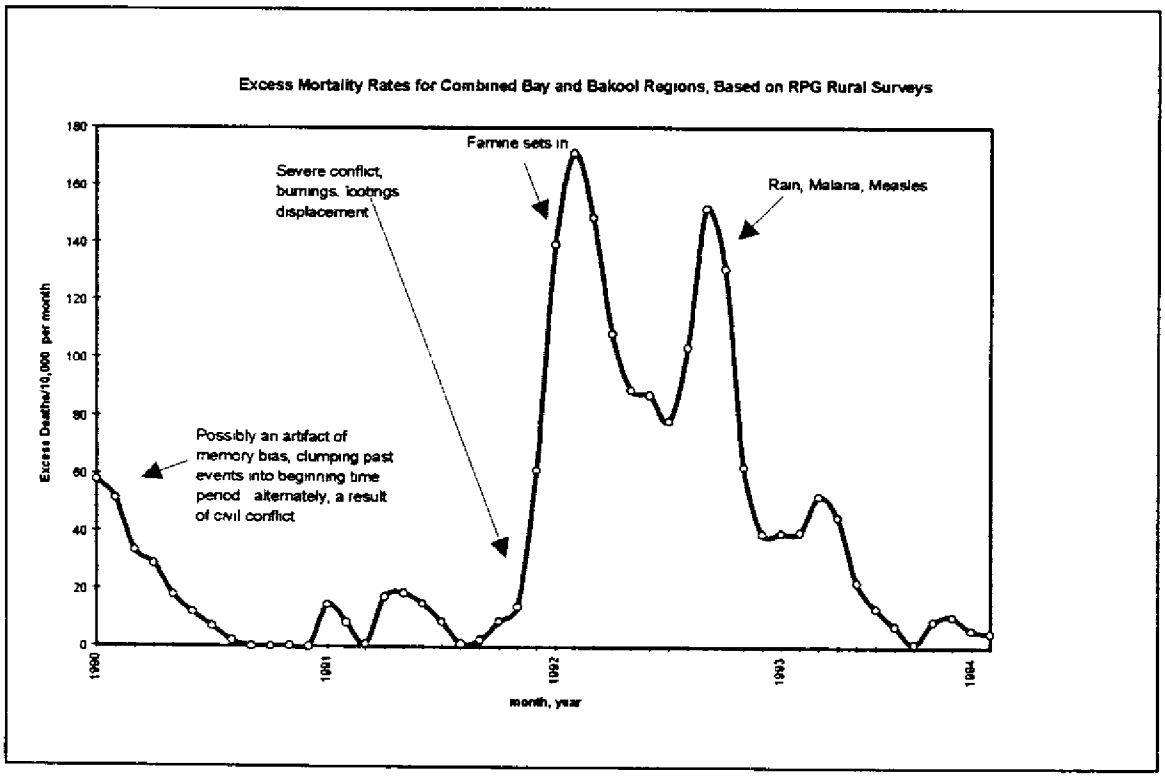

Figure 3. Excess deaths reported by families expressed in terms of deaths per 10,000 population per month. Responses were given by heads of households living in three rural districts in Bay and Bakool The blackened curve represents the reported deaths per month Reported deaths were clumped in early 1992 and around September 1992. The

north from battle areas into population centers and south into refugee camps along the border of Kenya. Those who came from rural areas into the cities died in large numbers because there was little support for them Those who escaped to Kenya faced health problems due to lack of potable water and overcrowding, but at the peak of the famine inside Somalia, mortality remained modest in the camps in Kenya

Second Wave: The Famine Intensifies

The second famine wave, depicted in Figure 3, emanated from the Bay region, focused in the area of Baidoa, following the looting and slaughter of local residents by the retreating troops loyal to Siad Barre in late 1991 and early 1992 Rahanweyn peasants in this region were targeted.[30] Assets were looted or destroyed, leaving villages empty not only of food but also of any assets with which to procure, trade for or produce food Many Bantu residing in this region also lost their possessions. The wave consisted mainly

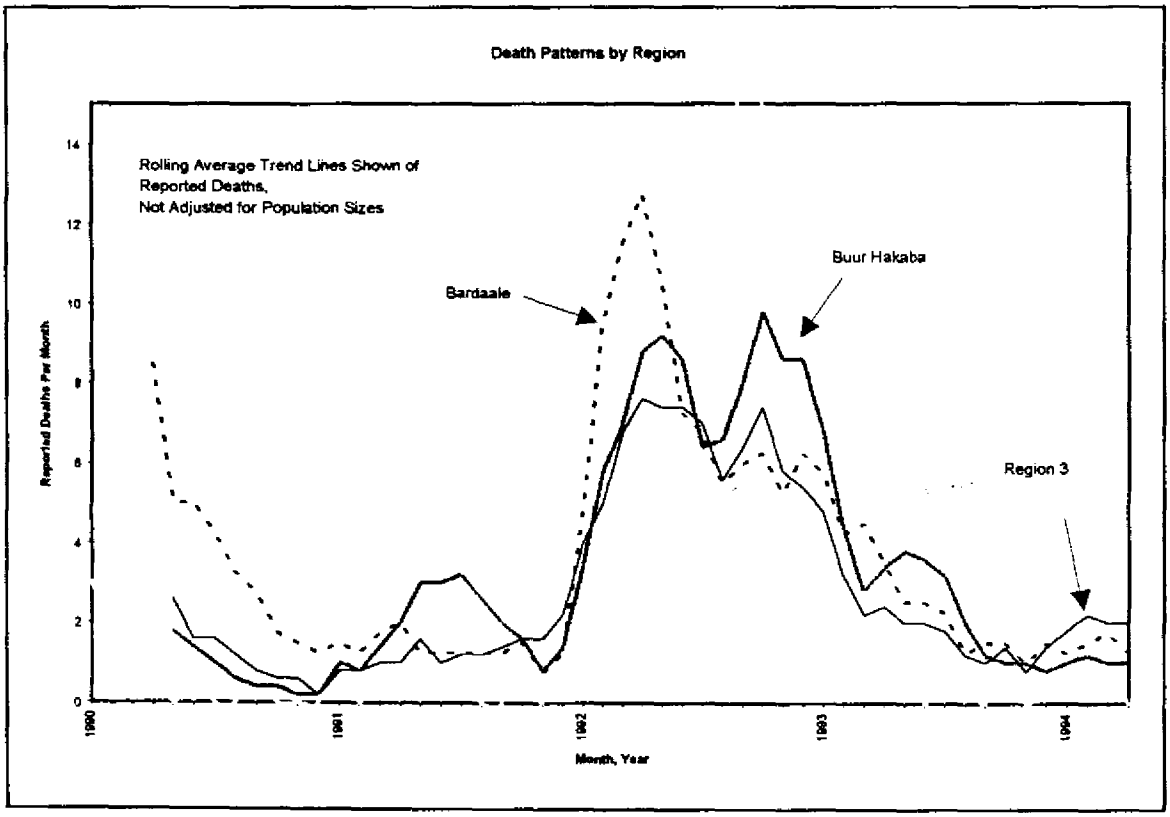

Figure 4. The aggregate famine wave of the three districts which were clumped together in chart 3. Data from household retrospective surveys conducted by RPG.

of the approximately 70,000 persons who were most vulnerable to illness and death who had migrated into Baidoa -- most to die.

The incidence of deaths in each of the three regions is seen in Figure 4, on the following page. As the graph depicts, each district experienced a peak mortality several months after the initial fighting that led to famine conditions.

Relief agencies arrived in the Baidoa area for the first time in April and May of 1992. Before then, health workers had little evidence of any crisis in this area. The ICRC resisted airlifting food until such evidence existed. By the time the first feeding programs had been established, excess mortality had already peaked.[31] By the time the media had visited Baidoa and relief flights were ongoing, the peak of the mortality had already passed.

This second famine wave led to an outpouring of tens of thousands from the Bay and Bakool regions into adjacent regions. Thus, the severely malnourished observed in

the second half of 1992 in relief centers in these other regions -- Belet Weyne in Hiraan, Bardera in the Gedo region, and Mogadishu itself -- were actually the famine victims of the neighboring Bay and Bakool regions.[32]

Deaths from this famine wave peaked between April and June of 1992, with malnutrition the main cause.[33] By this point in the famine, very severely malnourished adults were seen. NGOs had to rethink their entire approach to saving lives when confronted with such elevated mortality among non-children. Retrospective surveys[34] support the observation that while the greatest age-specific death rates were, as always, among young children, adults and older children had surprisingly high proportionate increases in mortality [35]

Those individuals strong enough to make it to Kenya or Ethiopia were able to access food and water and escape this famine wave. Those who remained in rural villages in the Bay region found only continued food shortage. Those who migrated to sites of relief distribution in nearby regions congregated in displaced camps where public health services were unable to prevent disease transmission.

Third Wave (July to Mid-October 1992)

In the late summer of 1992, a third and final wave of mortality swept the countryside It peaked in mid October. In this wave, measles, diarrhea and malaria swept the already-malnourished Daily mortality rates peaked in conjunction with the autumn rains. One estimate put the total deaths in September at 30,000.[36] Deaths per day were seen to peak immediately following rains, likely a result of the fact that the malnourished also had little shelter to protect them from evening hypothermia. It certainly also reflected increased spread of diarrhea and more mosquitoes, which increased the transmission of malaria and dengue fever.

In all three waves it is apparent from rural surveys that at least as much[37] mortality occurred outside of camps and cities as within camps and cities. Thus the total numbers of deaths recorded in the urban, town and camp sites[38] are only a fraction of the total deaths that occurred throughout Somalia.

The Influence of the International Relief Effort

The delivery and distribution of food contributed to the reduction of starvation deaths. Food delivery greatly accelerated U.S. forces landed in December1992 and vast quantities of food were distributed throughout Somalia during 1993 under the aegis of the U.N coalition forces.

Another important factor contributing to reduced famine death rates was the application of a known public health measure to the leading cause of mortality among famine victims In accordance with the U N plan of October 6, 1992, a mass immunization campaign focusing on measles[39] was implemented beginning in February 1993, which transformed various ad hoc efforts into a nationwide operation. UNICEF records of immunization activities in Somalia indicate that during the 5 month period of September 1992 and January 1993, before the U.N. mass immunization campaign was formalized, approximately 140,000 persons in 9 regions received measles vaccinations. However, during the next 5 months after a national UNICEF immunization campaign was established, approximately 500,000 persons in 16 regions were vaccinated.

By late 1992 ICRC and a network of NGOs were providing or supporting a host of medical (e.g., clinical services, therapeutic feeding) and public health services (e.g., immunizations, mass feeding, vitamin A prophylaxis, oral rehydration, water pumps and cleaning, surveillance, community health workers) At the peak, an estimated 1 million Somalis were being fed through a plethora of on-site and take-home feeding programs. These activities dug in and matured throughout 1993.

The massive health interventions during the first ten months of 1992 helped hundreds of thousands of Somalis. Field workers and Somalis from around the country agree that by the end of 1992, food supplies and access to food were vastly improved. They also concur that there were not the same scale of mass population dislocations that was characteristic of early late 1991 and early 1992.

Due to relief interventions along with the dying out of the most at-risk groups, malnutrition and mortality rates declined sharply after September and October 1992. Systematic random-sampling surveys and general (whole population) observations conducted in places like Baidoa indicated that monthly deaths generally decreased after July and August. Later, 1993 and 1994, surveys confirm that the population's nutritional status had improved by late 1992, and continued to improve during 1993.[40]

HOW MANY PEOPLE DIED?

The true number of Somalis who died can be measured, at best, only to a range. The uncertainty of how many Somalis who died is plagued by a more fundamental uncertainty about how many Somalis were alive before the famine.

Reports of the numbers of people who have died in famines in developing countries are rare, vague[41] and frequently inaccurate by wide margins. Analysts of the 1968-1973 drought in the Sahel present a range from 50,000 to 150,000 deaths, a wide confidence interval. Indirect evidence of famine deaths from China/1959 and Cambodia/1979 have been used only many years later to reconstruct general mortality estimates. Deaths are not commonly reported with precision by field personnel involved in relief activities. Usually, mention is made of the "affected population," which is derived from some estimate of the pre-emergency population in the affected geographic areas. Estimates of lives spared as a result of intentional humanitarian interventions are even less scientifically based.

Recent efforts by CDC and allied agencies have begun to remedy this inattention to accurate mortality estimates. Increasingly, epidemiologists have included mortality assessments in their field studies and reports.[42] In Somalia, CDC, MSF, SCF and UNICEF personnel made unprecedented efforts to conduct randomized, retrospective surveys to estimate the crude death rates in specific sites. Unfortunately, these methods were not fully standardized or explained.[43]

The first step in estimating total mortality is to judiciously estimate the size of the affected, at-risk population. Somalia's total population is perhaps the least accurately known of any in the world.[44] The estimate of the current total population that was used by agencies working in Somalia was a rough extrapolation of the population in the 1975 census, making assumptions about the rate of natural increase (births minus deaths) [45] Not only are the extrapolations speculative in their assumptions, but the 1975 census, in retrospect, seems to be highly suspect in its accuracy.[46]

Informants repeatedly expressed the view that among the many estimates of Somalia's total population, the most likely correct population guess would fall at the lower end of this range of population estimates. This comports well with the additional observation that Somalis make themselves "felt," disproportionate to their actual numbers, in refugee situations: for instance they are rarely under-counted and frequently over-counted (as through multiple registration).[47] The most common view of informants

is that Somalia's population is 4.5 million, but the U.N. recently adopted a planning figure of 5 5 million.[48]

The dilemma of total population size is closely related to the proportion of the total population that is pastoral vs. agricultural. There are several million agropastoralists in the southern portion of the country and for decades the conventional wisdom (printed in government documents and international guides) record that 2/3 of the population are migratory pastoralist. Therefore, one might conclude that there must be at least five million pastoralists (assuming a high-end figure of 7 million total in Somalia). Throughout the famine, however, these pastoralists, whatever their number, were largely unseen by relief agency staff -- except by the ICRC which managed a widespread livestock vaccination program.[49] It appears there are far fewer "pure" pastoralists than the conventional wisdom would suggest, and this correction accounts for the "missing" four to five million in the range of population estimates.

In the following calculations, a total of 5.1 million is used. Planning figures used by WFP during the emergency itself estimated the population in Somalia at 4.5 million Including an estimated 400,000 at-risk Somalis who fled to Kenya during this period, the 4 5 million figure is increased to 4.9 million By the time of UNITAF, on the order of 200,000 persons had perished.[50] The estimate used here of the pre-famine (1991) population is 5.1 million

Of this total population, citation is frequently made of the "at-risk" population· in other words, those Somalis who lived in the geographic areas hardest hit by famine and without high economic resources to help them cope. The U.N. and secondary sources gave 1.5 million as the population most at risk of famine.[51]

In associating death rates with subpopulations, the main problem is tracking populations as they move For example, a large proportion of the populations of Mogadishu and Kismayo at the beginning of 1991, were no longer resident in these cities by early 1993. However, many of the most vulnerable groups from nearby regions relocated themselves to camps in and surrounding these cities, replenishing the total population sizes of these areas.[52] The non-displaced resident populations of these cities were observed to exhibit only modest excess mortality while many of the displaced manifested very high death rates, both in transit and shortly after encampment.

Baseline Mortality

It has been surprisingly hard to estimate the normal-year death rates in Somalia. The infant and child mortality experience in Somalia has been poorly monitored over the

years; there have been few population-based surveys The best estimate of Somalia's infant mortality rate is 180/1,000 live births,[53] and a child mortality rate of 280/1,000 live births, during good years The life expectancy in Somalia in normal times is estimated to be at least 45 years. Based on all these considerations one might expect 97,000 deaths during a baseline one-year period of time [54]

Assessing Famine Mortality

There was no "original source" found by the study team for the often-repeated estimates of 200,000 to 500,000 deaths It is very likely that the estimate for Somalia was a back-of-the-envelope extrapolation[55] from the mortality rates reported in a few sites. Mohamed Sahnoun reports[56] that 300,000 had died from hunger by March 1992 when he arrived in Somalia [57]

Somali mortality data include surveys of feeding-center deaths, prospective surveys of graveyard, body, or burial shroud distributions, and retrospective population-based mortality surveys.

Data on feeding-center populations, while helpful in estimating the "at-risk population," is not directly useful in estimating mortality. Evidence of *severe* malnutrition among large feeding center populations can be of limited use in suggesting the scale of the problem in the larger population; but, estimating mortality <u>from</u> malnutrition data is a very inexact science.[58]

Graveyard or body count data are also not easily translated into mortality rates because of the uncertainty about the population denominator from which deaths are drawn.

Numerous retrospective surveys were conducted using the verbal autopsy method.[59] These provided the best indication of mortality rates and are the focus of this written review These were conducted by various agencies (CDC,[60] UNICEF, MSF) and varied slightly in their methods and the calendar periods used for review.[61]

Data from these surveys indicate that mortality rates were much higher in November and December 1992 than in preceding months.[62] These higher death rates in late November and December appear to contradict other evidence that the famine had passed its peak months earlier. But this anomaly may be explained in three ways:

- Respondents "clumped" deaths into the near-term period, perhaps influenced by delays in information about kin deaths coming to them,

particularly where families had been disrupted, or by the desire to emphasize the immediacy of their plight; it is likely that respondents were motivated to report the high October deaths in November, since the previous month was singled out, but no questions referred to the previous two months.

- Respondents, being displaced and being in emergency/displaced camps at the time of the survey, were more representative of households for whom the height of suffering and disruption was recent. The sampling strategy could not fully account for those who had relocated during earlier periods of time Thus this method of inquiry under-represented households where stress and death had peaked earlier -- households which may have died out entirely or moved from the displaced camps

- There truly was higher mortality in the late 1992 period than in previous months, though complementary data suggests that this was not the case.

The authors tried to glean from these studies an order of magnitude of death rate per region.[63] They did not try to test whether some death rates were significantly different from others.[64] The statistical power of these studies is not high; but, estimating the "effect size"[65] (i.e., the numbers who died) is of value even if the confidence interval is wide (i e., precision is lost). These studies represent valuable efforts to gauge the general severity of famine, not to test finely-drawn hypotheses about risks. Compared to other health status measures, mortality is fairly unequivocal. In the absence of cross-checks, it is not clear what is being examined in these studies,[66] as they dealt with very different populations. In most cases the interview pools were from areas or populations that were likely to have been magnets for the most severely affected and the internally displaced.[67] They also suffered from a counter-bias in that households where all the adults died or where all surviving adults who migrated to rural areas or to other countries were under-sampled [68]

In the end the study did not simply merge death rates from multiple studies or regions to determine a single, overall death rate.[69] Theory cautions against selectivity studies, however well-intentioned . Reviewer bias is introduced in judging which studies to accept and which to discard [70] Instead, all studies were accepted as pieces of evidence of the severity of conditions within the region where they were conducted.

Population Death Rates

Based on selective survey results, mortality rates (per 10,000 per day) varied by survey site, ranging from 1.9 deaths per day in Jowhar and 2.9 per day in Merca/Qorioley to 11.8 per day in Bardera and 12.5 in Mogadishu.[71] Eleven percent of the population in Afgoi had died based on surveys among surviving family members.

In most developing countries, the expected mortality per 10,000 per day for the general population is 0.5 (or approximately 2 percent of the total population dies per year in the case of Somalia). Thus, the observed mortality rates during 1992 reflect an excess mortality ranging from 3.8 to 25 times the expected rate for a developing country.

Similarly, the percent of the survey population that died during the recall period -- usually from late 1992 back to March 1992 -- ranged from 6 percent in Jowhar to 36 percent in the Marin camp in Mogadishu.

CARE reports a total average mortality rate in the southwest Bay region of 2 persons dying per family (mean family size of 8), giving a 25 percent crude mortality rate for the emergency period (April 1992 to February 1993).[72] In a similar survey in Bur Hakaba, World Vision reports an 18 percent death rate during this period.[73] It was reported that 39 percent of persons had died in displaced camps around Baidoa.[74]

Among children under 5 years of age, the mortality rates were higher than that of the general population, with rates ranging from 3.2 per day in Mogadishu and 3.8 per day in Jowhar to 19.8 in Hoddur and 22.7 in Bardera. The expected mortality rate per 10,000 per day for children under 5 years of age in developing countries is 2. Thus, the observed mortality rates during 1992 reflect an excess mortality ranging from 1.6 to 11 times the expected rate. The percent of the survey populations who died during the recall period ranged from 12 percent in Jowhar to 62 percent in Bardera. In contrast, we would expect that 4.9 percent of children under 5 years of age would have died within an 8-month period based on the expected daily mortality rate among children under 5 years of age in developing countries.

Those surveys which separately examined mortality of displaced and non-displaced individuals consistently found that mortality rates were higher among the displaced.[75] The highest mortality rates were generally observed among displaced persons residing in camps rather than towns, and for displaced children residing in camps. Taking the highest displaced mortality rate (town or camp) from each survey, the mortality rate ranged from 4.5 to 16.8. Dislocation, in itself, was the most dramatic risk factor. The excess mortality relative to non-displaced persons ranged from 1.5 to 3.7, with a midpoint of a 2-fold excess mortality relative to non-displaced groups.

For displaced children under 5 years of age residing in camps, the mortality rate per 10,000 per day ranged from 6.6 in Merca/Qorioley to 32.0 in Baidoa rates that are 3 3 to 16 times the normal expected background rate of 2 deaths per 10,000 per day. Among the 4 studies comparing displaced rates to non-displaced rates, the relative risk of excess mortality among displaced children ranged from 1.3 to 2 1, with a midpoint value of a 2-fold excess above non-displaced rates.

The famine was typical in that most of the lives lost were among the young: 47 percent[76] of all deaths were under 8 year olds On the other hand, the proportion of all deaths suffered by the very young is usually higher. So, as a multiple of baseline conditions, the increase in death rates was proportionally more for adults.[77] The famine in certain areas was so extreme that adults suffered severe malnutrition on a scale that is rare. Unlike famine victims in other parts of the world, these adults had too little body fat or protein to carry them through a prolonged period of deprivation.

Converging Evidence on Total Famine Mortality

Estimating the number of deaths, while a related issue, is slightly distinct from estimating the proportion of Somalis who died. A lower bound on the numbers that died can be gauged through the deaths observed by field workers, predominantly at centers where relief assistance was administered.

Minimum and Maximum Bounds

International observers witnessed and verified through surveys general levels of deaths in major population centers, principally during 1992. Based on their reports a conservative estimate would put the number of deaths in Baidoa at least 20,000,[78] 10,000 in Bardera,[79] 10,000 in Mogadishu,[80] 10,000 in Kismayo,[81] 7,000 in Jowhar, 2,000 in Afgoi, 5,000 in the Jilib area of the lower Juba,[82] and 5,000 in centers along the coast south of Mogadishu (e.g Merca[83]) and riverine centers (e.g. Quoreiley).[84] Therefore, even if no excess deaths occurred outside of the major population centers, which we know not to be true, a minimum estimate would be that at least 70,000 persons died due to famine in 1992/1993, a minimum estimate.

An upper bound on the numbers of deaths can be derived through consideration of the numbers at-risk in the affected regions. Approximately 2 5 to 3 million persons lived in famine-affected regions of the country. In each region, the population estimated to still

live in the region, following the famine, or accounted for in refugee camps was typically not at variance from original estimates by more than 200,000 (Bay Region), and more in the order of 20,000 to 50,000 in other affected regions (Middle Shabelle, Lower Shabelle, Middle Juba, Lower Juba). Based, therefore, on this liberal use of "missing" populations,[85] the highest upper bound possible number of deaths for the famine is 700,000.

Extrapolating From Proportions that Died

The bulk of the evidence on starvation and starvation-related (e.g. famine) deaths refers to the massive increase in affected populations in 1992. Most of the surveys conducted on death rates refer to the period after the 1992 Ramadan Most of the key informant experiences also date from about that time. Therefore, most of the estimation of famine death involves the twelve-month 1992 period; less is known about starvation during 1991. Consequently, conservative estimates made here of total famine deaths conclude with comparatively few during 1991.

During 1992, the range of survey data might be synthesized down to a single estimate that could be applied to a broader population of famine-affected Somalis. One median estimate of the numbers that died during the famine period (March to December, 1992) is 7 per 10,000 per day [86] Since the baseline crude death rate in such a population is approximately 5 per 10,000 per day, then the crude excess mortality rate might be estimated at 6.5 per 10,000 for the affected population. This leads to an estimate of 1,950 deaths per 10,000 For an at-risk poulation of 1.5 million, this implies an excess mortality of roughly 290,000 for 1992

But this approach treats all regions of Somalia as if they were homogeneous And it over-simplifies the famine as occurring at similar levels in different places at different times.

The study team took advantage of available evidence to contrast regions and time periods, allowing for a further step of refinement in the analysis of the total deaths during the famine.

Accounting for Regional Distinctions

Mortality rates were estimated by applying observed crude mortality rates to specific populations based on regional disaggregation. The ranges of deaths calculated are shown in Table 1 on the following page In this table, the reported range represents the

plausible death rates per region In this instance, "plausible" means reasonably possible, a liberal estimate. In contrast, the most likely, or probable death rates (a more conservative range) are presented in the rightmost column, "probable excess deaths."

The first column of Table 1 lists several of the key regions of Somalia, breaking out the most famine-afflicted. The second column cites the estimated population of each region.[87]

The rest of the table gives mortality data.

The third column presents a range of the proportions of Somalis dying during the twelve-months of calendar year 1992. This is the only row citing percentages. The percentage range in the third column cites the realistic outside boundaries of how many people may have died [88] Because of biases in the representativeness of information about deaths and because of measurement errors,[89] it is not practical to narrow the plausible range of death rates beyond these wide intervals

Specific death rate intervals are estimated for each of the major regions, based on evidence from key informant interviews and general health status reports from those regions.[90] For example, few reports from the Central regions of Somalia (e.g. Bari, Mudug) indicated famine conditions.[91]

Table 1. Geographic Area	1991 Pop in '000s	Plausible proportions of populations dying: a range	Net deaths 1992, range in '000s	Baseline crude deaths (1 9% Rate), in '000s	**Excess** (Net minus baseline) mortality 1992, in '000s	**Probable** excess mortality 1992, '000s
Bay	600	12% - 25%	72 - 150	11.4	60 - 138	100 - 110
Lower Juba	200	6% - 16%	12 - 32	3.8	8 - 28	12 - 16
Lower Shabelle	450	6% - 15%	27 - 68	8.5	18 - 59	25 - 28
Bakool	140	6% - 13%	8 - 18	2.6	5 - 17	5 - 8
Middle Juba	240	3% - 8%	7 - 19	4.6	2 - 12	6 - 9
Mogadishu	800	3% - 8%	18 - 64	15 2	3 - 48	14 - 16
Middle Shabelle	300	3% - 7%	9 - 21	5.7	3 - 15	10 - 12
Hirran	160	3% - 6%	5 - 9	3	2 - 6	5 - 6
Other	2,210	2% - 5%	48 - 123	42	6 - 98	25 - 30
Total	**5,100**		**206 -514**	**97**	**109 - 417**	**202 - 238**

This step -- synthesizing death rates from small samples and applying them as indicative rates for large regions -- is the most critical and controversial step in the overall analysis. Some argue that too little is known about the geographic variation in the famine to justify one figure as more or less representative of populations that were not directly observed. Indeed, no one conducted systematic comparisons of health or mortality between any regions during the famine. However, health professionals involved in assessment and effective reporting[92] on an operational basis did have meaningful observations of conditions across regions where they individually worked. It was the task of many project planners working with UNICEF, CARE, and UNOSOM (to name only a few agencies) to determine the magnitude of dying in different regions. The study team focused on culling the knowledge of field staff with respect to such geographic comparisons.

ICRC held a unique role in this regard, because it provided assistance in virtually every region of the country. Throughout the period of emergency, it needed to make site visits and comparative estimates of levels of severity of the health crisis across regions in order to determine the level of response per region.

Column 4 converts the percentages in column 3 into numbers of Somalis, merely multiplying the rates of column 3 with the population sizes of column 2.

Column 5 lists estimates of the baseline, or pre-famine mortality, in each region, in terms of thousands of persons dying in a normal twelve-month period. This is calculated roughly, without adjustment for age profile, as .02 multiplied by the population size.

Column 6 arrives at the numbers of persons dying in each region that were "excess" during the famine period. These numbers are merely the estimates of column 4 minus the baseline figures in column 5.

Column 7 (the far right column in Table 1) narrows the range from plausible to probable. While the plausible interval encompassed a wider range of uncertainty, the "probable" interval uses information to hone in toward the true range. By sacrificing certainty, the probable range has a higher likelihood of error.[93]

This narrower range is derived not from merely selecting the middle range from the plausible range, but by accounting for varying levels of certainty. For instance, the plausible range of deaths for the northeast and Gedo regions of the country (0 to 98,000) allows for the possibility that up to 100,000 died, the lack of evidence is suggestive that the true death count is at the low end of this range (here, 25,000 to 35,000). In contrast, the probable range of deaths of those beginning the period living in the Bay region (100 - 110) are believed to be at the high end of the plausible range (60 - 138) as so much survey

evidence points to high rates of deaths, even though most of these deaths were not directly seen or demonstrated.

The estimated total excess mortality of Somalis during the main famine period of 1992 is between 202,000 and 238,000, based on adding the "most probable" mortality figures for each region (the right-most column of Table 1)

This range is an interval of relative confidence, the true number of deaths may fall anywhere within this range Any point estimate within this range is approximately as likely as any other to be the true figure. It is important to stress the high level of uncertainty that remains over the calculation of deaths and that any one point estimate can mislead the reader. However, for convenience purposes, the midpoint of the range may be cited, in this case 220,000, keeping in mind that it refers to a confidence interval.

In addition to the 202,000 to 238,000 excess deaths that occured during the 1992 famine, another 10,000 persons are estimated to have starved in early 1993, based on the famine curve trends evident in late 1992 [94] An estimated 10,000 starved as a result of displacement and food insecurity in 1991.[95] Therefore the total excess deaths attributable to starvation[96] over the wider 1992 - to - 1993 period of emergency is 212,000 - 248,000

Other deaths related to the humanitarian emergency include persons killed directly through violence An estimated 50,000 died in the course of the fighting that led to the ouster of Siad Barre from power 1985 to 1991.[97] During 1991 and early 1992 another 15,000 to 40,000 may have been killed in inter-clan fighting. During 1993 some have estimated that up to 10,000 were killed, largely in the conflict between international troops and Aidid's forces in Mogadishu Overall, up to 90,000 may have died directly from fighting.

HOW MANY LIVES WERE SAVED BY THE INTERVENTIONS?

There is a tendency to estimate the impact of an intervention based merely on the magnitude of the intervention, as opposed to the quality of the intervention or the nature of the risks involved. For example, some have spoken of the numbers of lives "saved" in the Somalia relief effort, as well as other famine relief efforts, in terms of the millions of persons "reached" through assistance. Indeed, this approach helps set an upper boundary for the number of persons helped and the numbers potentially saved. In the case of Somalia, at least one million Somalis received relief in the form of foods and medicines at some point in time during the crisis. And another million agropastoralists and city-dwellers benefited from the increased access to food that occurred as a result of the expansion of food supplies in the country and the drop in food prices in late 1992.

But the numbers reached, or covered, by interventions are unlikely to closely approximate to the number of lives saved. Many of those most at risk of death die anyway, despite receiving assistance. More important, however, is the fact that the majority of the population that benefited would not have died whether they had received aid or not.[98] In general, the greater the aid coverage of a large population, the lower is the marginal effectiveness of such aid in saving lives [99]

Few evaluations of emergency assistance venture beyond this step of identifying total numbers "reached." There are, in fact, no guidelines for how to synthesize additional information on the nature of the risks of death, the rates of death, and the efficacy or "fit" of health interventions with respect to health problems. This lack of simple formulae is due to the exceeding complexity of the issue: hundreds of thousands of people exposed simultaneously to numerous health problems.

For example, persons on the verge of death from dehydration, who are assisted with a lifesaving new water system, may nevertheless die the following week, from, for instance, a measles epidemic. In the famine-ravaged zones of Somalia, illnesses "competed" with one another to be the final, lethal blow. Of those who died few perished from only one cause. Those who died of fever, respiratory infection, diarrhea and dysentery also suffered in great proportions from undernutrition, fatigue, dehydration, and anemia.[100] The synergistic effect of these conditions greatly increased the crude mortality rate in the affected population [101]

Therefore, in calculating the numbers of lives that were "saved" or were "savable," other questions must be answered along the way:

1. What proportion of deaths were related to specific illnesses? (this proportion is referred to by epidemiologists as the "attributable risk," or the "population attributable risk percent");

2. What is the lethal impact of the interaction (combination) of these illnesses on each victim, or on a population, accounting for group effects (such as "herd immunity")?

3. What is the predicted impact of any chosen health intervention on reducing or postponing deaths from each illness or combination of illnesses?

Much of the literature on lifesaving efforts in large populations is based on studies of long-term (non-emergency) situations In this regard, some lessons of history are instructive, as most countries confronted high-infectious-disease regimes in past centuries, if not still today. As many Western nations moved from high mortality rates (from cholera, dysentery, tuberculosis and typhoid) to stable low-mortality patterns, they did so prior to the advent of effective curative care or the existence of immunizations. "The rapid decline of mortality from diseases spread by water and food since the late nineteenth century owed little to medical intervention. The predominant influences which led to the improvement in health in the past three centuries were nutritional, environmental, and behavioral,"[102] writes one historian. Progress was due mainly to reduced contact with micro-organisms. Water purification, efficient disposal of sewage and food hygiene reduced exposure to water and food-borne diseases. Improvements in nutrition and hygiene also made significant contributions to the overall reduction in mortality.[103] In modern times, Sri Lanka, Costa Rica and India's state of Kerala show that the conscious extension of public health care structures and public health campaigns can successfully and markedly reduce mortality in advance of other development achievements.[104]

The circumstances within the Somalia famine were not unprecedented In Meiram, southern Sudan in 1988, similar problems occurred. As ICRC later did in Somalia, MSF-France in Sudan ceased distribution of dry rations in providing relief to internally displaced because dry food leaked out of the camps. They began, instead, to give out mass distribution of cooked food. Also similar to Somalia, deaths from diarrhea were high as the displaced depended on stagnant water pools because they could not afford to use local pumps Hypothermia was reported and the lack of blankets was identified as a relief problem.[105]

Health experts tend to agree that in Somalia-like famines, excess mortality is controlled primarily through the control of epidemic infectious disease and malnutrition. In Somalia, malnutrition clearly underpinned most of the vulnerability to death that occurred So many hundreds of thousands were severely malnourished in Somalia that it became meaningless to speak of "who" was malnourished as opposed to "how" malnourished [106] That these Somalis had gone many months without adequate food

strongly suggests that they were additionally deficient in micronutrients, particularly water soluble vitamins thiamine, riboflavin, pantothenic acid, folic acid, niacin, and ascorbic acid.[107]

Thus, interventions that targetted the nutrition aspect of health risks combatted all diseases at once. The reduction of malnutrition will, by itself, lead to reductions in diarrhea and related mortality.[108] They address the underlying cause of "frailty" to other infections.[109]

But to achieve high coverage and high impact, feeding programs became very expensive. Famine relief programs with high food transport expenses have cost over $200 per year per person reached This contrasts sharply with the expense of measles immunization which costs in the range of $1 to $10 per person reached in a war zone.

The Role of Food Aid

Food aid is the program of first and last resort because it has a high profile and its health benefits are universally accepted Relative to other commodities, cash, or works projects, food aid is felt to be self-targeting, particularly when distributed through on-site feeding centers (kitchens). In Somalia, because malnutrition and diarrhea did create a great need for food and feeding programs, food aid was an appropriate response.

Ideally, a greater total volume of food could have been delivered to more rural distribution points and by an earlier date. More was clearly needed in early 1992 when ICRC was bearing most of the logistical burden of delivering food aid.

However, in an ideal program, the proportion of expenditure and effort on food -- relative to other health interventions -- would have been significantly less CARE, CRS, World Vision, ICRC, WFP, and UNHCR focused largely on food distributions[110] while other programs were comparatively under-represented: water, sanitation, essential drugs, case-finding, public health worker outreach, surveillance, and other health interventions. NGO decisions as to what interventions they would undertake were based more on their organization's past activities than on any coordinated review of needs in Somalia.

Over time, NGOs took on additional tasks as institutions learned more about broader program of health care. IMC and CRS are two cases in point· by 1994 both agencies were implementing extensive primary health care training in the Bay region By the end of 1992 large quantities of food were reaching most rural markets, increasing immediate food security, yet possibly slowing the process of reconstruction.[111]

Thus, the large-scale food/nutrition interventions mounted largely by ICRC[112] were effective in addressing these problems and in preventing deaths in mid and late 1992. The monetization program was designed to direct commodities back through the formal business sector, thereby re-empowering wholesalers. Monetization occurred well after the decline in food prices, however, and thus did not have a direct impact on food security during the crisis.

Lives Saved 1991 - August 1992

The work of NGOs in Somalia in 1991 was geographically restricted, largely to Mogadishu and the border areas. Their activities were focused primarily on medical care, which fit the early needs of casualty-related trauma. No literature was found to help in making estimates of the relationship between medical/surgical interventions and the rates of deaths averted. Thus such estimates are mostly speculative. The emergency medical and surgical efforts of relief organizations such as MSF,[113] IMC, and ICRC reached some 5,000 war victims[114] and may have affected the prognosis or survival rates of about half, or 2,500.

Many of those who received aid at therapeutic feeding centers went on to die. In effect, the food aid postponed these deaths but did not avert them. Other Somalis were supported until they could recover fully. There were still others who received food aid, immunizations, and medical care, which influenced their health status, but did not save their lives because they would not have died during this period in any case. Estimating this later proportion is a process dependent on projecting the course of the famine itself had there been no massive relief effort.

Some proportion of Somalis, who would not have otherwise done so, died because of relief activities.[115] For example, the camp settings to which many displaced persons were drawn,[116] created new, additional health risks that claimed some lives that would not have been lost. It is questionable, for example, whether there would have been a measles epidemic had populations not congregated in densely-settled camps [117] There continues to be a debate in the epidemiology literature about the degree to which measles epidemics, such as the one in Somalia, are precipitated more by malnutrition or by the heightened exposure that occurs when populations come into contact with one another as in displaced camps [118] Dysentery and respiratory infections were also exacerbated by the increased transmission that occurs in camp settings

Intensive feeding around the feeding centers saved the lives of some fraction of the total population served. Of the persons who received assistance in the most dire displaced

camps, a large proportion were extremely malnourished Based on these malnutrition rates, case-fatality may well have been as high as 50 percent. Indeed, high case-fatality rates were seen. It is necessary to base estimates of lives saved on known statistical correlations between malnutrition and mortality. Such a simplistic approach neglects, however, the tight interaction between disease and malnutrition: "The practice of quantifying the relative contribution of various diseases to mortality... presumes implicitly that malnutrition's contribution is additive.[119] Over one-third and in some cases over half of those dying in the famine zones had listed as primary cause of death "diarrhea," which leads to malabsorption of nutrients. Therefore, sometimes malnutrition cannot be fully remedied merely through more food. Feeding programs may help to interrupt a downward spiral of infection and malnutrition, but, alone, they may not suffice to reverse the spiral to recovery of those who are already ill.

Because ICRC and the NGOs were feeding in excess of 1,000,000 Somalis at one point in time, some have argued that the numbers of lives saved was of a higher order of magnitude -- possibly in the hundreds of thousands This is plausible. However, experience in other famines suggests that it may be impossible to know: in some famines where no food aid is given, mortality, while raised, does not claim a large proportion of the population In other famines it does. In Somalia, it is difficult to determine what would have been the nature of the food economy had no food assistance been delivered. It is possible that even greater numbers of refugees would have fled to Kenya and Ethiopia. If no food aid had been provided in refugee camps in Kenya, would those refugees have found other means to cope?

Beginning in early 1992, the operations of these organizations expanded ever further, encompassing greater geographical regions, emphasizing more on primary care and food aid. ICRC and many NGOs began operating wet feeding programs. ICRC began dry feeding distribution, bringing food by dhow to numerous coastal ports, including the central regions, and cross border from Kenya. By March 1992, the ICRC began a shift to airlifting food and in April began providing wet feeding at Red Crescent -administered kitchens. The peak of mortality for the famine hit during this expansion of relief programs.

The numbers of persons who survived this period, later returning home from the feeding centers, was of the same order of magnitude as those who died within or in the vicinity of the camps -- some 70,000 to 100,000 [120] Without question, many of these survivors would not have lived without relief assistance. Very few were saved through hospital or curative care Few, also, were saved through immunizations or MCH programs, as they were almost non-existent during this time. Some benefited from provision of new water systems, but these were often implemented only in conjunction with feeding centers.[121] Thus, most of the lives saved during the first half of 1992 can be

credited to the benefits of the food programs (and whatever care and rehydration therapy was provided at the feeding centers).

Malnutrition and mortality have been found to be highly correlated in emergency settings, particularly among displaced populations.[122] While correlation does not prove causality, a reasonable approximation of the proportion of the 100,000 survivors from these programs who would not have survived without food aid would be half. In other words, of the 100,000 who were at risk during this period, received food aid during this period, and lived beyond this period, some 50 percent would not have lived had food aid not been received. Thus the total number of lives saved during this period was 50,000.

Lives Saved September 1992 through December 1992

The continued work of the ICRC and the NGOs from August to December 1992 arguably saved more and more lives, and this effort was enabled powerfully by the US/Canada/Germany/WFP/UNICEF/ICRC airlift that expanded in August At the same time, more food began to come into the country through overland routes as well, as CARE, CRS and other NGOs entered the relief effort in a large way. Much of the food coming into the country began to reach the rural areas, affecting markets countrywide.

Analysis could focus on the numbers of persons who could rely on these emergency kitchens But a more telling finding was the degree to which these food programs helped stabilize food availability and access country-wide. By November 1992 the price of food, an inverse reflection of its availability, had plummeted well beyond anyone's expectations or predictions.

By the end of October, mortality rates associated with the famine were steeply declining.[123] All told, over 1 million were reached by relief directly, and most of the rest of the population indirectly, through greatly increased food availability. As the famine declined and the scale of emergency efforts increased, the marginal benefit of interventions declined.

When the famine would have declined based on its own natural history is subject to much debate. On the one hand, the third wave of mortality hit hard in the early fall, and death rates in places like Bardera were still high in December 1992. During September and October, mortality rates appeared to climb, though not to the same levels seen in May to July, and measles was rife despite stepped-up efforts

However, much of the apparent increase in deaths was really due to the increased visibility of famine-affected populations, as the last victims were drawn to the over 1,000 feeding centers around the country. In fact, death rates had steeply fallen in most places, including the Bay region, by December. The famine curves shown in Figures 1 and 2 suggest that the famine had followed a natural curve-shaped course, and may have been self-limiting in this manner.

Economists might argue that it was the market effect of the bringing in of food aid,[124] not predominantly the individual feeding programs, which broke the back of the famine through sheer food supply. In any case, the mortality curves were on the downswing. The famine was burning itself out, but the assistance was having its beneficial impact as well

During this period, the international assistance effort had greatly increased. In addition to those persons directly receiving assistance, most of the total population benefited from the food market effects of the assistance. The numbers of people benefiting was higher than in previous periods, which would imply that the impact of the relief during this period was greater than during the previous period: up to 60,000 lives saved. However, the numbers of people at risk of death were likely to have been fewer than in the earlier (second wave) famine period. Except for a few abrupt spikes in death rates in September (due largely to measles) and October (accompanying the rainfall), the long-term famine curve was declining after July 1992. Evidence from key informants confirms that the peak period of deaths had already passed before the food airlift began and the fall 1992 increase in NGO activity. Many of the deaths in this period represented the inevitable "playing out" of cumulative nutritional stress and disease. By this reckoning, fewer lives were saved than during the previous period, perhaps as few as 20,000.

The probable number of lives saved during this period may be said to fall in the middle of these two estimates· 40,000.

Lives Saved December 1992 through 1993

Following the UNITAF intervention, mortality rates were no more than, and probably less than 10,000 deaths per month.[125] Deaths in Baidoa had dropped to 8 per day by December, lower by January; deaths in Bardera were reported at 20 to 25 per day in January, but this was probably not accurate.[126] Perhaps most of these deaths resulted from months of cumulative malnutrition and illness, and not new health risks.[127] Therefore, many of these deaths were very likely to have occurred with or without UNITAF's

intercession. The combined UNITAF and relief effort interventions might be said to have speeded up the conclusion of the famine curve by one full month. This follows from examination of the curve of mortality in figures 3 and 4.

Note that the steep drop in deaths from October to November to December cannot be attributed to UNITAF, nor to the relatively good Deyr (January 1992) harvest.[128] Rather it reflects the cumulative food-distribution, immunization, and rehydration efforts of all programs countrywide. UNITAF's accomplishment was to have helped numerous NGOs reach more areas more quickly with more resources. Again, from January to April 1993, this might be said to have sped up the end of the famine curve by a total of one month.[129] Therefore the lives saved was perhaps as low as 10,000.

However, UNITAF accomplished more than merely speeding up the conclusion of the famine waves that were underway at the time. UNITAF also reduced the likelihood of increased violence, warfare and secondary food insecurity. By reducing the presence and activity of "technicals"[130] the UNITAF forces induced a calm and level of safety that allowed merchants and farmers to reestablish some trade. Because new famine waves did not begin in late 1992 and early 1993, it is plausible that UNITAF prevented large numbers of starvation deaths.

During the period of the famine, however, just looking at December 1992 up through March 1993, excess deaths ranged from 10,000 to 25,000.