

**Morbidity and Mortality among Iraqi
Children from 1990 through 1998:
Assessing the Impact of the Gulf War and
Economic Sanctions**

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Glossary of Terms

ACCD	Arab Council for Childhood and Development. State of the Child in the Arab World.
BRIT	Brittanica Online
CCCU	Community Child Care Units
CESR	Center for Economic and Social Rights
CIA	Central Intelligence Agency
DPT	Diphtheria, Pertussis, and Tetanus Vaccine
EPI/CDD	Iraq Immunization Maternal and Childhood Mortality Survey
FAO	Food and Agricultural Organization
GCHS	Gulf Council Health Survey, National Childrens Health Survey
GNP	Gross National Product
IMR	Infant Mortality Rate
IST	International Study Team
Listwise Method	Interpolating missing data by using cases with complete data sets for all variables
Means Method	Imputing simple mathematical average values from known data sets wherever missing values appear
MER	Middle East Review
MICS	Multiple Indicator Cluster Survey
MOH	Iraqi Government Ministry of Health
MOP	Iraqi Government Ministry of Planning
NGO	Nongovernmental Organization
Pairwise Method	Imputing data for missing variables by using data for similar cases
PAR	Population attributable risk is the proportion of all mortality which is due to the effects of malnutrition.
Stepwise Approach	Iteration procedure for systematically choosing the combination of variables to include in a multivariate model
SOWC	State of the World's Children
U5MR	Under five-year-old Mortality Rate
UN	United Nations
UNICEF	United Nations Childrens Fund
UNSCR	United Nations Security Council Resolution
WB	World Bank
WFP	World Food Program

Summary of General Findings

By Richard Garfield

Sustained increases in young child mortality are extremely rare. In Iraq, there have been many reports suggesting a rise in rates of death and disease since the Gulf war of January/February 1991 and the economic sanctions that followed it and continue to this day. There is no agreement, however, on the magnitude of the mortality increase, its causes, who is responsible for these deaths, or how to stop them from happening. Because the best data and the greatest changes in mortality occur among young children, this report focuses exclusively on deaths among children under five years of age. Information from twenty-two field studies, including data from thirty-six nutritional assessments were reviewed, along with demographic estimates from nine sources, three Iraqi government reports, ten UN-related reports, and eighteen press and research reports.

Data on the health and well being of children were drawn from four large, well designed and managed studies examining death rates among children from 1988 through 1998; Iraqi Ministry of Health data (26, 28) serve as a prewar baseline. Before the establishment of sanctions prior to the Gulf war in August 1990, for each 1000 children born, 40 died before reaching five years of age. Careful reexamination of a previous study showed a slight increase in mortality during sanctions prior to the Gulf war. A large rise in mortality in the period during and eight months after the Gulf war was reported in the well publicized international study done by an international study team from Harvard University (29, 30). Data are not available from any reliable studies on mortality since 1991. Very good data are available for the years 1996 through 1998, however, on child nutrition, water quality, adult literacy, and other social and health indicators which influence child mortality.

A variety of methods were used to estimate the mortality rate that is predicted by these indicators. The most reliable estimates were derived from a logistic regression model using a multiple imputation procedure. The model successfully predicted both the mortality rate in 1990, under stable conditions, and in 1991, following the Gulf war. For 1996, after five years of sanctions and prior to receipt of humanitarian foods via the oil for food program, this model shows mortality among children under five to have reached a minimum of 80 per one thousand, a rate last experienced more than thirty years ago. This rise in the mortality rate accounted for between a minimum of 100,000 and a more likely estimate of 227,000 excess deaths among young children from August 1991 through March 1998. About one-quarter of these deaths were mainly associated with the Gulf war; most were primarily associated with sanctions. Mortality was highest in the southern governorates of the country and lowest in Baghdad. Mortality was higher in rural areas, among the poor, and among those families with lower educational achievement. The increase in mortality was caused mainly by diarrhea and respiratory illnesses. The underlying causes of these excess deaths include contaminated water, lack of high quality foods, inadequate breast feeding, poor weaning practices, and inadequate supplies in the curative health care system. This was the product of both a lack of some essential goods, and inadequate or inefficient use of existing essential goods.

Given the most likely estimate of 227,000, there were an average of about 60 excess deaths each day. These child deaths far outnumber all deaths on all sides, among combatants and civilians, during the Gulf war. It exceeds the number of deaths known to result from any of the bombing raids in Iraq even on the days of the bombings. It exceeds each week the number of deaths that occurred in the tragic bombing of the

Al Furdos bomb shelter during the Gulf war. That incident caused an international uproar, an apology from the Joint Military Command, and a revision in the procedures for selecting targets. Reaction to the much greater number of child deaths associated with sanctions has been far more muted. Confusion over the number of deaths and rhetorical argument over which side is responsible for those deaths has prevented the international community from focusing more effectively on how to prevent their continued occurrence.

Studies from 1996 onward suggest that there was little decline in mortality rates at that time. Since March 1998 the oil for food program has greatly increased access to essential supplies and the mortality rate has surely declined, but data are not yet available to estimate the magnitude of that decline. Indeed, the failure to institute stepped-up monitoring when sanctions were initiated in 1990 continues to limit the capacity to carry out timely and reliable assessments of humanitarian conditions in Iraq. Despite a steep rise in mortality rates, most Iraqi children survive under the social, economic, and political crises of the 1990s in Iraq but experience profound limitations on their health and well being. Far more attention needs to be devoted to identifying and minimizing the humanitarian damage to the Iraqis alive today, in preparation for an eventual shift from relief to reconstruction and development in the years ahead.

Foreword

Assessing the Humanitarian Tragedy in Iraq

by George A. Lopez and David Cortright

No modern humanitarian emergency has been as intensely examined as the humanitarian crisis in Iraq in this decade. Since 1990, more than thirty major studies have been conducted on the impact of the war and the continuing economic sanctions. Major reports have been issued by the United Nations Children's Fund (UNICEF), the World Food Programme (WFP), the Food and Agricultural Organization (FAO), the Harvard Study Team, and the Center for Economic and Social Rights in New York. In 1997 alone extensive health and nutritional surveys were conducted by UNICEF and a joint FAO/WFP team. The findings of these most recent investigations were summarized in a November 1997 report to the Security Council by Secretary General Kofi Annan:

United Nations observers regularly report an exceptionally serious deterioration in the health infrastructure: a high infant mortality rate and high rates of morbidity and mortality in general, poor and inadequate storage conditions for supplies, an unreliable supply of electricity and back-up generators, faulty or non-functioning air-conditioning, defective cold-storage, interrupted water supplies, broken/leaking sewage systems and non-functioning hospital waste disposal systems.ⁱ

One of the most alarming reports on the consequences of the sanctions appeared in a December 1995 letter to *The Lancet*, the journal of the British Medical Association. Sarah Zaidi and Mary Smith-Fawzi, members of the 1995 FAO study team that had examined health and nutritional conditions in Iraq, asserted on the basis of the FAO report that since the end of the Gulf War sanctions were responsible for the deaths of 567,000 Iraqi children.ⁱⁱ A *New York Times* article picked up the story and flatly declared "Iraq Sanctions Kill Children."ⁱⁱⁱ In May 1996 a feature segment of the widely viewed CBS television program *60 Minutes* depicted sanctions as a murderous assault on children.^{iv} UNICEF added fuel to the fire with an October 1996 report that 4500 children under the age of five were dying every month in Iraq from hunger and disease.^v Critics have called the UN sanctions "a massive violation of human rights" and have described the situation in catastrophic terms: "More Iraqi children have died as a result of sanctions than the combined total of two atomic bombs on Japan and the recent scourge of ethnic cleansing in former Yugoslavia."^{vi} Former Attorney General Ramsey Clark, Bishop Thomas Gumbleton, and others regularly claim that sanctions have killed more than a million Iraqis, most of them children.

Doubts about the numbers were raised immediately. In January 1996, researchers at the London School of Hygiene and Tropical Medicine published a letter in *Lancet* about inconsistencies they found in the infant and under-five child mortality rates used by the FAO analysts.

In late 1996, Canadian scholars noted that the claim of 567,000 deaths was an extrapolation based on a sample of 36 infant deaths and 245 child deaths reported between 1991 and 1995. Others pointed out that the baseline figures used for comparison—infant mortality rates before the Gulf War—were themselves based on estimates, because Baghdad did not report these statistics in the five years preceding 1990.

In October 1997 *Lancet* published another letter from Zaidi that cast grave doubt on the most important findings of the 1995 report. Zaidi and her colleagues at the Center for Economic and Social Rights participated in a 1996 study mission that used the same survey methods and questionnaires as the 1995 FAO investigation. They found that the mortality rates estimated in 1996 were much lower than those reported in 1995, for unknown reasons.⁶ Interestingly, this major disavowal of the catastrophic numbers went unnoticed by the press.

One problem with many of the most frequently cited studies is that they rely primarily on official Iraqi information sources. The 1995 FAO study contains a table reporting more than 500,000 deaths among children due to sanctions, but the source for these figures is the government of Iraq.

The study also contains an estimate by the Iraqi Ministry of Health that 109,000 people died annually because of sanctions, but it observes that the study's investigators had no way of confirming this figure.⁷

Similarly, a 1996 World Health Organization report on health conditions in Iraq was based largely on data supplied by Baghdad. The report simply accepts unsubstantiated Iraqi figures and uses them to estimate infant mortality and disease rates.^{vii}

These studies and assertions raise profound questions, especially regarding the most pressing: Are the sanctions killing babies? Beyond this, many wonder about the scale of the humanitarian crisis. Who is responsible? The answers to these questions are crucial not only for the fate of the Iraqi people and the course of UN policy there, but for the future of Security Council sanctions in general, as that body is now experiencing fatigue and division about the future of sanctions in light of the Iraq experience. At stake are the legitimacy and viability of economic sanctions as instruments of nonmilitary international policy.

We have contributed to the debate on Iraqi sanctions several times, especially criticizing the strategic misuse of these sanctions and their politicization.^{viii} After 1995 we were increasingly calling attention to the severe humanitarian consequences of the sanctions. While we count ourselves among the critics of sanctions in Iraq, we have been skeptical of the claims that have been made about the scale of the humanitarian crisis. As a result we have drawn serious criticism from various commentators and especially from activists concerned with the immorality of sanctions against Iraq.^{ix} For several years we have had concerns about the accuracy of the most widely quoted figures about Iraqi mortality. Part of our concern and doubt was fueled by knowing the facts about the data discrepancies we noted above. But when the *New York Times* and *60 Minutes* are going to use a particular number of child deaths, however inaccurate, such figures take on life and meaning of their own. We had hoped to be able to verify these assertions about the enormous figures and to see if we could acquire any reasonably objective assessment. However, the more we studied the problem of sanctions-related mortality in Iraq, the more confusing the picture became. Inconsistencies and methodological problems seemed to plague nearly all of the more than two dozen major studies conducted in Iraq by UN and independent agencies. The inquiry was clearly beyond our own expertise.

To gain a more accurate picture of sanctions-related mortality in Iraq, we commissioned public health specialist Richard Garfield of Columbia University to conduct an independent study. Garfield was a member of the initial Harvard Study Group that investigated the impact of sanctions in Iraq in 1991, and he had published studies on the health impact of sanctions against Cuba and Nicaragua. We asked Garfield to evaluate the studies that have been conducted on Iraq to date and to take a fresh look at possible new

methodologies for determining sanctions-related mortality, especially for children under five years of age. The present study is the result of Garfield's effort.

We believe it breaks new ground in examining the humanitarian impact of sanctions and provides as reliable a scientific basis for estimating the mortality impacts of the sanctions in Iraq as can possibly be obtained at this time and under these circumstances. We are grateful to Garfield for the enormous amount of energy and research he brought to this study, and we also owe a debt to the numerous colleagues in the public health field who provided critical commentary to Richard on earlier drafts of the work. We hope that his report will make a significant contribution to a more informed assessment of the Iraq sanctions. We believe that Garfield's study and innovative methodology may have wider significance in offering new approaches to the necessary task of assessing the humanitarian impact of United Nations sanctions.

The estimates offered by Garfield of 106,000 to 227,000 deaths of Iraqi children under five since the imposition of sanctions are significantly lower than the claims presented by the most vocal critics of sanctions in Iraq. But even the more conservative estimates in Garfield's study are horrifying. In particular we ourselves, who have been publicly skeptical of larger estimates, especially those used by the activist community,^x find no solace or academic satisfaction in these gruesome numbers. Garfield confirms that hundreds of thousands of innocent children in Iraq have died prematurely and unnecessarily during this sanctions crisis. This is an appalling humanitarian tragedy. The humanitarian crisis in Iraq demands urgent attentionCfrom government and citizens alikeCto put an end to the suffering of innocent children. We know that Richard Garfield's work will make a major contribution toward this important goal.

George A. Lopez
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Goshen, Indiana
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Notes

1. United Nations, *Report of the Secretary General Pursuant to Paragraph Three of Resolution 1111 (1997)*, S/1997/935, 28 November 1997, 14.
2. Sarah Zaidi and Mary C. Smith-Fawzi, "Health of Baghdad's Children," *The Lancet* 346, no. 8988 (2 December 1995): p. 1485; see also the editorial in the same issue, "Health Effects of Sanctions on Iraq," 1439.
3. Barbara Crossette, "Iraq Sanctions Kill Children, UN Reports," *New York Times*, 1 December 1995, A6.
4. CBS Television, *60 Minutes*, 12 May 1996.
5. Barbara Crossette, "UNICEF says Thousands of Young Iraqi Children are Dying Ever Month," *New York Times*, 29 October 1996, A6.
6. Center for Economic and Social Rights, *UN Sanctioned Suffering: A Human Rights Assessment of United Nations on Iraq* (New York: Center for Economic and Social Reights, May 1996): 1.
7. This material on source discrepancies was originally published in the sidebar 'Counting the Dead' in George A. Lopez and David Cortright, "Pain and Promise," *The Bulletin of the Atomic Scientists* 54, no. 3 (May/June 1998): 41.
8. See George A. Lopez and David Cortright, "Trouble in the Gulf: Pain and Promise," *The Bulletin of the Atomic Scientists* 54, no. 3 (May/June 1998): 39-43; David Cortright and George A. Lopez, "Are Sanctions Just? The problematic Case of Iraq," *Journal of International Affairs* 52, no. 2 (Spring 1999): 33-53; and Thomas G. Weiss, David Cortright, George A. Lopez, and Larry Minear, eds. *Political Gain and Civilian Pain: Humanitarian Impacts of Economic Sanctions*, (Lanham, Md.: Rowman and Littlefield, 1997).
9. See the letters and discussions in *Sojourners*, May/June, 1998 as an axample.
10. See George A. Lopez, "The Sanctions Dilemma: Hype Doesn't Help" *Commonweal*, September 10, 1998, 10-12.

Morbidity and Mortality Among Iraqi Children from 1990 Through 1998:

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By Richard Garfield

Introduction

As tools of international pressure that fall between diplomacy and armed force, sanctions usually aim to achieve political ends at far less cost to the embargoing countries than would be incurred by warfare (67). In modern times economic sanctions became a more common tool of coercive foreign policy, as a prelude or alternative to warfare, after the end of the Cold War. Multistate sanctions, such as those imposed by the United Nations (UN), were applied only to Southern Rhodesia (1966) and South Africa (1977) prior to the end of the Cold War. Since then multistate sanctions have been applied against Iraq (1990), Somalia (1992), Libya (1992), the Yugoslav Federation of Serbia and Montenegro (1992), Liberia (1992), Haiti (1993), Angola (1993), Rwanda (1994), and Sierra Leone (1997). In the last fifteen years, the United States has also passed resolutions invoking sanctions against more than seventy countries with more than half of the world's total population.

Has the Embargo Killed Iraqi Children?

U.S. and UN policies toward Iraq are greatly influenced by questions about the humanitarian impact of the embargo. Have Iraqi children been dying due to the embargo, as the government of Saddam Hussein argues? If so, to what extent has mortality increased? Is the humanitarian suffering in Iraq a tragic but necessary cost to prevent Iraqi aggression and the proliferation of weapons of mass destruction, as U.S. Secretary of State Madeleine Albright has argued? Or is it, as some UN Security Council members, and religious and peace groups argue, an excessive, unnecessary, and unjustifiable cost? Even the U.S. government believes there has been a serious increase in child deaths in Iraq. During U.S. embargoes against Haiti and Cuba, the State Department argued that reported mortality increases were not real. Regarding Iraq, it argues that the mortality increase is the fault of Saddam Hussein rather than the U.S.

As an editorial in the *Washington Times* on 5 December 1997 stated, "No one seems to be able to agree on exactly how big the 'starvation' problem really is . . . there is really no reliable source of information . . ." (1). Reports from the Iraqi government and its supporters suggest that more than a million excess deaths have occurred. International missions and humanitarian organizations since the end of the Gulf war describe Iraq in apocalyptic terms, imminently close to famine and social breakdown. **This study aims to establish minimum estimates for the magnitude of mortality changes among under five-year-olds and to identify the mechanisms responsible for major mortality changes.**

The well being of citizens in an embargoed country is impacted by the resilience of that country's economic and social systems. The vitality of such systems is threatened by the stresses that an embargo places on the

production, importation, and distribution of essential goods. But changes in the distribution of essential goods within the family and the mobilization of underutilized resources due to political or social policies modify the impact of resource changes brought on by economic sanctions. Such effects are indirect, difficult to isolate from other factors, and impossible to measure with precision.

Other sources of social stress often accompany embargoes, including economic inefficiencies, inequitable distribution of goods, civil conflicts, and population movements. These factors also threaten a population's health and impede the ability to measure changes in health care and health status. Even a dramatic decline in key resources does not always or immediately lead to increases in morbidity or mortality, however, due to the resilience of such health assets as public education, healthful behaviors, trained health workers, and infrastructure, which deteriorate only gradually (3). Infant mortality can decline even during periods of severe resource shortage if those scarce resources are distributed efficiently (2).

Social disruptions in Iraq have weakened the country's health system and vital statistics reporting systems. Further, information provided by the Iraqi government may not be reliable. Since 1990 the Iraqi health system's data management and processing capability has been greatly reduced. The system was computerized prior to 1990; it is now entirely dependent on paper records which are known to be incomplete. The government of Iraq's health reporting systems depend nearly exclusively on information generated from public hospitals. Besides problems introduced by growing delays, greater inaccuracies, and poorer diagnostic capacity in public hospitals, the information provided was increasingly incomplete because a growing proportion of all diagnoses from 1991 to 1997 were recorded in private hospitals and a growing but unknown proportion of all deaths occurred outside of hospitals (8). Press-oriented processions through Baghdad with small caskets, designed to denounce the U.S. and UN for culpability in deaths, demonstrates the political utility of poorly defined data on deaths among children for those opposed to sanctions (9,10).

In nearly all countries basic information on births and deaths is available only from the government. Faith in the veracity of such reports is tempered by checks on the completeness and accuracy of statistical information. Except for the survey work of the Iraqi Nutrition Research Institute, such checks have not been carried out by independent agencies in Iraq during the 1990s. Further, original data sets from some of the studies carried out in cooperation with international investigators, most notably the **1996 Multiple Indicator Cluster Sample Survey (MICS)** study jointly carried out by UNICEF and the Central Statistical Organization of the Iraqi government, have never been released to international investigators (35, 36). As a result, the credibility of these data cannot be adequately confirmed.

Fortunately, independent sources for data on many issues, including health and social measures in Iraq are available. On mortality, these sources include three pre-1990 demographic surveys carried out by the government of Iraq (26) or international consultants (28, 60), and surveys by academic researchers from other countries to assess child deaths in 1991 (29) and 1996 (45). On nutrition, these include national level assessments of nutritional indicators among children under five taken in 1991 (29), 1996 (35, 36), 1997 (47, 48), and 1998 (49). Information from these studies is supplemented by other surveys among convenient or at-risk populations (See Appendix B). Additional survey information is available on the quality of drinking water, breast feeding and weaning practices, literacy, the condition of hospitals, the price and availability of foods, and the transmission of infectious diseases.

Experiences of Other Embargoed Countries

Almost all sanctions regimes have provisions for exempting food and/or medicines. Nonetheless, with the exception of South Africa, all embargoes listed above led to limitations on the importation of foodstuffs and medicines (4). Most of the embargoes were also associated with capital shortages and limitations in the importation of consumption and investment goods. In many countries the embargo-related lack of capital was more important than direct restrictions on importing medicine or food. In some embargoed countries, including Cuba and Yugoslavia, the terms of the embargo prohibited the direct purchase of medicines. Although embargoed countries routinely blame shortages of essential drugs, medical supplies, and surgical equipment almost entirely on the embargoes, it has seldom been possible to demonstrate this directly.

Those most likely to be affected by sanctions include pregnant and lactating women, children under five years of age, and those with chronic diseases in need of ongoing medical services. When food and medicine become scarce, the risk of inadequate weight at the start of pregnancy, poor weight gain during pregnancy, micronutrient deficiencies, infectious conditions, and stress all increase. Each of these factors increases the risk of a poor pregnancy outcome. In Cuba, the percentage of low-weight births rose 19%, from 7.3% in 1989 to 8.7% in 1993, eliminating ten years of progress. The number of women with inadequate weight gains during pregnancy or with anemia also rose rapidly (5). A longitudinal study among rural Haitians showed an increase in the proportion of malnourished children from 5% to 23% from 1991 to 1992 (6).

Embargoes are often associated with a dramatic increase in the price of staple goods. It is estimated that the embargo on Cuba creates a virtual tax of 30% on all imports that must be purchased from smaller and more distant markets (5). The price of staple foods increased fivefold in Haiti from 1991 to 1993, unemployment rose rapidly, and the export of mangos, on which many of the poor farmers depended, was halted (6).

Those countries with the greatest import dependency have experienced the greatest declines in child nutrition. About half of all proteins and calories intended for human consumption were imported to Cuba during the 1980s; importation of foodstuffs declined by about 50% from 1989 to 1993. Reduced imports and a shift toward lower quality protein products are significant health threats. Milk production declined by 55% from 1989 to 1992 due to loss of imported feed and fuel. A daily glass of milk that was provided to all children in schools and day care centers through age thirteen was reduced and is now provided only to children under age six. Per capita protein and calorie availability declined by 25% and 18%, respectively, from 1989 to 1992 (5). Several essential medical products are produced only in the United States and when exceptions to the embargo have been granted, serious delays occurred while foreign firms sought U.S. authorization for sale. Sometimes the purchased products expired or spoiled by the time they arrived.

Young children are more likely to suffer from poorer nutrition, increased infectious disease transmission, and a medical system with decreased capacity to respond to the increased needs under economic sanctions. Even in Cuba, where the medical system has aggressively tried to respond, and in Haiti, where up to a third of the population received medicine and food from international relief agencies, these trends were observed

(4).

Weakened physical and medical infrastructures strain the capacity of a health system to respond to emergencies during childbirth. More women may give birth without medical assistance or in a facility lacking electricity, transportation, or equipment and supplies for emergency interventions.

Data on the effect of embargoes on women are limited. Maternal mortality among Cubans rose by 50% in the period from 1993 to 1994, when embargo-related shortages in that country's health system were most severe. Extraordinary governmental efforts to provide extra food rations to pregnant women and revamp birthing procedures reversed the trend toward rising mortality. In Haiti, it was shown that sanctions were responsible for increased demand on women's labor to generate money and engage in income-substitution activities, thus depriving children of the time and attention to assure healthy weaning and child care. In societies where women are less powerful or where abuse against women is widely tolerated, they are likely to bear the brunt of the increased burdens caused by an embargo.

The resources needed to maintain nutrition and essential medical care for women and young children are often minimal. Promoting breast feeding, guaranteeing access to food for women and children, preventing contamination of food and water supplies, ensuring immunization, and assuring stocks of a small number of emergency medicines could protect most women and children from the short-term threats posed by an embargo. Indeed, many families already boil water, immunize their children, and breast feed in response to the perceived health threats caused by embargoes. This mobilization of basic resources to protect the microenvironment of the child is likely responsible for the decreased infant mortality in Haiti (7), Nicaragua (2), and Cuba (5) during embargoes, even while mortality among those under five (Haiti) or over sixty-five (Cuba) rose.

Not all embargoes have been implemented aggressively, and even under the strictest embargoes, some goods get through. Yet all these embargoes have increased costs and reduced economic activity for target countries. Embargoes with the greatest impact on the health of the general population are usually those which are multilateral and comprehensive, occur in countries with heavy import dependence, are implemented rapidly, and are accompanied by other economic and social blows to a country. Iraq shared each of these characteristics.

The lack of resources during the embargo on Iraq was exacerbated by several other events. The war against Iran during the 1980s resulted in the destruction of some health and social facilities in southwestern Iraq prior to 1990. Large-scale bombings during six weeks of Operation Just Cause, prior to the ground war in 1991, affected transportation, electric power, and communications throughout the country (30). In southern Iraq and in Kurdish territories in northern Iraq, postwar uprisings occurred in urban areas, causing further destruction of basic infrastructure needed for health and well being. After the Gulf war major facilities such as bridges and roads were rapidly repaired. The country's social infrastructure—including health institutions, schools, electricity, water pumps and pipes—did not receive the same attention. The deficit in these infrastructural assets, while difficult to count, likely greatly exacerbated the shortage in resources generated by the embargo.

Initiation of Sanctions

Sanctions began on all items except medicines on 6 August 1990. Following the Gulf war of January and February of 1991, sanctions were reaffirmed by the UN. Starting 3 April 1991, Iraq was again permitted to import food in addition to medicine. In fact, little of either commodity was imported. From 1991 to 1993, humanitarian organizations imported only 5% of the medicines and foods considered necessary for Iraq (11). In addition, Iraq purchased about 10% of the medicines they had previously imported with funds from permitted sales of oil to Jordan. Some other humanitarian goods were purchased in 1991, with UN Security Council approval, using Iraqi funds which had been frozen in other countries. To address Iraq's humanitarian needs the UN Security Council passed Resolution 706 in August 1991 authorizing limited sales of Iraqi oil to pay for imports of food and medicine. The Iraqi government rejected the resolution. In 1995 the Security Council passed Resolution 986, again authorizing sales of oil for food imports. The government of Iraq approved the plan in 1996, and the first deliveries of humanitarian goods began in 1997.

Starting in March of 1991, reports of an impending humanitarian disaster were common. John Field, a nutritionist, reported in June 1991, "What we have in Iraq is a situation of rapid decline . . ." (12). Sadruddin Aga Khan, former UN High Commissioner for Refugees, also reported in June 1991, "We are neither crying wolf nor playing politics, but it is evident that for large numbers of people of Iraq, every passing month brings closer the brink of calamity" (13). Similar impressions were provided through 1996, when Philippe Heffinck, UNICEF representative in Iraq, said, "The situation is disastrous for children. Many are living on the very margins of survival" (14).

But information presented on the level of excess mortality has been confusing and contradictory. In 1993 the Iraqi government reported that sanctions caused a greatly increased number of deaths. It provided data (15) showing a rapid rise in mortality among under five-year-olds, up from 592 per month in 1989 (all figures are per 100,000 children) to 2289 per month in 1991, 3911 per month in 1992, and 4409 per month in early 1994. Among those over age five, reported deaths rose from 1700 per month in 1989 to 7000 in 1994. These data were derived from hospital-based death reports; they represented an unknown but changing proportion of all deaths and cannot be considered reliable indicators of mortality change. These data are presented in table 1. Another source (16) claims a sixfold increase in under five-year-old mortality, from 257 deaths per 100,000 under five-year-olds per month in 1989 to 1536 per month in 1994. Iraqi Ministry of Health in 1996, with the assistance of a consultant from the World Health Organization, printed a report (17) showing an average monthly excess of 4500 deaths among under five-year-olds. UN humanitarian agencies then reported 4500 embargo-related deaths as a verified fact (14). Other Iraqi officials reported 6000 excess deaths per month among under five-year-olds in 1998. At such high rates of excess mortality, it was estimated that about 500,000 (1) or 560,000 (18, 19) under five-year-olds and 1.2 million people of all ages (20) had died as a result of sanctions by 1995, 1.4 million (9, 21) had died due to sanctions by 1997, and 750,000 under five-year-olds and 1.5 million people of all ages had died due to sanctions by mid 1998 (22). Most recently, Iraqi Minister of Health Umeed Mubarak stated that there are now 5900 excess deaths among under five-year-olds each month, and that more than one million children and nearly 1.4 million people of all ages have died in Iraq due to sanctions (23).

Table 1: Average Number of Reported Deaths among Children under Five Years of Age, per

100,000, per Month (Ministry of Health, Government of Iraq)

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997
Deaths	592	742	2289	3911	4147	4409	4652	4750	4804

Advocates of ending sanctions have accepted Iraqi claims without critical examination. One report, estimating excess deaths of children under five years of age at 500,000 in 1995 (44), has since been often repeated by others as evidence of attempted genocide. The World Health Organization further complicated matters in that same year by uncritically reporting unedited Iraqi Ministry of Health data as their own (17). Others argue that Iraqi mortality data has been falsely elevated (24), that there are inconsistencies in the data sets (25), or that the total population data from the 1997 national census show that no elevated levels of infant and young child mortality exist (25). These skeptics suggest that the humanitarian crisis exists mainly as a propaganda tool of the Iraqi government. This study will examine a variety of methods to estimate the mortality levels and determine which of these claims, if any, are plausible.

In 1990, prior to sanctions and the Gulf war, Iraq produced 2.9 to 3.2 million barrels of oil a day and exported 2.5 million barrels (68). This generated export earnings of \$19 billion a year to the government, providing 95% of the funds for the national budget and 64% of the country's gross domestic product. Iraq's legal foreign trade was cut by an estimated 90% by sanctions. Illegal oil sales have been reported repeatedly, using an overland route to Turkey and via sea and land to Iran (24), but it has never credibly been suggested that these sales amounted to more than a small fraction of presanction exports. In the first eight years of the embargo, Iraq estimates that it lost \$120 billion in foreign exchange earnings. During this time Iraq received about \$1 billion in humanitarian donations (65).

Prewar, Presanctions Mortality Estimates

Data Sources

A national census was conducted in Iraq in October 1987 and reported in the *Demographic Yearbook* (75) published by the United Nations in 1990. The census recorded information on deaths that occurred in households during the previous year. Infant and under five-year-old mortality rates calculated from these data are the lowest of any of the prewar sources.

In the 1980s, each of the seven countries in the Gulf region was surveyed by the Gulf Council of Health Ministers. The Iraqi sample included 9404 households, including 9583 ever married women of childbearing age and 11,791 children under six years of age. The *Gulf Child Health Survey (GCHS)* (26) conducted in Iraq in March/April of 1989 was the last survey carried out in this series. This survey had both individual- and household-level modules. The module on child care, relating to children six years old or younger, is the main portion of the data collected in the questionnaire used in this report. The full report is proprietary and

has never been released by its authors; a detailed summary of that report is used here which provided both direct and indirect estimate^{xi}; the indirect estimates are used here, and refer to the period from 1975 to 1986.

During May 1990, months before the Gulf war, UNICEF collaborated with the Ministry of Health and Ministry of Planning to conduct the *Iraq Immunization, Maternal and Childhood Mortality Survey (EPI/CDD)* (28). This survey provided direct and indirect estimates of mortality among mothers and children. About 10,000 women of childbearing age across Iraq were surveyed.

In August 1991, following the Gulf War, the *International Study Team (IST)*, also known as the Harvard Study Team, conducted a community-based cluster sample survey collecting direct- method estimates of child mortality from 25 August to 5 September 1991 (29, 30). Thirty-one interviewers collected data in 271 clusters of 25 to 30 homes each. Data on 16,172 live births from January 1991 through August 1991 were collected from women aged 15 through 49, interviewed in 17 of the country's 18 provinces. The IST calculated a baseline infant mortality rate of 32.5 per one thousand live births^{xii} for the period from 1985 through 1990 using direct methods. This level is one of the lower estimates among all studies included. This may be explained by the fact that the IST excluded deaths for which dates were missing. Although the exclusion criteria omitted only 0.6% of all births, it eliminated 4.4% of all deaths from the analysis (26a).

Pre-1990 Mortality Estimates

Estimates of prewar mortality show a high level of agreement. Although curative health services, potable water, urbanization, importation of foods, and education of women were paid for with rising petroleum exports, Iraq, like many Arab states, demonstrated only a gradual decline in infant mortality during the 1960s and 1970s. Governmental policy favored population growth. The strategies to achieve this were limitation of family planning and abortion coupled with programs to reduce mortality among infants and young children. Targeted programs were then implemented in the early 1980s to improve vaccination coverage, promote breast feeding, reduce diarrheal morbidity, and improve domestic hygiene. These programs are associated with the accelerated decline in infant mortality during the 1980s (26a).

Compared with neighboring Jordan, Iraq in the 1980s had lower measles vaccine coverage, a higher proportion of women giving birth without professional assistance, a lower percentage of women receiving prenatal care, a lower female literacy rate, a lower rate of breast feeding at birth, a higher percentage of children having diarrhea in the preceding two weeks, and a lower proportion of the population with access to clean drinking water (31). Each of these factors suggest that infant and child mortality should be higher in Iraq than Jordan. Indeed, indirect estimates from similar surveys (EPI/CDD) in Iraq and Jordan generated estimates of infant and under-five mortality which were consistently higher in Iraq during 1981 through 1987. Yet more rapid mortality declines in Iraq left rates increasingly similar in the two countries toward the late 1980s.

Due to limitations of both direct and indirect methods of estimating infant and under five-year-old mortality in Iraq in the years immediately prior to the Gulf war, it is impossible to provide a single figure for the rate of infant deaths during 1970 through 1990 with absolute confidence. Infant and under five-year-old

mortality estimates from the four studies detailed above are presented in figures 1 and 2 in Appendix B. As predicted, the 1988 census and the IST studies provide the lowest mortality estimates. All studies show a trend toward mortality decline. The trends show an accelerating rate of decline in the 1980s. Both indirect and direct estimates were obtained in the EPI/CDD survey; marriage duration-based estimates are reported here.

The accelerated decline in the 1980s is dramatic, especially in light of the Iran-Iraq war from 1980 to 1988. That war resulted in an estimated 100,000 deaths among Iraqi soldiers and a major diversion of economic resources to the war. Little of the fighting, however, occurred in the interior of the country. Despite limitations on social investments during these years, education levels of the population improved, access to doctors and hospitals improved, the population continued to become more urban, clean water became more accessible, food prices remained stable, and immunization coverage improved (34a).

In 1977 the Iraqi government estimated its infant mortality rate at 61 per thousand; by 1987 it had fallen to around 40; (36 according to GCHS, 42 according to the EPI/CDD). An unpublished 1992 report by UNICEF statistician Gareth Jones summarized, "Evidence . . . point(s) to a strong, rapid downward trend in infant and child mortality over the past fifteen years. During the 1980s, in particular, the downward trend in infant mortality has been particularly steep" (26a). Infant mortality during the period from 1987 through 1990 likely continued this downward trend and was in the range of 35 to 40 per thousand, representing a decline of 34 to 43% in a decade. Mortality among children under five years of age similarly declined from around 82 per thousand in 1980 to an estimated 40 (GCHS) or 50 (EPI/CDD) in 1990.

In figure 3 in Appendix B, the values for estimates from the four studies examined shown in figures 1 and 2 were averaged. Straight line regression lines were calculated for the under one- and under five-year-old average mortality estimates and projected to 1990. These generate an estimated infant mortality rate of 53 live births per thousand live births in 1975, dropping to 32 in 1990. Under-five mortality was estimated at 71 live births per thousand in 1975, dropping to 38 in 1990.^{xiii} A more conservative estimate is made if data from 1988 are averaged with the projected trends to 1990 to establish a baseline. This generates prewar and presanction estimates of 34 for under one-year-olds and 40 for under five-year-olds.

Table 2: Estimated Infant and Under Five Mortality Rates (Per Thousand)

Description	Year															
	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Under Five Mortality Rate	84	80	77	74	71	68	65	62	59	56	53	50	47	44	41	38

Infant Mortality Rate	64	62	60	58	56	53	51	49	47	45	43	40	38	36	34	32
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Sanctions Prior to the Gulf War

The IST survey, mentioned above, was carried out on children born between January 1985 and August 1991. The IST used the entire period prior to the Gulf war, January 1985 through December 1990, as their prewar, baseline period for analysis. Confidence is strong regarding the quality of these data, as expected influences on infant mortality were found. Male infant deaths exceeded female, the rural death rate was about 30% higher than the urban rate, illiterate mothers had an infant death rate about twice that of mothers with a secondary education, and births to mothers under twenty years of age or over thirty-five years of age had a higher risk of infant death. These rate differences, and their relative importance, are consistent with trends among most low- and middle-income developing countries.

The IST included the period of prewar sanctions in their baseline because the average infant mortality level during 1985 through 1990 was almost identical to that for the four-month sanction period of 1990 (August 1990 through December 1990). But the 1985 through 1990 rate is an average over a period of rapid mortality decline. A subsequent reanalysis of these data provided a separate analysis for the prewar, presanction period (January 1985 through July 1990) and the prewar sanctions period indicated above (32). This analysis derived a prewar, presanction infant mortality rate which reached 36 births per thousand in the 12 months prior to initiation of sanctions. This rate is the same as that derived by the regression line presented above as the baseline rate for this study.

Comparing mortality among under one-year-olds during the prewar sanctions period to the mortality rate during the same months in the prior year, the rate rises from 36 to 42 deaths per thousand. This represents a 17% rise in infant mortality. Among under five-year-olds, the rate for the prewar sanctions period, compared to the same months of the prior year, rises from 44 to 49 per thousand for under five-year-olds, representing an 11% increase.^{xiv}

This rise in mortality, while only modest in magnitude, has not previously been identified. It suggests that sanctions, even without subsequent war-related destruction and during a short period of time, could affect survival chances among young children. During this 19-week period, electric power, water, and transportation systems throughout Iraq were still intact. Civil war in Kurdish and Shi'ite areas had not yet begun. The only notable changes identified during this period were the partial withholding of food stocks and medicines in Iraq in response to sanctions and anticipation of war. It appears that these relatively minor changes were sufficient to increase the risk of death in the most vulnerable population sectors. Increased risk of death was almost entirely among children aged two to fifteen months. There was no excess rate of death after fifteen months of age. Newborns can be largely protected from external threats of death by maternal antibodies and breast feeding. It is those children of poor or uneducated mothers who are not breast fed or who are weaned early who face diarrhea/malnutrition which can lead to death without timely medical intervention. It will be seen subsequently that children in these age groups were particularly vulnerable to high rates of malnutrition during postwar sanctions as well.

The Gulf War and Postwar Uprisings

The International Study Team used as their baseline the entire period from January 1985 until Gulf war bombing began. The IST then calculated a mortality rate among children under five years of age combining the war and initial postwar period in the first eight months of 1991 which was 3.2 times higher than the prewar rate.

For the same period the IST found that excess mortality rates were 1.8 deaths per thousand during the first month of life, 4.3 deaths per thousand for the second to the eleventh month of life, and 5.2 deaths per thousand for one- to four-year-olds (29). Babies under one month of age were thus relatively protected. According to mothers' reports, deaths due to diarrhea rose fivefold, and the rate for injury-related deaths rose fourfold. Before the war, 20.7% of all deaths among under five-year-olds were due to diarrhea; during and after the war, 38% of deaths were due to diarrhea. Diarrhea had already become more common in the prewar sanctions period; it was further exacerbated in the period of war-induced destruction of electric and water systems throughout Iraq. This was especially true in Kurdish and Shi'ite areas where uprisings occurred in the immediate postwar period. Mortality among Kurdish children, displaced en masse to areas without sanitary conditions by the uprising in the north, rose from 3.5 times the prewar rate in Baghdad to 11 times the rising rate in the capital. A mother's education was always an important predictor of young child survival. Increased dangers to child health in the sanitary environment further exacerbated the influence of mother's education on child survival. The under five-year-old mortality rate was 2.5 times higher for illiterate mothers compared to literate mothers before the war; illiterate mothers were at a greater disadvantage after the war, experiencing an under five-year-old mortality rate that was 3.5 times higher during and after the war (29).

It is notable, but expected, that increased mortality among under five-year-olds during the war and postwar period of uprisings was not reflected in death data from Iraqi hospitals (29). Most of these deaths occurred at home; many of them occurred when hospitals functioned only on an emergency basis or when transportation was unavailable. For example Basrah, in southern Iraq, was a site of much fighting. Hospital data there during 1991 show a decline in reported deaths.

Military Deaths in the Gulf War

Middle East Watch collected data on eyewitness reports of 2665 civilian deaths during the war. The Iraqi government reported 2278 civilian deaths. Most deaths were reported from both sources; combining the unduplicated deaths on these two data bases yielded a total count of 3663 civilian deaths (26). Since not all deaths were observed or reported, this must be considered a minimum estimate. The U.S. Census Bureau suggested that the total number of civilian deaths probably was around 5000, but at least one independent observer believes that the number is much smaller at around 1000 (33). It is not known how many of these deaths occurred to children under five years of age.

Engagement reports and estimates during the air war (December 1990 through January 1991) and the

ground war (January 1991 through February 1991) have been combined to yield a total estimate of 49,000 to 63,000 deaths among Iraqi troops during the Gulf war. These include 20,000 to 25,000 deaths from air attacks in Kuwait, 12,000 to 15,000 deaths from air attacks in Iraq, and 17,000 to 23,000 deaths in ground fighting. Among adult male Iraqi troops, a midpoint of 56,000 deaths has been estimated (34a). None of these estimates can be confirmed; others suggest that the death toll may have been under 10,000 (33).

U.S. deaths in the Gulf war totaled 293. Deaths among other UN allied forces totaled 50. Thirteen Israeli civilians also were killed (68).

Assessing Mortality by Survey During Sanctions

The first survey to assess mortality levels among children following the Gulf war was the IST study in 1991. This stratified cluster survey included information on births and subsequent deaths among a cohort of 16,076 children under age five. For the period of the Gulf war and postwar uprising, 1 January 1991 through 31 August 1991, they estimated an under five-year-old mortality rate of 128.5 per one thousand live births. In Baghdad alone, they found a baseline level of under five-year-old mortality during 1985 through 1990 of 34.0 and during the period from January 1991 through August 1991 of 60.7 (29). The expected relationship of greater risk of death to children of rural or low education mothers was found. Infants under one month of age were relatively less vulnerable, with an estimated rate increase in 1991 compared to that of the period from 1985 through 1990 of 80%, while those two- through sixty-months had nearly fourfold mortality rate increases (29).

Subsequently, in 1995 an FAO study in the poor urban neighborhood of Saddam City in Baghdad calculated a mortality rate among under five-year-olds of 216 per one thousand live births (44). This same neighborhood, included in the postwar IST study in 1991, had an infant mortality rate of 80 per thousand. These infant and under five-year-old mortality estimates are more than twice as high as data from a prior or a subsequent study. The study suffered from serious flaws in methods and interpretation:

- the study sample was small, including only 2108 children;
- several of the study clusters showed mortality rates far higher than all the others;
- there were no international team members on some of the field data collection teams;
- there were no independent verification checks on any of the field teams.

As a check on the accuracy of these data, a subsequent study in 1996 (45) selected 44 newly randomized clusters throughout Baghdad and repeated 20 clusters from 1995. Only 80% of the mothers interviewed in repeat clusters could be confirmed as having been previously interviewed the year before. Among these 237 mothers, 96% of all births were confirmed on both surveys but 65 of the 74 deaths reported among them in 1995 were not reported again in 1996. Nine of the 18 deaths reported in 1996 had not been reported in 1995. The 1995 study's conclusions were subsequently withdrawn by the authors (45), but not before national projections from these flawed data were published. Notwithstanding the retraction of the original data, their estimate of more than 500,000 excess child deaths due to the embargo is still often repeated by sanctions critics.

The 1996 survey covered all of urban Baghdad with a slightly larger sample than the 1995 survey. It also provided validity checks and had both international and national staff in every team. The estimate of 38 deaths per thousand children under five years of age derived in 1996 (45), is thus a more reliable estimate for urban Baghdad. It is too small, too urban, and too localized in the capital city, however, to provide for any wider geographic or temporal trends in the country.

The Purchase of Humanitarian Goods During the Embargo

Following Iraqi acceptance of UN Security Council Resolution 986 (UNSCR 986), a memorandum of understanding was concluded between the Secretariat of the United Nations and the Government of Iraq agreeing on terms for implementing the oil for food program. On 8 August 1996, the UN Iraq Sanctions Committee established procedures for implementation, which came into force 10 December 1996. The first letters of credit were signed in February 1997, the first supplies were received in March 1997, and the first goods were distributed in April 1997. Thus, a delay of two years occurred from passage of UNSCR 986 to the receipt of the first foodstuffs by Iraqis. The first medical goods arrived in Iraq in May 1997, six years after postwar sanctions began (69).

On 4 June 1997, the UN Security Council adopted Resolution 1111, renewing for another 180 days the authorization for Iraqi petroleum sales and purchases of humanitarian aid contained in UNSCR 986 of 14 April 1995. On 12 September 1997, the Security Council replaced the two 90-day quotas with one 120-day quota and one 60-day quota so that Iraq could export its full \$2 billion quota of oil within the original 180 days of Resolution 1111. This quota made 64% of the funds, representing \$1.3 billion, available for humanitarian assistance in the 15 central and southern governorates. On 4 December 1997, the UN Security Council adopted Resolution 1143, renewing for another 180 days, beginning 5 December 1997, the authorization for Iraqi petroleum sales and humanitarian aid purchases contained in UNSCR 986. The UN Office of the Humanitarian Coordinator for Iraq estimated that, on average, it took 66 days to get a food contract approved by the Sanctions Committee, 59 days for the food to be delivered, and 7 more days to make the food available for distribution (65).

On 20 February 1998, the UN Security Council adopted Resolution 1153, authorizing the sale of Iraqi petroleum and petroleum products and the purchase of humanitarian aid for a 180-day period. On 25 March 1998, the Security Council adopted Resolution 1158 for the remainder of the second 90-day period and set the authorized value during that time frame to \$1.4 billion pending implementation of UNSCR 1153. This began on 30 May. On 19 June the Security Council adopted UNSCR 1175, authorizing the expenditure of up to \$300 million on Iraqi oil infrastructure repairs to help Iraq reach the higher export ceiling permitted under UNSCR 1153. In early October the country was exporting about 1.8 million barrels of oil per day, up from 1.2 million barrels in early 1998 (69). By December 1998 Iraq was able to produce as much as 2.4 million barrels per day, compared to the 2.9 to 3.2 million barrels a day just prior to sanctions in 1990. The value of these 2.4 million barrels has been considerably reduced with the decline in oil prices on the spot market; while Iraq was authorized to export as much as \$4.5 billion in the fourth term of the oil for food deal, it is estimated that Iraq's oil production for this period generated only \$2.7 billion. After deducting compensations and the cost of UN operations, this would leave \$1.79 billion for humanitarian supplies and parts for the oil industry (70).

UNSCR 1175 also reaffirmed the Security Council's endorsement of the Secretary General's recommendation that the oil for food distribution plan be ongoing and project-based. The fifth period of oil for food authorized Iraq to export up to \$5.2 billion worth of oil from December 1998 through May 1999. Iraqi oil exported to the U.S. since 10 December 1996 is 51.5 million barrels (69).

There have been frequent disagreements over distribution plans, the monitoring and processing of contracts, and delays in purchase, supply, and distribution of oil for food goods. The first complete rations to reach Iraqis from oil for food stocks occurred in August 1997. Full rations again were distributed in September 1997, and then March 1998, a year after distribution of goods began. At that time, nine months after the implementation of the second phase of UNSCR 986 began, 75% of purchased medicines had arrived for South/Central Iraq and 50% of the goods for the 3 northern governorates had arrived (65). From March 1997 to September 1998, \$2.2 billion in food and \$336 million in value of medicines were imported to Iraq under the oil for food plan (71). In late 1998, medical products delivered to central government warehouses reached their final destination in an average of 22 days.

Water and Sanitation Systems

Ninety percent of Iraq's drinking water is supplied by the Tigris and Euphrates Rivers. With high centralization of water supply and a very flat topography, modern pumping and water treatment systems are essential to maintain supply and drinking quality. From 1983 through 1989, the proportion of all water supplies that were treated to make them potable was doubled (34a) and 92% of the people were believed to have access to potable water. According to the Iraqi Ministry of the Interior, use of water declined from 270 liters per capita in Baghdad in 1989 to 135 liters in 1997. In rural Iraq, it declined from 180 liters per capita per day in 1989 to 60 in 1997 (34). As these same water systems supplied most people during the 1990s, access to piped water is high but its quality has declined. Household access to piped water fell from 89% of the population in 1989 (20) to 81.3% in 1996 (35). By 1995, only half of the water treatment capacity of the country was operational; this declined to 40% in 1997 (34a). Access to potable water reportedly declined from 95% to 77% of the urban population, and from 75% to 44% of the rural population (35, 36).

What is reported as potable water may include all water that is piped. The Iraqi Ministries of Health and of Water Systems each test piped water systems for drinking quality. In 1997 their laboratories agreed on test results only 80% of the time; it is not known if one of the systems is more accurate than the other. Thus, there is no routine way to determine what proportion of all the piped water systems are contaminated. In Baghdad governorate, 5% of the 237 samples collected in the second quarter of 1997 were contaminated. In the same period of 1998, 2.4% of the 373 samples collected failed a coliform test for potability. In 1991, an estimated 39% of all piped water sources delivered contaminated water (29). This estimate dropped to 16% in 1993 (15), and 5% in early 1998 (34).

The 13 waste water treatment plants in south/central Iraq are only partly functional. About half of all sewage is dumped directly into the rivers without treatment. Iraq is capable of carting away about a quarter

of the solid waste that it carted prior to 1990 (34a). Sixty-nine percent of the population had adequate sanitation services in 1988 (4); this rose to 74.2% in 1996 (35). Sanitation and potable water levels were lowest in the southern governorates. More water and sanitation systems were destroyed or rendered useless in the northern governorates than in any other part of the country, during military campaigns against the Kurds in the 1980s, the insurrection in 1991, or during the postinsurrection refugee crisis (34a). The UN administration of this zone facilitated the actions of UN humanitarian organizations and about a dozen NGOs. Their actions left the northern governorates with the best water and sanitation systems in the country by the mid 1990s.

Health Services

In times of rapidly declining social conditions, health services can serve as a safety net to reduce the rise in excess mortality. Prior to the Gulf war, an estimated 97% of the urban and 78% of the rural population had effective access to curative services. By 1997, the capacity of the curative health system was greatly reduced. Although the doctor- and bed-to-population ratios remained nearly stable, the number of reported operations dropped by 70% nationally, the number of laboratory tests performed dropped by 60%, an estimated 30% of hospital beds were no longer in use (34a), about 75% of all hospital equipment no longer worked (8), and a quarter of the country's 1305 health centers closed. A reported 80% of all medical equipment was out of service (34a). Given the limited ability of the hospitals to function, average length of stay dropped by about 50%. Three hundred and sixty million dollars was reportedly spent in 1989 (11) and \$500 million was spent in 1990 to import, and \$200 million to produce, medicines and medical products. This fell to \$50 million in 1991 (37), \$22 million in 1995. With oil for food funds, it rose to more than \$300 million in 1997. Per capita spending on health was about \$3 in 1995 and \$17 in 1996, still only about half the level of health spending prior to 1990 (34, 37).

Supplies to the health system were notably higher by late 1997 due to supplies provided via UN Security Council Resolution 986 funds (11). Use of public ambulatory health services rose 42% from March 1997 to March 1998, hospital stays became longer on average, and more lab tests and x-rays were performed per patient (38). In November 1998, an average of 44% of 18 essential medicines were available in health centers. Overall, 22% of all formulary medicines were found in hospitals and health centers, and 32% of medicines were available for patients registered with chronic diseases. While these levels are low, they are a considerable improvement over the levels available through 1996 (11).

Even with improved supply, the health system has responded slowly and inadequately to the changing disease profile and level of available technology in the country. Diarrhea has become the most common fatal pathology among under one- and under five-year-olds (34). Diarrhea should routinely be treated aggressively with oral rehydration, especially in poor countries. The *1996 Multiple Indicator Cluster Survey (MICS)* demonstrated that while most mothers knew of oral rehydration, most health centers and mothers were applying it incorrectly. Only a third of all mothers, for example, continued to give food during diarrhea episodes (35, 36). The second most common fatal pathology among under five-year-olds is now acute respiratory infection. By 1996 only a third of Iraqi mothers were able to recognize the major warning signs of respiratory distress. These high rates of preventable mortality are unusual for a country

like Iraq. Even after six years of embargo, its high rate of urbanization, relatively high literacy rates, access to doctors, and widespread mass media would be expected to be associated with lower rates of diarrhea and respiratory infection.

Rates of ever having breast fed reportedly rose from 89% in 1988 (31) to 94.7% in 1996 (35, 36). Breast feeding at 6 months of age rose slightly from 60% in 1988 (31) to 65.4% in 1996 (35, 36). In October 1997, 21% of all infants in South/Central Iraq were exclusively bottle fed, only 13% of those birth through four months were exclusively breast fed, and 34% of six- through nine-month-olds receive milk without any supplementary weaning foods. These rates are distressingly high, creating a large cohort of children at especially high risk for poor nutrition, depressed immunologic levels, and worsened diarrhea and acute respiratory infections. Especially when access to high quality foods is limited, access to curative medicines is inadequate, and the quality and quantity of water is poor, mobilization of the health and welfare systems to insure optimal maternal and child nutrition through improved weaning habits, expanded breast feeding, preferential access to food for women and children, and simple early intervention to reduce morbidity in diarrhea and upper respiratory infections are key actions for protecting health. Such mobilizations, education, and health promotion have not been sufficiently frequent or effective in Iraqi health, education, and social welfare systems in the 1990s. Some actions, such as including infant formula on the ration in 1998, even discouraged needed health actions like breast feeding. Bottle feedings among infants increased from 21% in 1996 to 31% in 1998; only 15% of infants were exclusively breast fed during the first six months, and the introduction of complementary semi-solid foods failed to reach a third of children aged six through nine months (64).

Nutritional promotion and education was stimulated by Nutrition Rehabilitation Units and Community Child Care Units (CCCUs). Twenty rehabilitation units were initiated in hospitals and health centers in 1995. There were 62 such units in 1998.

CCCUs are neighborhood social service centers were begun in 1996 with local resources and volunteers, including retired teachers, students, and community leaders. These centers screen children and educate mothers about health and nutrition. The CCCUs have screened 900,000 children of whom 250,000 were considered malnourished and 120,000 were referred for ongoing care to primary health care centers. The units also plan to provide supplementary foods to 600,000 pregnant and lactating women (64). The Iraqi Ministry of Education, the Federation of Iraqi Women, and the Federation of Iraqi Youth take part. The program grew from 100 centers in 1996 to 1333 in 1998. These centers are designed to distribute extra food rations to at-need children (based on weight), which are supposed to be accompanied by health education. Like many such programs around the world, evaluators found that these centers provide relatively little education and health promotion. Child weighing and food distribution centers provide an excellent opportunity to promote the health of women and children. Hopefully as the CCCUs mature they will engage neighbors in more health education and promotion activities.

Changes in Health Status

Data from the Iraqi Ministry of Health suggests a rapid worsening of the health conditions of Iraqi children

(See table 3). These data reflect the experiences of only that shrinking portion of the population which uses public medical care services. They can only be used to indicate general trends as they are based on incomplete and changing levels of coverage of the population. These data suggest a rapid deterioration of the health status of the population. Low-weight births, children treated for malnutrition, and the reported number of illnesses which are associated with contaminated water all rose rapidly from 1990 through 1994, and subsequently stabilized at high levels by 1995.

Table 3: Ministry of Health Data (11, 14, 17)

Description	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
Percent Registered Births Under 2.5 Kgs.	4.5	10.8	17.6	19.7	21.1	22.1	22.6	23
Children In Treatment Programs for Malnutrition	0	1000	10,600	12,500	13,900	17,900	20,200	20800
Reported Cases of Cholera	0	0	1217	976	825	1345	1216	831
Reported Cases of Typhoid	?	22,000	175,000	193,000	227,000	244,000	266,000	152000
Reported Cases of Giardiasis	?	1130	5010	5960	6020	5880	6890	5850

Education/Literacy

According to Iraqi government sources, there was a 20% increase in the primary school drop-out rate in the early 1990s. The proportion of the population which was literate grew rapidly in the 1980s; it is then estimated to have fallen from 73% of the population above age 15 years in 1987 to 60% in 1993 (37). Illiteracy among ever-married women under 50 years was 50% in 1989 (31); in the northern governorates it was 64% in 1996 (36). Data from the MICS study suggest that adult literacy for the country overall was 68% in 1996. Female literacy and school enrollment rates were lowest in the southern governorates.

Immunizations

The supplies and equipment needed to assure effective infrastructure for immunizations, supply of vaccines, and organization in government-run health facilities deteriorated in the early 1990s and immunization coverage declined. Immunization coverage levels, which fell during the early 1990s, returned to presanction levels by 1996 (31). Estimates of measles immunization levels during the 1980s varied from 37% to 78% of two year olds (31).

Most importantly, coverage declined from 82% of the under 2 year olds in 1988 to 73% in 1992. Diphtheria, pertussis, tetanus (DPT) coverage similarly declined from 86% to 69% in the same period. By 1993 the Ministry of Health once again gave priority to immunization coverage. By 1995 measles coverage was estimated at 95% and DPT coverage was estimated at 89% (34). Immunization coverage levels, which fell during the early 1990s, returned to or exceeded presanction levels by 1996. Estimates of measles immunization levels during the 1980s varied from 37% to 78% of twelve-month-olds to twenty-three-month-olds (31); according to the 1996 MICS study (described below) it was 79.9% (35, 36). It was lowest in the southern governorates.

Income and Food Prices

A rapid decline in the GDP and its most important component, export earnings from the petroleum sector, led to a rapid rise in inflation and in food prices for goods not purchased via ration, and a rapid decline in per capita product. Prior to the Gulf war 62% of Iraq's GNP was generated by petroleum sales. Unauthorized oil sales, the stimulation of some import substitution industries, and the hope of an influx of capital and goods via oil for food led to an easing of the economic decline by 1996. The purchasing power of an Iraqi salary by the mid 1990s was about 5% of its value prior to 1990 (34).

Table 4: Economic and Nutrition-Related Data from Non-Iraqi Government Sources

Description	Year								
	1990	1991	1992	1993	1994	1995	1996	1997	1998
GDP, U.S. Dollar estimate (41)	3508			1500	1036		540		

Value of 1 U.S. Dollar in Dinars on Black Market (42)			90	510	4095	1575	1200	
Grain Production in Millions of Tons (34a)	3.5	2.7	3.0	3.2	2.8	2.5	3.0	2.2
Per capita calories available on the ration (39, 40)	1225	1300	1700	1770	1130	1500	1275	2030
FAO Average Estimated Caloric Intake (39, 40)	3150	2310	2270	2279	2283	2268	2277	2463

Nutrition

Undernutrition is both a poor health outcome and, especially among children, a risk factor for elevated mortality. Prior to the Gulf war, local production supplied an estimated 30% of the country's foodstuffs. In 1989 Iraq imported over \$2 billion in foodstuffs (61).

The Iraqi Ministry of Trade supplied about 343,000 metric tons of basic grains per month prior to September 1990. About 3375 calories per capita per day were available in this prewar, presanction period (39). In the region, only Turkey had higher calorie availability levels. With the imposition of sanctions, the amount of grain distributed by the government declined to 182,000 metric tons per month during September to December 1990 and 135,500 metric tons per month during 1991 (12). The rationing system provided essential goods at highly subsidized prices. Rationing of wheat, rice, oil, and sugar began in September 1990, following the imposition of prewar sanctions (See table 4). The ration provided per capita calories per day varying from 900 to 1300 during September 1990 through June 1991 (12). It then was gradually raised to 1770 calories, providing about 70% of essential needs. The ration was reduced to about 1100 calories in October 1994 due to the inability of the government to import or produce adequate goods, returned to about 1500 calories in 1995, fell to 1275 calories in December 1996, and rose to 2030 as of March 1998 with oil for food deliveries (61). Total calories per day, including food secured through the ration, in the private market, and through autoproduction, was estimated at 2277 during 1993 through 1995 (39). This level fell about 9% short of the recommended level of 2500 calories and was 32% below per capita levels prior to sanctions and the Gulf war. These lower calorie levels were last characteristic of Iraq during the 1970s. An average of 1900 calories is believed to be needed to prevent starvation.

Oil for Food Implementation

UN Security Council Resolution 986, permitting the export of \$2 billion of petroleum each 6 months, of which about \$849 million was available for food import and production in the 15 central and southern governorates, raised hopes of a return to rations covering the majority of calorie and protein needs. Under UN Resolution 986 rations were to rise to 2030 calories per day. It is assumed that outside the ration, the average Iraqi is able to acquire an additional 500 calories worth of food per day. Thus, since mid 1997, most Iraqis have been able to acquire calories above recommended levels and 12% below prewar, presanction levels. Micronutrient levels, however, were not adequately covered by the ration. Especially deficient were supplied levels of iron and vitamin A. Adequate rations would require an estimated \$10 per capita per month in additional spending. This would raise the cost of humanitarian supplies by an estimated \$2.6 billion per year (65).

Little information is available about nutrition levels of young children prior to the Gulf war. Studies in Baghdad demonstrated 3 to 4% of under five-year-olds to be more than two standard deviations below the mean reference population's weight. Only five health centers were involved in these studies; rates of underweight were very low at four centers and 18% at the fifth (74). A study in Basrah in the period from 1983 through 1984 found that 5% of children under one year had low weight for age. These rates were similar to that for the reference population, indicating a low level of malnutrition in the capital city. Malnutrition was undoubtedly more common in outlying governorates and rural areas. The National Child Health Survey (26) found in 1989 that 89% of mothers ever breast fed.

The percentage of children born under 2.5 kg was reported to be 5% in 1984 and 9% during the period from 1982 through 1988 (31). The Ministry of Health reported that in 1990, 4.5% of the approximately 60% of all births occurring in public hospitals were low in weight (under 2500 gms). A baseline rate of low weight births of 5% prior to the Gulf war is similar to the rates found in many developed countries. The rate of low birth weight births rose to about 20% in Iraqi government hospitals in 1995. An increasing but unknown proportion of all births occurred outside medical facilities during the 1990s. Those giving birth in hospitals are thus likely to be progressively less representative of the general population through 1997. Yet even if low weight births nationally rose only half as much as those occurring in hospitals, to 10%, this represents a doubling of the rate of low weight births. Low birth weight is the most important predictor of mortality; the rise in low birth weight in Iraq almost surely is associated with a sharp rise in mortality in the first month of life.

Problems of undernutrition are found among adults as well as children. The 1997 FAO/WFP survey found that among adults over age 26, 25% of men and 16% of women had low body mass index (BMI) measures, indicating likely undernourishment. The March 1998 MOH/UNICEF/WFP study found that 6% of mothers surveyed had a low BMI, 11% were borderline low, and 8% were obese. Undernutrition was most common among mothers under thirty years of age; there was no urban-rural difference. (49)

Assessing Nutrition by Survey During Sanctions

Data in table 7, Appendix B show information from available nutritional studies in Iraq.^{xv} It is not possible to directly compare these studies as they differ in their geographic coverage, the method of selecting a sample, the age group included, sample size, the way malnutrition is measured, the individuals doing the assessment, the size of the population included, and the methods of selection of study participants.

The results of only one study were not made available for inclusion in Appendix B. That was the 1996 cluster sample survey carried out in Baghdad by the CESR.

No nationally representative data on malnutrition is available prior to 1990. Reports on several studies from Baghdad suggest that chronic and acute malnutrition rates were modest and were similar to those of a well nourished WHO/NCHS reference population in the U.S. It is assumed that poor Baghdad neighborhoods, outlying governorates, and rural areas experienced higher rates. During January 1989 through August 1990, the Iraqi Ministry of Health reports that about 1% of hospital admissions were for malnourishment. This rose to 2.5% of all admissions during September 1990 through April 1992 (17).

The single most often studied community in Iraq is that served by the Sheik Omar Health Center in a poor Baghdad neighborhood. See Appendix B, table 1. A gradual increase in underweight children is observed through 1992. Other studies in Baghdad overall, or in the poor neighborhood of Saddam City, also show a rise in all three nutrition indicators by 1995; a high level of malnutrition is still found in 1997. See Appendix B, table 2. These data are consistent with that from the hospital in Saddam City, Baghdad.

High rates of malnutrition are observed in most disadvantaged outlying governorates. See Appendix B, table 3. Especially notable are the higher rates of malnutrition found in urban Wasit governorate in comparison to rural Wasit in a 1992 study by Obeid.

Only the four studies presented in Appendix B, table 7 were:

- national or nearly national in scope (the IST failed to include one small governorate);
- generated a sample which was representative or nearly representative. The IST study generated wider variance estimates due to the methodologic impact of clustering. The MICS study did not have this limitation. The 1997 and 1998 Clinic Exit Surveys studies failed to include a small portion of children who did not visit clinics during immunization campaign days;
- had foreign nationals directing the design process and involved in data collection;
- provided independent validity checks on the work of field measurement teams.^{xvi}

The IST data forms the only representative national study available for the immediate postwar period. Thus its estimates that 9.2% of Iraqis under five years of age in 1991 had low weight for age, 18.7% had low height for age, and 3.0% had low weight for height (30) can be considered the postwar baseline. These rates were likely higher than those experienced during the 1980s. The northern governorates, under UN administration since 1991, showed high rates of malnutrition in 1991 (See Appendix B, table 4). High rates of acute malnutrition among under one-year-olds in both the northern and central and southern governorates was observed in the period from 1996 through 1998 (See Appendix B, table 5). Chronic malnutrition then was relatively more prevalent among under five-year-olds in central and southern governorates (See Appendix B, table 6). Acute

and chronic malnutrition rose considerably through 1996, leaving under five-year-old Iraqis throughout the country with high rates by 1996. These high rates declined only moderately from August 1996 to March 1998.

The MICS and the 1998 Clinic Exit Survey showed that although acute malnutrition was not predicted by education levels, chronic malnutrition and mixed chronic and acute malnutrition were twice as common among children whose mothers had low educational levels. Male children, and all children in rural areas, those born within two years of a prior birth, those in large households, and those with poor quality sources of water and sanitation had higher malnutrition rates. Acute malnutrition is highest during the weaning period from six to twenty-three months of age, gradually returning to baseline levels afterwards. Chronic malnutrition occurs later in life, rising notably at age twelve to twenty-three months. The rate of chronic malnutrition continues to rise gradually in subsequent months of age. Weight for age, a mixed indicator of acute and chronic malnutrition, similarly rises at age twelve to twenty-three months and stays up thereafter.

Malnutrition varies considerably by geographic area. MICS data showed that the southern governorates had the highest rates. Similarly, southern governorates had lower levels of school enrollment, lower levels of adult literacy, 10 to 15% lower rates of measles immunization, and levels of access to clean water and sanitation facilities which were less than half that in the rest of the country. In these areas, diarrhea and respiratory infections are the most common causes of death among children (35, 36).

By contrast, Baghdad governorate has both higher levels of breast feeding, and higher rates of age-appropriate introduction of weaning foods (49). It has been noted informally that some neighborhoods of Baghdad, especially those with many college graduates, had notable rates of obesity in 1998, while in some poor areas as much as half of the children were stunted.

Estimating Mortality from Data on Malnutrition

Methods and Results

Given the uncertainties and inconsistencies of the various studies on Iraqi mortality rates, and the incomplete nature of Iraqi mortality reports from hospitals and vital statistics registries, there is an urgent need for independent estimates of mortality changes since 1990. Except for IST data for 1991, the only reliable national data sets for Iraq are for malnutrition and other social indicators. This report uses these reliable nutrition data sets to develop estimates for changes in mortality rates in 1996. Methods for estimating under five-year-old mortality rates from these nutrition and related data are presented below. Four analyses, based on three independent data sources, are detailed. These are followed by exploratory regression analysis and, finally, a logistic regression.

Model 1: Correlating Malnutrition and Mortality Data

Data from the 1996 MICS survey for each of the three measures of malnutrition were compared to the data for all other countries in the State of the World's Children Report (41) with levels of malnutrition within a range of

10% higher or lower. Eight countries reported a prevalence of low weight for age in a range of 20 to 26%, twelve countries reported low height for age in a range of 28 to 34%, and ten countries reported low weight for height among under five-year-olds in a range of 9 to 11%. The average under five-year-old mortality rates reported for those countries that shared Iraq's weight for age values were 126.1 ± 67.0 , for those countries that shared Iraq's height for age values were 131.2 ± 76.5 , and for those countries that shared Iraq's weight for height values were 148.6 ± 64.2 . The unweighted average of these three rates is 135.3 ± 69.2 . The major weakness in this approach is the assumption that the relationship between mortality and malnutrition in Iraq is likely to be similar to countries with more stable social conditions. While higher malnutrition usually implies higher mortality, the relationship is not likely linear and may be heavily influenced by other cultural or material factors.

Model 2: Projections from the Mortality Rate in Baghdad

The mortality rate in the 1996 CESR study in Baghdad cannot be used as a national estimate because, as in most developing countries, mortality is likely to be higher outside the capital city. Data from the IST study provided relative mortality rates for Baghdad and the rest of the country for children under one month of age, one to eleven months of age, and twelve to fifty-nine months of age (29). Among under one-month-olds, excess mortality outside of Baghdad relative to mortality in Baghdad is 4% and 21% for the periods 1985 through 1990 and January 1991 through August 1991, respectively. Among one- to eleven-month-olds, it is 149% and 250% and among twelve- to fifty-nine-month-olds it is 338% and 505%, for the same two periods of time. The IST found in 1991 that 25% of all under five-year-old deaths occur in the first month, 47% occur during the second to twelfth month of life, and 28% occur during one to four years of age. Using these same rates of proportional mortality among under five-year-olds, total mortality among under five-year-olds outside of Baghdad should be between 1.6 and 3.2 times higher than in Baghdad. Assuming that a quarter of all under five-year-olds live in Baghdad, this suggests a national rate of under five-year-old mortality in a range from 47 to 100. The midpoint estimate of this range is 73.5 ± 26.5 . Weaknesses in this method include the imprecision of projecting for the nation from one area, the possibility that variables influencing mortality have not changed proportionally in Baghdad and the rest of the country, and the possibility that proportional mortality by age, estimated from IST data for two periods, could have changed in subsequent years.

Model 3: Comparison with Eight Malnutrition and Mortality Studies

Pelletier et al. identified eight observational studies in six countries where weight for age assessments were correlated with subsequent mortality rates among under five-year-olds (50). While the log of mortality rate in these eight studies generated nearly parallel slopes of increase as malnutrition increased, the baseline levels of mortality among those with mild malnutrition varied eightfold. Point estimates and confidence intervals for mortality among under five-year-olds from these eight studies were 11.4 ± 8.3 per one thousand births for those with normal weights, 19.3 ± 16.1 per thousand among those mildly underweight, 34.4 ± 23.4 per thousand among those moderately underweight, and 91.4 ± 63.2 per thousand for those severely underweight. Each of these rates is multiplied by five to derive the cumulative rate of death among under five-year-olds. Multiplying these rates by the proportion of under five-year-old Iraqi children with normal weights (42.8%), mildly underweight (34.3%), moderately underweight (16.6%) and severely underweight (6.3%) as determined in the MICS survey generates a rate of 92.9 ± 68.7 deaths per thousand under five-year-olds. Limitations in this approach include the imprecision in using as a model data with widely varying values, the wide confidence band

generated, and the possibility that malnutrition-mortality dynamics in Iraq may be different from those in countries used to develop this model.

Model 4: Comparison to Countries With Similar Expected Population Attributable Risk

Pelletier et al. (51) observed that although mortality rates varied a great deal, the slopes of the increase in the rate of mortality at various levels of malnutrition were nearly parallel. This permits calculation of an equation for the slope of relative risk of mortality and calculation of the population attributable risk (PAR) associated with stunting. The PAR, in this case, is the proportion of all mortality which is due to the effects of malnutrition. Thus, while the actual mortality rate remains unknown, the proportion of all mortality which is attributable to mild, moderate, and severe malnutrition can be calculated. Rates of the population attributable risk varying from 12% to 66 % were presented for 53 countries (50). Data on the proportion of under five-year-old Iraqis with moderate and severe malnutrition were transformed according to equations provided by Pelletier (50) and fitted to his regression equation to estimate the population attributable risk for malnutrition in Iraq in 1996. The Iraqi rate of 64% PAR was within a 10% range of only the highest three countries among the 53 presented: Nepal, Bangladesh, and India. Data on the under five-year-old mortality rate for these three countries was taken from the *1998 State of the World's Children Report*. They averaged 113.0 ± 2.6 . Limitations in this approach are similar to those in the first model and the small number of countries upon which this model's comparisons are based.

Without data to provide validation of any of the mortality estimates generated here, one could have little confidence in any one of the models developed above. Together, however, these four estimates, depending on three independent data sources, demonstrate a consistent trend toward increased mortality. (See Table 6 below.) These models generate a range of estimates of mortality among under five-year-olds that range from 74 to 135, averaging 104 ± 42 . This represents an estimate of more than a doubling in the mortality rate.

Table 6: Summary of Mortality Estimates from Four Models

	Description	Summary of Findings	Results or Average
Model 1	Correlation of Rates of Moderate to Severe Malnutrition		135.3 ± 69.2
	Weight for Age (Underweight)	126.1 ± 67.0	
	Height for Age (Stunting)	131.2 ± 76.5	
	Weight for Height (Wasting)	148.6 ± 64.2	
Model 2	Projecting from Baghdad	73.5 ± 26.5	73.5 ± 26.5

Model 3	Average of 8 Studies	92.9 ± 68.7	92.9 ± 68.7
Model 4	Population Attributable Risk Comparison	113.0 ± 2.6	113.0 ± 2.6

Exploratory Multiple Regressions

The above models may overestimate mortality by failing to take account of long-term social development investments which have only partly deteriorated. Malnutrition is one, but not the only factor influencing mortality rates among children under five years of age. Literacy, measles immunization coverage, and access to clean water and sanitation facilities likely moderate the impact of nutritional and financial declines related to the sanctions. Other factors, including the proportion of children in primary school, the percent of mothers who are literate, and the percentage of children who are breast fed, may be independent influences or markers for independent influences on mortality rates. Fortunately, the 1996 MICS study and other recent surveys provide these data for Iraq. Data from the *State of the World's Children Report* (41) for these and the three nutritional indices for all of 195 other reporting countries were used to establish regression equations to predict under five-year-old mortality rates. Not all data items were complete for each variable in all 195 countries; while several variables were available for all countries, some data were available for as few as half of all countries. A complete set of all variables existed for only 48 countries.

Missing data were dealt with by the listwise method, including only data for countries with complete data sets for all variables; by the pairwise method, where data was imputed for missing variables if data for similar countries existed; and by the means method, where simple mathematical average values were imputed wherever there were missing values. Three to six independent variables were included in each regression model as selected by the stepwise procedure. The stepwise approach is the most common method for selecting variables to be included or excluded from the statistical model. A total of only seven of the nine potential independent variables were ever included in any one of these six stepwise models. Of these, the variables *Percent of infants breast fed at six months* and *GNP* showed the lowest significance and the least contribution to parameter estimates even when included by the stepwise procedure.

Because the mortality rate among under five-year-olds appeared to rise in an exponential manner models were subsequently developed for the natural log of mortality. Unadjusted, unweighted R-square values are reported here. Table 7 shows that all of these models generated R-square values, from .73 to .84. Logarithm transformations of the dependent variable consistently generated higher R-square values and smaller standard deviation estimates. Fitting known data for Iraq in 1996 listed at the bottom of the table to the regression equations generated by these models derived estimates of under five-year-old mortality in Iraq from a low of 46 to a high of 110 per thousand.

Which of the regression models presented in table 7 is likely to be most accurate? While each model shows a rise in mortality among under five-year-olds from pre-1990 levels, the range of values generated is widely dispersed. Log transformation of the dependent variable provided lower point estimates, and had dramatically smaller confidence intervals around the point estimate for mortality levels in Iraq. The log models are thus considered better than the models for which the untransformed under five-year-old mortality is used as a dependent variable. One of the logarithmic models generated a far lower point estimate for Iraq than any other

model. This occurred because the beta value for measles immunization was strong for this, and only this, model. While measles immunization is likely an important factor influencing survival among under five-year-olds, a regression model heavily weighted to that one variable minimizes other variables, including nutritional status, which are important in their own right and serve as a marker for access to other essential goods. Indeed, the high measles immunization rate in Iraq is partly the result of a general deterioration of the health system and other social conditions; it is possible to strengthen this one program while most other influences on health are deteriorating.

Only three variables appear in nearly all of these models. With the exception of the model just mentioned, these same three variables have far larger beta values than any other. These variables are literacy among adults, stunting prevalence among under five-year-olds, and percent of population with potable water.

Table 7: Exploratory Multiple Regression Models

Dependent Variable	Independent Variables	Beta Values	Missing Data Handling Method	Number of Data Points	R-Square Value	Under Five-Year-Old Mortality Estimate (per thousand)	95% Confidence Interval
Under Five-Year-Old Mortality	Stunting	1.013	Listwise	47	.73	107	5.6
	Adult Literacy	-0.1488					
	Pop with Water	-0.957					
Log of Under Five-Year-Old Mortality	Per Capita GNP	8.92 ⁵	Listwise	47	.82	104	1
	Stunting	6.963 ³					
	Pop with Water	5.20 ³					
	Sanitation	-3.57 ³					
Under Five-Year-Old Mortality	Stunting	1.968	Pairwise	75-191	.76	110	8.8
	Sanitation	-0.552					
	Primary School	-0.615					
	Pop with Water	-0.876					
Log of Under Five-Year-Old Mortality	Stunting	6.031 ³	Pairwise	75-191	.84	83	1
	Adult Literacy	-0.809 ³					
	Per Capita GNP	-2.24 ⁵					
	Pop with Water	-6.08 ³					
Under Five-Year-Old Mortality	Stunting	0.809	Means	195	.72	112	4.5
	Measles	-0.596					
	Pop with Water	-0.809					
	Adult Literacy	-1.446					
	Per Capita GNP	-2.25 ³					
Log of Under	Adult Literacy	7.38 ³	Means	195	.77	46	1

Five-Year-Old Mortality	Stunting	4.40 ³			
	Pop with Water	-2.94 ³			
	Measles	-5.06 ³			
	Per Capita GNP	-3.405 ⁵			

Data Used for Above Rates:	(in percentages):	Sources:
Adult Literacy:	68	(34,49)
Measles Immunization Coverage	80	(35,36)
Stunting Prevalence, Under Five-Year-Olds	31.2	(35,36)
Population with Potable Water:	52 (79% with water, 1/3 est. contaminated)	
Percent Households with Adequate Sanitation:	74.6	(35,36)
Percent Attending Primary School:	74.2	(37)
Exclusive Breast Feeding, 4 months	30	(35,36)
Per Capita GNP (in dollars):	761 (in 1994)	(37)

Imputing Values for Missing Variables

Since the countries with the most complete data sets are likely a biased sample of all countries, there is interest in an improved approach to imputing values for missing variables. The choice of listwise, pairwise, or means methods to impute missing variables is arbitrary, and fails to provide enough variation to the imputed values.

The **Bootstrap** procedure provides a theory-based method to estimate missing data through multiple imputation of missing values. This procedure involves multiple sampling with replacement from the universe of known values to estimate the unknown values.

We use the multiple imputation method (73) to impute data for the missing values in the database from which regression models are developed. The multiple imputation approach uses data items which are nearly complete in the database to create linear regression estimates for the missing values of interest. The value being estimated is thus a dependent variable with some known data values; the known three variables are independent variables used in these models. From this database, those variables include the under five-year-old mortality rate, the under one-year-old mortality rate, and GNP per capita. The model for estimating each missing value is:

$$Y = \beta_0 + \beta_1 V_1 + \beta_2 V_2 + \beta_3 V_3 + \epsilon \quad \epsilon \sim (\theta, \sigma^2)$$

where Y is the variable to be estimated, β_0 is the intercept value, $\beta_1 V_1$ is the value for the first independent variable, etc. . . ., and ϵ is an error term, error resulting both from variance of the data input, (θ), and the estimation procedure, (σ^2). The procedure for imputing the missing values is done five times, creating five

data sets with estimated values. Stochastic variations for the imputed values permits us to fit the following logistic regression model for under five-year-old mortality with a binomial distributed error term.

The binomial distribution, which provides for a logistic transformation of regression models is appropriate for variables that can have either one or another expression, as in the result of death or not death, of interest for this model. This error term includes variance from only the regression model:

$$\log p/1-p = \beta_0 + \beta_1 V_4 + \beta_2 V_{10} + \beta_3 V_{11} + \epsilon$$

With coefficients and error terms from the above procedure, known data for the model independent variables are included in the five data sets. The mean value of the dependent variable predicted by these five models provides our estimate of under five-year-old mortality in Iraq. The variance of these five estimates provides an additional error term for the imputed variables, by the formula (73):

$$\text{Var}(\hat{p}) = \frac{1}{5} \sum_{i=1}^5 \text{Var}(p_i) + (1 + \frac{1}{5}) \cdot 4 \cdot \sum_{i=1}^5 (p_i - \hat{p})^2$$

The R-square values and the point estimates for Iraq generated by the regression models, using a data base which includes values which were imputed where original values were missing, are very similar to those generated by the exploratory regression above (See table 8). Using the log of mortality still consistently generated lower point estimates for Iraq than regressions using untransformed under five-year-old mortality. As predicted, little power is lost by including the three most important independent variables rather than the entire variable set.

Table 8: Untransformed and Log Regressions Using Imputed Values for Missing Data

Dependent Variable	Independent Variables	Missing Data Handling	Number of Data Points	R-Square Value	Under Five-Year-Old Mortality Estimate
Under Five-Year-Old Mortality	Adult Literacy Stunting Pop With Water	Multiple Imputation	191	.77	110
Under Five-Year-Old	Adult Literacy Stunting	Multiple Imputation	191	.77	105

Mortality	Pop with Water Per Capita GNP Breast feeding Sanitation				
Log of Under Five-Year-Old Mortality	Adult Literacy Stunting Pop with Water	Multiple Imputation	191	.72	78
Log of Under Five-Year-Old Mortality	Adult Literacy Stunting Pop with Water Per Capita GNP Breast feeding Sanitation	Multiple Imputation	191	.82	76

Logistic regression including all variables provided a point estimate for under five-year-old mortality in Iraq midway between estimates using untransformed and log transformed values of under five-year-old mortality (See table 9). Beta coefficients for the three main variables were even more important in the logistic model. Eliminating the three other variables used in the full model hardly changed the R-square value or the point estimate for Iraq. Parameter estimates for the coefficients for the short logistic model were -1.0132 for the intercept, -0.0194 for each unit of adult literacy, 0.0213 for each unit of stunting, and -0.0128 for each unit of population with potable water.

Data on literacy, sanitation, and stunting for each governorate from the MICS survey (35,36) were grouped by region of the country. Estimates for under five-year-old mortality rates in the four regions of the country show Baghdad governorate to have the lowest rate. The southern governorates, where Suni Muslims predominate, where resource allocation has been poorest in the oil for food program, and where the Iran-Iraq war and post-BGulf war uprising were fought, has the highest under five-year-old mortality rate. Mortality in the southern governorates is estimated to be 34% higher than the level in Baghdad. The northern governorates, where UN administration and NGO actions have reduced the impact of the post-BGulf war uprising and displacement of the predominantly Kurdish population, has a rate of mortality higher than Baghdad and lower than the southern governorates (See table 10).

Rural areas likely have higher infant mortality rates than urban areas. Access to potable water is about 50% lower in rural areas. Illiteracy is much higher among women above 15 years in rural areas in the northern governorates (54% compared to 32% in urban areas) and in Baghdad (51% compared to 27% in urban areas). Sanitation is greater than 50% lower and measles immunization 10% to 15% lower in rural areas (35,36). There are, however, some advantages in rural areas. Breast feeding prevalence is higher and the introduction of weaning foods occurs on a more timely basis in rural areas (49). These feeding practices are probably the reason that stunting is only slightly worse in rural than in urban areas. Stunting in 1996 occurred among 32% of urban and 33% of rural children in the central and southern governorates, and among 25% of urban and 30% of rural children in the northern governorates (35,36). Throughout the country, girls are breast fed slightly less than boys and have higher rates of stunting.

Table 9: Logistic Regression Model

Dependent Variable	Independent Variables	Missing Data Handling	Number of Data Points	R-Square Value	Under Five-Year-Old Mortality Estimate	95% Confidence Interval
Binomial Under Five-Year-Old Mortality	Adult Literacy Stunting Pop with Water Per Capita GNP Breast feeding Sanitation	Multiple Imputation	191	.76	88	80-99
Binomial Under Five-Year-Old Mortality	Adult Literacy Stunting Pop with Water	Multiple Imputation	191	.75	87	80-95

Table 10: Estimated Under Five-Year-Old Mortality for Iraq in Short Logistic Regression Model with Imputation

Region	Estimated Under Five-Year-Old Mortality (per Thousand)	95% Confidence Interval
National	87	80-95
Northern Governorates	81	75-87
Central Governorates	83	76-89
Baghdad Governorate	76	73-80

Southern Governorates	102	89-117
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Validity Check on Mortality Estimates

The estimate of 87 deaths per thousand children under five years of age in Iraq cannot be validated as no other good sources currently exist on mortality for the period after 1991. Indeed, this entire exercise would not have been carried out if such a source did exist. But good quality mortality estimates have already been provided for the end of the period of stability prior to sanctions and the Gulf war (mid-year 1990) and for the first eight months of 1991, including the period of the Gulf war, sanctions, and the postwar uprisings. Estimates for literacy, potable water, and stunting in these two periods of time were applied to the logistic regression model described above. Values generated by these models are shown to provide good estimates for the known under five-year-old mortality rates (See table 11).

Table 11: Comparison of Binomial Model and Known Rates of Under Five-Year-Old Mortality

Time Period	Known Rate (per thousand)	Model Estimate (per thousand)
1990	38	36; 33-40
1991	128	103; 90-119

The model successfully estimated the 1990 mortality rate within a 95% confidence interval. It provided a slight underestimation for the 1991 rate. This underestimation was expected, as 1991 was a period of rapid mortality increase due to war-related factors. It is assumed that the regression model estimates mortality rates when the dependent variables are stable; it should provide an underestimate when those dependent variables are undergoing rapid change. Indeed, given this assumption, it is surprising how well the model approximated the known value for under five-year-old mortality.

Implications of Mortality Estimates

It will not be possible to verify these under five-year-old mortality estimates until the 1997 national Iraqi census is analyzed in detail or other high quality mortality studies are done. Meanwhile it is important to identify the likely magnitude and mechanisms by which sanctions policies impact death rates in Iraq.

Attributable Risk of Political, Economic, and Social Disruption in the 1990s

Attributable risk of under five-year-old deaths is derived by calculating the rate of excess mortality, and multiplying this by the population exposed to that risk and the period of time of the exposure, divided by

five (for an annual, rather than cumulative five year estimate). The population of children under five years of age in Iraq is reliably calculated by the Gulf Child Health Survey in 1989 as about 2.639 million. Lacking current information about fertility in recent years prevents us from accurately determining the under five population in subsequent years. It is predicted, roughly, by a six percent increase per year since 1989. These projections are presented below.

Table 12: Calculations of Excess (Attributable) Mortality Among Under Five-Year-Olds (Conservative Model)

Year	Baseline Death Rate/1000 Under Five-Year-Olds	Period Death Rate/1000 Under Five-Year-Olds	Excess Deaths/1000 Under Five-Year-Olds	Percent Rate Increase	Under Five-Year-Olds (in Thousands)	Est. Excess Deaths
1990	40	40	0	0	2,756	0
1991	40	47.5	7.5	19	2,756	4,134
1992	40	54	14	35	2,756	7,717
1993	40	60.5	20.5	51	2,756	11,300
1994	40	67	27	68	2,756	14,882
1995	40	73.5	33.5	84	2,756	18,465
1996	40	80	40	100	2,756	22,048
1997	40	80	40	100	2,756	22,048
1998*	40	80	40	100	2,756	5,512
TOTAL						106,106

*First quarter only

The projections in table 12 are based on the following assumptions:

1. That under five-year-old mortality in Iraq in 1990 was 40 per thousand.
2. That under five-year-old mortality would have remained stable at the 1990 rate. It is more likely that the mortality rate would have fallen by at least another 20% more in the 1990s if sanctions and the Gulf war had not occurred, accounting for an additional 16,000 deaths.

3. That the mortality increase during sanctions prior to the Gulf war was negligible. If the increase in the rate of mortality during four months of sanctions prior to the Gulf war is included, an additional 900 deaths are estimated.
4. That by 1996 under five-year-old mortality had risen to at least 80 per thousand, the lower bound of the 95% confidence interval. If the point-estimate of 87 (from table 9) deaths per thousand rather than the lower estimate of the 95% confidence interval had been used, about 10,000 additional deaths would have been calculated.
5. That the mortality increase occurred in a straight-line trend from 1991 through 1996. Indeed, evidence was presented to suggest that excess mortality likely rose faster, at least by 1995, through an embargo-related rise and the effect of postwar fighting and destruction. Lacking data to plot a trend other than a straight-line increase, however, we will use this assumption, which will tend to minimize the total estimated number of excess deaths. Weighting the increase in deaths higher in the earlier years would account for 10,000 to 15,000 additional deaths.
6. That mortality, having risen to 80 in 1996, remained at that level through March 1998. Nutritional survey data through March 1998 suggest that a decline had not yet begun. It is probable that improved access to food, medicines, and other humanitarian inputs resulted in a reduction in the level of excess mortality later in the year, especially and earliest in the northern governorates. Lacking quantitative indicators of improvements since March 1998, we are unable to estimate the magnitude of subsequent mortality decline.
7. That a decline in family formation, divorce, and the birth rate has occurred. While no conclusive evidence of such a decline or its magnitude exists, it is likely that this is true. If the birth rate had risen as it did during the 1980s, there would have been 50% more under five-year-olds in Iraq in 1997 than there were in 1990. Calculations using this rising birth rate would account for an additional 33,000 deaths.

Following these assumptions, an estimate of more than 100,000 excess deaths occurred among under five-year-old Iraqis from August 1990 to March 1998. During January 1996 through March 1998, this represented an average of about 1800 excess deaths among under five-year-olds per month, or about 60 per day. This conservative estimate is 40% of the number of 4500 excess deaths claimed by the Iraqi Ministry of Health in 1996. If these conservative assumptions are replaced by the main estimates for values of the variables included above, the total number of estimated excess deaths thru March 1998 more than doubles to 227,000 (See table 13).

Table 13: Calculations of Excess (Attributable) Mortality among Under Five-Year-Olds (Most Likely Model)

Year	Baseline Death Rate per Thousand Under Five-	Period Death Rate per Thousand Under Five-	Excess Deaths per Thousand Under Five-Year-Olds	Percent Rate Increase (excess deaths divided by	Under Five-Year-Olds (in Thousands)	Est. Excess Deaths H
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	Year-Olds	Year-Olds		baseline rate)		
1990*	40	40	0	0	2,756	0
1990**	40	46	6	15	2,756	1,102
1991	40	100	60	150	2,921	35,052
1992	39	70	31	79	3,096	19,195
1993	38	65.5	27.5	72	3,282	18,051
1994	37	73	36	97	3,479	25,049
1995	36	80.5	44.5	124	3,688	32,823
1996	35	87	52	149	3,909	40,654
1997	34	87	53	156	4,144	43,926
1998***	33	87	54	164	4,393	11,861
TOTAL						227,713

* First eight months

** Last four months

*** First quarter only

H Excess deaths per thousand times under five-year-old population per thousand, divided by 5 (children under five stay in the population five years)

Comparisons with Iraqi Reports of Excess Deaths

Many of the claims of million-plus deaths due to economic sanctions are based on Iraqi Ministry of Health information provided since 1993 on the number of excess deaths recorded in hospitals due to selected causes. Among children under five years of age, all deaths due to respiratory infections, diarrhea, gastroenteritis, and malnutrition are counted as deaths caused by sanctions. Among those over five years of age, all deaths due to cardiac diseases, hypertension, diabetes mellitus, renal diseases, liver diseases, and cancers are counted as caused by sanctions. These data are presented in table 14.

There are serious methodologic problems with these data. First, not all the deaths from these causes are related to sanctions. Indeed, cancer and heart diseases were the most common causes of death among adults prior to the Gulf war. Second, diagnostic drift among physicians in all countries is notoriously common, especially in politically or social charged situations. Diarrhea and respiratory infections were the most common underlying causes of death among young children in Iraq prior to the Gulf war. Some of the increase in the numbers of deaths recorded as being due to these causes may be affected by subtle as well as not so subtle pressures to consider these the immediate cause of death in the current period.

Finally, many deaths occur outside of hospitals and would not be included in the data systems from which these data come. In 1989, for example, only about a third of all estimated deaths among under five-year-olds were registered in hospitals. Since the embargo, many people now no longer go to hospitals, or go to hospitals for only a brief period. Finding no treatments, they likely take their family members home to die in far greater numbers than before sanctions were imposed. Moreover, many hospital-based deaths are listed as "causes unknown" due to the lack of adequate diagnostic and laboratory equipment. Most hospital data systems are in disarray, with clinical notes written on odd scraps of paper or old charts of other patients (8). Most hospital statistical offices no longer generate routine reports and few of their computers still work. Many hospital-based deaths must go unrecorded or misdiagnosed in such an environment.

The so-called sanctions-related deaths in Iraq could well be interpreted as an accounting of all hospital-based deaths. A more precise estimate of excess deaths in Iraqi hospitals would be made if the "baseline" level of 7100 (derived from multiplying the 592 average deaths per month among under fives in 1989 shown in table 1, by 12, for an annual average) is used. Compounded for population growth and subtracted from the total deaths reported for subsequent years, the direction of excess deaths in this exercise is similar to those reported by Iraq for under five-year-olds.

Even gross estimates of deaths among those *above* age five are much more problematic to generate. Adult pathologies are less dependent on environmental and social conditions for which we have good estimates and depend more on clinical variables. No attempt will be made to estimate above five year old excess deaths here.

The figure of 106,106 excess deaths (See table 12) from 1990 through the first quarter of 1998 is intended to be a best conservative estimate of excess mortality among under five-year-olds. Excess deaths are not the only important impact on health and welfare of the population. Prior to 1990 death came to about one in every twenty Iraqis under age five. During the 1990s about one additional Iraqi out of twenty born died before reaching age five. Even a small number of documentable excess deaths is an expression of a humanitarian disaster, and this number is not small. But damages also are likely to occur among many of the other eighteen out of twenty Iraqis who do not die prior to age five. Many of these damages may be serious or irreparable. In Iraq these likely include reduced mental capacity due to malnutrition, reduced educational achievement because of school dropouts, social deterioration from family breakdown and poverty growth, and reduced governability through increases in crime and lawlessness. Excess mortality is important as a severe denial of all rights to affected individuals and because it is a measurable state. It may well be that these other impacts, less clearly countable or attributable to sanctions, may be more important for quality of life among Iraqis overall. Excess deaths should thus be seen as the tip of the iceberg among damages to occur among under five-year-olds in Iraq in the 1990s.

Table 14: Estimated Excess Deaths, Ministry of Health and This Analysis Compared

Year	Baseline Deaths Reported by Iraqi Ministry of Health in 1990 and Projected for Population	Death among Under Five-Year-Olds Reported by Iraqi Ministry of Health	Excess Deaths Among Under Five-Year-Olds Reported by Iraqi Ministry of Health	Estimated Excess Deaths in the Conservative Analysis	Estimated Excess Deaths in the Likely Analysis
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	Growth				
1990	7,537	8,903	1,366	0	1,102
1991	7,989	27,473	19,484	4,134	35,052
1992	8,468	46,933	38,465	7,717	19,195
1993	8,976	49,762	40,786	11,300	18,051
1994	9,515	52,905	43,390	14,882	25,049
1995	10,086	55,823	45,737	18,465	32,823
1996	10,690	56,997	46,307	22,048	40,654
1997	11,332	57,656	46,324	22,048	43,926
TOTAL			296,676	106,106	227,713

***First quarter only**

The Significance of Mortality Changes

The total number of war-related Iraqi civilian and military deaths may have been as high as 66,663.^{xvii} The minimum estimates of under five-year-old mortality detailed above represent close to four civilian deaths during the postwar embargo, 1991 through 1997, for each war-related death. By contrast, the Al Furdos bomb shelter, bombed on 13 February 1991 during the Gulf war, resulted in the death of 209 civilians. Targeting of that site resulted in an international outcry, an apology from the U.S., and a modification in the criteria for choosing subsequent bombing targets. Yet current excess death levels among under five-year-olds, conservatively estimated earlier in this analysis from 1996 through 1997 as 60 per day, comes close to that level *every day*. Similarly, the bombing raids by the UK and the U.S. in December 1998 resulted in an estimated 60 civilian deaths. It went unreported that during those three days, 180 Iraqi civilians likely lost their lives due to worsened living conditions related to the sanctions.

How sure can we be that under five-year-old mortality rose in Iraq? The gold standards of evidence for this assertion do not yet exist. Strong and consistent survey data collection, in some cases by independent international researchers, show deteriorating nutrition, water quantity and quality, sanitation, literacy, and immunization levels. Hyperinflation, stagnant salaries, and shortages or high prices for medical goods and food throughout the 1990s are consistent with these disastrous trends. Flawed reporting from the Iraqi Ministry of Health, mistakes in carrying out or interpreting some nutritional surveys, and a lack of access to some of the original survey data sets limit our ability to determine with confidence the

levels to which mortality has risen. To overcome these problems, this paper developed a variety of means to independently estimate mortality levels among under five-year-olds. Those analyses showed a considerable rise in mortality. The final estimate used is the most conservative of the estimates made.

What made mortality among under five-year-olds rise? A short-term rise in deaths occurred during the initial embargo in 1990. Diarrhea and war-related mortality rose steeply during and following the Gulf war and postwar insurrection in 1991. Starting in 1991, decreased access to food and increased risk of respiratory and diarrheal infections led to a marked increase in malnutrition among those reaching twelve months of age, when the protections offered by breast feeding have waned and risks from poor weaning practices rise. Those unprotected by breast feeding were at far greater risk. Although the prevalence of breast feeding was high, supplementary bottle feeding was also high and rising. Few infants were exclusively breast fed during the first six months, and the introduction of complementary semisolid foods failed to reach a third of children aged six to nine months. Malnutrition among women giving birth led to a high rate of low weight births and high perinatal mortality. Without significant improvements in sanitation, food sources, or medical care, many of the children with acute malnutrition after weaning became chronically malnourished as toddlers. They were at increased risk of serious disease and death, especially from measles, diarrhea, and respiratory infections. Throughout Iraq, grain and meat production fell, purchasing power and educational achievement declined, and the energy, water, medical, and transportation infrastructure declined. These changes left all Iraqis at greater risk for poor health outcomes. This risk was greatest among those with more limited access to goods, services, and infrastructure. This included those in rural areas, those with lower income and educational levels, girls, and those where the public health infrastructure was repaired the least (especially southern governorates).

Why didn't the Iraqi government respond more rapidly and effectively to the decline in health and deterioration of the health system? Iraq's health and social systems, designed on a capital-intensive model of importation of goods to raise the standard of living, were poorly suited to Iraq's suddenly transformed epidemiologic situation in the 1990s. The health system in the 1980s was heavily oriented toward sophisticated curative care. Many physicians received specialty education in advanced clinical specialties but few public health or community health specialists were trained. Thus, there were few people with the skills to facilitate efficient reorganization or rationing decisions in the health system. The Iraqi government resisted reorganizing to confront the economic crisis caused by sanctions, in apparent hopes that sanctions would not last long. The Iraqi national consciousness of "sitting on a sea of oil" also mitigated against a culture of adaption to what became a severe and sustained capital shortage. Finally, with a highly centralized, one-party political system, popular pressure from the Iraqi people did not exist to demand a more effective response by the government. While waiting in vain for the return of oil-based affluence in the early 1990s, Iraq was heavily isolated from potential international assistance in remodeling the health system. Major changes in the focus of the health system were needed to encourage breast feeding, promote measles immunization, introduce appropriate weaning foods, screen children and provide supplementary rations for those in need, and focus on providing simple and early interventions for diarrhea and respiratory infections. These changes began only in 1995 and have grown slowly since then.

Why did levels of malnutrition level off around 1996? The eventual development of the primary care strategy outlined above probably contributed to the plateauing of rising levels of malnutrition. Since 1997 the promise, and then the reality, of oil for food relief, eased the economic crisis and made more medicines and foods available.

What further research is needed now? We need to learn much more about the impact of social deterioration on those who do not die in Iraq. Among children, this includes research on changes in mental capacity, educational achievement, and access to learning materials among those in school; employment and survival strategies among those not in school. Changes in learning and employment opportunities in higher education and in-service training should similarly be explored. Changing types and levels of delinquency and familial and governmental responses should be studied. Changing patterns and levels of family formation, family functioning, and family-related social pathologies should be identified. The changing knowledge and practice base of professionals, cut off from routine international exchange, should also be identified. We should learn more about the nutritional status of older children and adults and identify the pathways by which those changes occurred. Changing patterns of resource generation and utilization, including both formal (money) and informal (unpaid labor) resources, in Iraqi households should be identified. This will assist in identifying the coping strategies used throughout the decade.

Now in its third year, an extensive review of the oil for food program is needed. Where, and in what ways, has this program been successful? In what ways has it been ineffective in improving humanitarian conditions in Iraq, and why? What further areas should be included in the oil for food program if any? Addressing these issues will facilitate dealing with the most important question of all—when moving from the humanitarian assistance oil for food program to postcrisis reconstruction and development, what strategies and issues should be given priority? How can reconstruction be implemented in the most efficient and effective manner to speed Iraq's recovery?

What level of humanitarian suffering is acceptable? According to the Charter of the UN and the international human rights conventions, governments and international organizations are responsible for protecting and improving social and economic conditions. No dogma exists to establish an acceptable level of violations of these conditions or to measure the trade-offs between one class of rights and another. In practice, human rights covenants specifying rights to safety, security, health care, and education of citizens in embargoed countries have been frequently and repeatedly violated. It may be argued that embargo-related violations are a lesser of evils—compared to the ills the embargo against Iraq is designed to prevent (nuclear weapons) or limit (biological and chemical weapons, violations of borders). Yet even if there may be legitimate justifications for the violations of some rights, the humanitarian disaster which has occurred in Iraq far exceeds what may be any reasonable level of acceptable damages according to the principles of discrimination and proportionality used in warfare.

The Geneva Conventions on the protection of civilians in warfare and rules of military engagement provide useful comparisons. The shortage of food and medical care experienced during the embargo would likely have triggered an emergency response and wide condemnation of the U.S. and UN if it had occurred among civilians in occupied territory during warfare. Any occupying force which would continue to deny more than 20 million civilians adequate access to food and medicine might be prosecuted for war crimes. The far greater number of deaths to civilians in the embargo, compared to civilians in the Gulf war, civilians during postwar bombings, or soldiers during the Gulf war, all would be unacceptable levels of collateral damage were sanctions guided by the rules of warfare.

Only recently has a large-scale reaction against the humanitarian impact of sanctions occurred in the U.S. Ironically, this response increased during 1998, when the most severe embargo-related damages had already ended. The focus on excess deaths, while important, is perhaps misplaced as a primary focus at present. More attention should be focused on the well being and living conditions for Iraqi children. Even

at the time of highest mortality among under five-year-olds, nine out of ten Iraqi children survived to reach school age. The large-scale limitations that sanctions impose on their lives is now the major issue in need of attention if humanitarian damage is to be reduced. It will become an increasingly important issue as sanctions are eliminated on humanitarian goods and postwar, postsanction reconstruction begins. Many Iraqis believe that oil riches will return their country to its pre-Gulf war status within months of the lifting of sanctions. More likely, long-term social and economic investments will be needed for a five- to ten-year period to recover. Community-based health education and health promotion efforts, involving neighbors and civil organizations can speed and make more effective the process of reconstruction. In this regard, the CCCUs provide an excellent Iraqi model for postconflict development.

Conclusions

Sustained increases in young child mortality are extremely rare in this century (3). Such a large increase as that found here is almost unknown in the public health literature. In Iraq, a rate of mortality among under five-year-olds in excess of 80 per one thousand births was last experienced about twenty years ago (52). Living conditions in Iraq, thus, represent a loss of several decades of progress in reducing mortality. This is a social disaster which should be urgently addressed. To the degree that economic sanctions complicate access to and utilization of essential goods, sanctions regulations should be modified immediately. In addition, the international community should urgently make available to Iraq

materials and expertise to improve child health programs and policies in the fields of feeding and weaning practices, diarrhea and respiratory infection recognition and care, and maternal and child health care, family income, and education.

Perhaps more importantly, careful and aggressive monitoring of the humanitarian situation should be instituted as soon as any future sanctions are considered. The Iraqi tragedy has been compounded by an extended period of inadequate monitoring following 1991. No international assistance was provided to the Iraqi Nutrition Research Institute or the Statistical Branch of the Ministry of Health at least until 1995. There was a delay of six years in initiating a large-scale program to provide humanitarian supplies.

Accurate mortality data are seldom available for monitoring short-term or recent changes in a country. Common methods for demographic assessment require a lag time of three to five years for assessing mortality (27). Further research on more timely monitoring indicators, like nutritional status, and more accurate and complete monitoring data on factors such as weaning practices and water quality, are needed to assess and guide humanitarian interventions in emergency situations around the world.

Qualitative data, information from small surveys, and service statistic data from health institutions and NGOs providing humanitarian assistance have often been available, but underutilized in developing timely and accurate assessments of health and well being in Iraq. We must develop more skill, standardize procedures, and increase the coordination of efforts among the many small and large institutions that can contribute to these assessments.

There is much to learn from the problems in data collection, interpretation, and reporting which have

occurred in Iraq. These problems limited the utility of researcher efforts and create unnecessary confusion regarding the reliability of data sources. Information on the reliability and precision of estimates of mortality and well being derived from varied sources can then better orient and facilitate timely interventions to reduce morbidity and mortality in many situations around the world.

Notes

1. In the direct method (also called life table method), women of childbearing age are asked the dates of birth and death of their children. Life table estimates of the risk of dying at various ages are calculated from these data in five-year cohorts. This method has been shown to provide good estimates of mortality risk when well designed and conducted by trained interviewers. Compared to the indirect estimation method, this direct approach requires more and higher quality information from mothers, and thus is more subject to error. When there are errors, they tend to bias toward low mortality estimates, as there is a tendency to omit reports of those births that result in child deaths.

Indirect methods are based on questions about the total number of children ever born to a woman and the number of children who subsequently died (27). The indirect approach is less vulnerable to errors in reported births and deaths. The proportion of child deaths to women in five-year cohorts are compared to standard patterns of fertility and deaths by age and converted into probability estimates of mortality. This approach generates reliable estimates of childhood mortality for a period of time 5 to 15 years prior to interviews, but tends to overestimate mortality levels in the years just prior to interview. This overestimation is reduced when women are grouped by duration of marriage rather than age; data reported here are marriage-grouped.

2. Throughout this document, the infant mortality rate (IMR) and under five-year-old mortality rate are per 1000 live births.

3. The 95% confidence interval for this estimate is a range of 16 to 60 deaths per thousand. A 95% confidence interval means that 95 out of 100 sample rates would be within this range. The confidence interval is unusually wide for this estimate because there are few data points available for their calculation.

4. Despite a small number of total deaths in the survey data and adjusting for increased variance introduced by the cluster method used to select respondents, the difference between these periods remains highly significant ($p > .00$) in proportional hazards analysis [survival probability $.964 \pm .015$ (32)].

5. Among under five-year-olds, weight for ages is a composite indicator of both acute and/or chronic malnutrition. Low weight for age, indicates that the child is underweight. It is an expression of a process which has resulted in stunting or wasting or a combination of both. It is the most widely used international comparative indicator of undernutrition. Weight for height is a measure of acute, or recent, malnutrition. Low weight for height indicates that the child is wasted. Height for age is an indicator of chronic or long-standing malnutrition. Low height for age indicates that the child is stunted.

Mild malnutrition is represented by the proportion of the population between one- to two-standard deviations below the reference population's distribution. Moderate malnutrition is indicated by a two- to three-standard deviation deficit, and severe malnutrition is indicated by a three- or more standard deviation deficit from the reference population distribution. All malnutrition data reported here refer only to the proportion of children who are moderately or severely malnourished.

6. Details on the methods of the four best studies are examined here:

The IST carried out a multistage cluster sample survey from 25 August 1991 to 5 September 1991. Weighting of the samples included from each governorate was based on the population enumerated in the 1987 national census. The clusters to be included were randomly chosen from a list of population centers in each cluster and a microcomputer-based random number generator. Once the first house in a cluster was chosen, researchers went to that home. If a woman aged 15 thru 49 lived in the home and had experienced a live birth since 1991, the household was included in the study. All children under five years of age were weighed. While this method does not generate a random sample, it closely approximates it. Since population census data were not fully accurate or available, it is the best method available to get a representative sample of the population. The greatest limitation of this approach is the correlation of results, making confidence bands around a point estimate approximately 30% wider than they would in a true random survey (46). There were 299 clusters included in 17 governorates, proportionate to the relative magnitude of the population per governorate. Within each cluster 25 to 30 households were included. All children under age five in these households were included in the anthropometric survey. This included a total of 2676 children.

In 1996, UNICEF and the Iraqi government's Central Statistical Organization, led a large-scale sample survey in both the 15 governorates controlled by the Iraqi government (35) and, separately, in the three governorates in the Kurdish zone in the north (36). The sample frame for the **Multiple Indicator Cluster Sample Survey (MICS)** was developed by organizations sponsoring the nutritional survey. It used a probability sample -- both the sites to be included in the sample and the households were representative. It included 6375 households -- 425 households in each of the 15 south and central governorates. Survey teams included international investigators and Iraqis trained by the Nutritional Research Institute. The MICS survey was the first national nutritional survey conducted since the IST study in 1991.

The World Food Program, UNICEF, and the Iraqi Ministry of Health in April 1997 subsequently carried out a large-scale nutritional survey during a national polio immunization campaign (47, 48). The immunization campaign in April included every fifth to tenth child present for immunization. This 1997 clinic Exit Survey provided a sample of 15,466 children. This over sampled children aged one and two relative to those aged four and five. A stratified random sample including 87 of the 850 primary health centers in the country was included. The 15 south and central governorates, covering 85% of the population, were included. The results are similar to those found in the 1996 large-scale multistage cluster sample survey carried out by UNICEF.

In March 1998 the World Food Program, UNICEF, and the Iraqi Ministry of Health again carried out a clinic exit interview during the spring polio immunization campaign (49). The results of the 1998 Clinic Exit Survey are similar to the clinic exit interview study in April 1997 and the MICS study of August 1996. Malnutrition is highest in rural areas and slightly higher among males. Results from these studies, taken together, suggest that malnutrition rose rapidly from 1991 to 1996 and has been roughly stable among those under five years of age from August 1996 to March 1998.

Table 5: National Nutritional Assessments In Iraq Among Under Fives

	August 1991 (IST) (29)	August 1996 (MICS) (35,36)	April 1997 (Immunization Clinic Exit Survey) (47, 48)	March 1998 (Immunization Clinic Exit Survey) (49)
Percent Moderate or Severe Underweight for Age	9.2	23.4	24.7	22.8
Percent Moderate or Severe Underheight for Age	18.7	31.2	27.5	26.7
Percent Moderate or Severe Underweight for Height	3.0	11.0	8.9	9.1

7. See page 15; estimate of 3663 civilian deaths plus high estimate of 63,000 adult male Iraqi military deaths.

Afterword

Apportioning Responsibility for the Iraq Humanitarian Crisis

by George A. Lopez and David Cortright

No discussion of the severe humanitarian impact of sanctions in Iraq would be complete without at least some reference to the difficult question of culpability. Can analysts assess the responsibility of the relevant political actors for the large number of preventable deaths that have occurred during the sanctions crisis? Officials of the U.S. and British governments acknowledge that sanctions have caused severe hardships in Iraq, but they blame these outcomes on the government in Baghdad. We don't believe that the United States and its Security Council allies can escape responsibility so easily, as we explain below, but the government of Iraq does indeed bear a major portion of responsibility for the crisis. Baghdad not only initiated the Gulf crisis with its invasion of Kuwait, but it has repeatedly acted in the intervening years to prevent a resolution of the confrontation and prolong the suffering of its people. The government could have averted much of the humanitarian crisis at any point during the past eight years by complying with the terms of Resolution 687 and permitting full inspection of its weapons programs. In refusing to do so Baghdad placed a greater priority on preserving its military might and political power base than on preventing the further deterioration of Iraqi society.^{xviii}

Evidence of Baghdad's disregard for its own people can be seen in its spending choices. Despite the sanctions, Iraq has not been without financial resources. It has retained access to hard currency reserves and overseas financial holdings, despite international efforts to seize these assets. It has managed to earn export revenues through a small but lucrative illicit oil trade via Turkey and Iran. Limited oil sales have also been allowed through Jordan. Baghdad could have used the limited but nonetheless significant resources at its disposal to take more vigorous action to address the needs of its people and relieve humanitarian suffering. Instead it has marshaled its resources for such purposes as constructing dozens of palaces,[@] erecting monuments to its own glorification, and attempting to rebuild its vast military apparatus (including efforts to smuggle military technology and circumvent restrictions on weapons of mass destruction).^{xix} During the past six years Baghdad has also undertaken a massive civil engineering project and campaign of military oppression against the marsh Arabs of southern Iraq.^{xx} The tragic irony is that while Basra and other Iraqi cities still lack adequate water piping and sewage treatment facilities, the government has found the resources to drain the marshes and build a 350-mile river channel through the southern region.

The most significant serious rights denial of its people has been Iraq's rejection of the UN's oil for food program and its obstruction of the humanitarian assistance operation once it got underway. The UN Security Council first approved the oil for food relief effort in September 1991 in Resolution 706. Iraq rejected the resolution. In 1995 the Security Council again approved the

oil for food program in Resolution 986. After further delays, the Iraqi government finally agreed and the program started in late 1996, with food deliveries beginning in 1997. Iraqi officials have opposed the oil for food program as overly intrusive and a violation of national sovereignty. They also reject the program because they see it as providing the basis for the UN to maintain sanctions indefinitely. The Iraqis insist that the only proper humanitarian response is to lift sanctions and allow the country to repair its oil industry, resume trade, and rebuild its shattered economy and society. While one might grant Iraq its own policy stance on the sanctions issue, its Aall or nothing@ position on sanctions removal helped to compound the humanitarian crisis.

If the oil for food program had been accepted when first proposed in 1991, much of the suffering of the Iraqi people in the intervening years might have been avoided. If Resolution 986 had been implemented immediately in 1995, rather than after a delay of nearly two years, humanitarian relief would have arrived sooner.^{xxi} And various reports indicated even at this late date that food and medical supplies did make a difference in 1997. By agreeing to these measures, Baghdad could have avoided much of the humanitarian crisis. Its failure to do so was a cruel act of human rights abuse and shifted much of the responsibility for the crisis squarely onto its own shoulders.^{xxii}

This obstinance has placed the UN in an untenable situation. To offer an analogy with warfare, it is as if the opposing army has brought children to the front lines and allowed them to be massacred. Would a military force facing such a diabolical maneuver be justified in attacking? Is the Security Council justified in maintaining comprehensive sanctions against an opponent willing to make innocent children the primary victim? A policy designed to exert pressure on an aggressor regime has been perverted by that regime into a virtual attack on innocents. It may be correct to say that responsibility for the humanitarian suffering rests with Saddam Hussein, but this does not solve the practical problem of overcoming injustice. The oil for food program has been an attempt to address the humanitarian suffering caused by sanctions in Iraq, but it is not a sufficient answer and does not acquit the members of the Security Council of the obligation to take further steps to prevent the suffering of innocent civilians. Precisely because it is known that the Iraqi government is victimizing its own population, the UN incurs an obligation to adjust its policies and find a different approach to achieving its objectives in Iraq.

The culpability of U.S. officials arises from their misuse of the sanctions instrument in Iraq. We have addressed this issue at greater length elsewhere but suffice it to say here that officials in Washington have been excessively rigid and unyielding in their use of sanctions and have refused to offer incentives to encourage Iraqi cooperation. Iraq has made some minor concessions over the years, however reluctantly, and substantial progress was made by UN weapons inspectors in dismantling Baghdad=s nuclear and ballistic missile capabilities.

While Iraq has not fully complied with UN resolutions, and many uncertainties remain, its partial concessions and the progress achieved inspections merit a partial easing of coercive pressure. The effective use of sanctions requires the reciprocation of partial concessions. An easing of economic pressure in response to partial compliance can produce further concessions. In part this is a recognition of the limits of sanctions and what they can be expected realistically to accomplish.^{xxiii} Sanctions should not be used in a purely punitive manner to starve an opponent into submission. Sanctions work best in combination with incentives and other forms of external influence as part of

a carrots and sticks diplomacy designed to resolve a conflict through negotiation.^{xxiv} In the Iraq case, however, there has been no reciprocation of Baghdad's concessions, and thus no incentive for the government to take further steps toward compliance.

The Security Council's refusal to reciprocate Iraq's partial concessions suggests that the purpose of the continuing sanctions, at least for the United States, is no longer (or was never merely) to enforce Resolution 687. The political goal posts have been moved. Resolution 687 states explicitly that the ban on Iraqi exports will be lifted when Iraq complies with UN weapons inspections, but U.S. Secretary of State Madeleine Albright declared in March 1997 that the United States does not accept this view.^{xxv} The larger objective has become to impose political and military containment on the regime of Saddam Hussein. This is implicit in the many statements from U.S. officials that the sanctions will not be lifted until Saddam Hussein is removed from power. In November 1997 President Clinton remarked that Asanctions will be there until the end of time, or as long as he lasts.^{xxvi} While many UN member states disagree with this view, they have been unwilling or unable to prevent the United States and Great Britain from dominating UN policy toward Iraq and maintaining a rigid and unyielding posture toward the continuation of sanctions.

Under these conditions sanctions quickly lost the carrots and sticks leverage so crucial to their effectiveness. If Baghdad's conciliatory gestures, however partial, had been reciprocated earlier, a different political dynamic might have evolved between the UN and Iraq. The lack of such reciprocation has meant, from Iraq's perspective, that the government has little to gain from further steps toward compliance. Baghdad relied instead on strategies of obstruction and confrontation, attempting to wear down UN resolve and widen the political differences within the Security Council. Ultimately that strategy failed. The result has been a persistent political impasse and the continuation of the humanitarian crisis. Saddam Hussein may be the target of these measures, but it is the human shield of innocent and vulnerable people in Iraq who continue to bear the brunt of the sanctions.

The American and British bombing strikes of December 1998 have further eroded the justice of UN sanctions policy in Iraq. By using military force without provocation, Washington and London sacrificed whatever potential effectiveness or morality may have remained in the continued use of sanctions. By acting without the approval of the Security Council and against the wishes of key member states, the United States and Britain undermined the authority of the United Nations and the legitimacy of the UN mission in Iraq.

The resort to bombing indicated that Washington and London no longer have confidence in the ability of sanctions to pressure Iraq to comply with weapons inspections. They have rejected the option of using sanctions as an instrument of carrots and sticks diplomacy to obtain a just resolution. Sanctions have now become secondary to the use of military force and have lost their claim to ethical purpose. They have become merely instruments of punishment that cause suffering for the vulnerable. U.S. officials seem to be aware of the moral difficulties of such a policy and have responded by offering to expand the oil-for-food program, but this ameliorative program cannot resolve the underlying immorality of continuing comprehensive trade sanctions.

In the aftermath of the bombing, divisions and uncertainty about the UN mission in Iraq have increased. American officials oppose the completion of weapons inspections and argued instead

for a policy of containment enforced through continued sanctions and the threat of military force. Members of the Russian Duma, angered by the U.S. and British military action, argued for unilaterally abrogating the sanctions, and resuming trade with Iraq. French policymakers spoke vaguely of a new mission for UNSCOM and an easing of trade sanctions. The bombing seems to have pushed UN policy further away from securing Iraqi compliance with weapons inspections, and toward a narrowly punitive mission directed exclusively by the United States and Great Britain with yet again Iraqi citizens being the victims. Such a policy cannot meet the standards of effectiveness, morality, and authority.

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March 1999

Notes

1. Some, such as Joy Gordon, "Using a Pick-Axe for Brain Surgery: The Ethics of Economic Sanctions and Their Predictable Consequences," *Ethics and International Affairs* 11 (forthcoming), would contend that outsiders cannot find fault with a government that seeks to use its resources for national defense when it is besieged by sanctions.
2. House Committee on International Relations, *U.S. Policy Toward Iraq: Hearing Before the Committee on International Relations*, 104th Cong., 2d sess., 28 March 1996, pp. 40-45: Vladimir Orlov and William C. Potter, "The Mystery of the Sunken Gyros," *The Bulletin of the Atomic Scientists* 54, no. 6 (November/December 1998), 34-39.
3. Kenneth Katzman, "Iraq: March Arabs and U.S. Policy," report to Congress by the Congressional Research Service, Library of Congress, Washington, D.C., 13 April 1994.
4. The government continued to impede the program even after it began by interrupting oil sales and delaying the submission of the distribution and pricing plans. From June through August 1997 Iraq halted all oil exports, creating a substantial shortfall in revenues for humanitarian relief. According to the Secretary General, Iraq's decision to forego oil deliveries during this period was the most important factor in slowing the pace of aid deliveries. See *Report of the Secretary*

General Pursuant to Paragraph 7 of Resolution 1143 (1997), S/1998/90, 1 February 1998, p5. When the relief program was extended in December 1997 Baghdad again failed to provide the required distribution plan and interrupted oil exports for a month. The Secretary General's September 1998 report on the program noted additional delays resulting from the failure of the Iraqi government to submit simplified pricing mechanisms that would expedite the delivery of supplies. See *Report Pursuant to Resolution 1153*, S/1998/823, 8.

5. These and other incidents remind us that the Iraqi government is one of the most abusive on earth. The February 1997 report of the UN Special Rapporteur describes Iraq as "a dictatorial, totalitarian state which allows no political dissent." The corruption and criminality of the regime have rendered "the whole population subject to the arbitrary, widespread, and self centered interests of a privileged class of government officials and Baath party leaders." Recent abuses by the regime include "mass arrests followed by many executions" reportedly numbering in the thousands in response to an assassination attempt against Saddam Hussein's eldest son Uday in December 1996. The UN observer also reports more than 16,000 unresolved cases of disappearances, which gives Iraq "decidedly the worst record in the world" in this grisly category. See UN Commission on Human Rights, *Report of the Situation of Human Rights in Iraq, Submitted by the Special Rapporteur of the Commission on Human Rights, Mr. Max van der Stoep, Pursuant to Commission Resolution 1996/72*, E/69.4/1997/57, 21 February 1997, 3-4.

6. See our previous writing on these matters in George A. Lopez and David Cortright, "The Sanctions Era: an Alternative to Military Intervention?" *The Fletcher Forum of World Affairs* 19, no. 2 (May 1995): and Cortright and Lopez, *Economic Sanctions*.

7. See David Cortright and George A. Lopez, "Carrots, Sticks, and Cooperation: Economic Tools of Statecraft," in *Cases and Strategies for Preventive Action*, edited by Barnett R. Rubin (New York: Twentieth Century Fund, 1998), 113-34.

8. Albright, "Preserving Principle and Safeguarding Stability."

9. Quoted in Barbara Crossette, "For Iraq, A Doghouse with Many Rooms," *The New York Times*, 23 November 1997.

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Appendix A

Demographic Indicators

Data since the national 1987 demographic census are based on projections. A wide variety of inconsistent sources are available. None of these can be confirmed until detailed analysis of the 1997 census becomes available.

Major sources of demographic estimates come from *Middle East Report (MER)* (@Facts and Figures/The Impact of Sanctions in Iraq,@ compiled by Pamela Ording-Beecraft and Sally Ethelston, *Middle East Report* No. 206, Vol. 28, no. 1 (Spring 1998): 4) the *CIA World Factbook (CIA)*, the *Gulf Health Survey*, *State of the World=s Children Report*, and the *U.S. Census (USC)*. These data are presented in the following tables A1 through A6.

Of greatest importance for this analysis is the trend, over time, of the total fertility rate.

Economic decline is normally associated with declining family formation and fertility, and this has been reported anecdotally for Iraq as well (66). But population movement to rural areas, growth of labor participation in agriculture, declining female education, and a desire to replace perceived excess deaths due to war and embargo in Iraq may be associated with increased fertility. Fertility and migration are key for interpreting the effect of changes in mortality rates on population growth.

The total number of expected deaths in 1991 was approximately 105,000 (26). Of these, 30,000 were expected among children under fifteen years, 39,000 were expected among males fifteen or older, and 36,000 were expected among females fifteen or older. Life expectancy in Iraq was 67.8 years. About 816,000 births were expected.

Table A1: Estimated Crude Deaths per One Thousand Population

Year	SOWC	ACCD	MOH	CIA	MER
1988	8		8	–	7.2
1989		8	8	8	7.2
1990				7	7.2
1991				7	10.4
1992				9	10.4
1993				7	10.4
1994				7.26	10.4
1995				6.82	10.4
1996				6.57	–
1997				6.33	–

Table A2: Estimated Crude Births per One Thousand Population

	SOWC	GCHS	ACCD	MOH	CIA	MER
1988	42			43	--	40.3
1989		33	33	43	45	40.3
1990					46	40.3
1991					46	38.4
1992					45	38.4
1993					46	38.4
1994					44.1	38.4
1995					43.6	38.4
1996					43.1	–
1997					42.5	–

Table A3: Estimated Total Lifetime Births per Woman

Year	SOWC	GCHS
1988	6.3	
1989		5.3
1990		
1991		
1992		
1993		
1994		
1996		
1997		

Table A4: Estimated Crude Fertility Growth Rate per One Hundred Population

Year	MOH	CIA	MER	UNICEF
1988	3.5	3.5	3.3	
1989	3.5	3.8	3.3	
1990		3.9	3.3	
1991		3.9	2.8	
1992		3.5	2.8	
1993		3.9	2.8	3.6
1994		3.7	2.8	
1995		3.7	2.8	
1996		3.7	–	
1997		3.6	--	

Table A5: Estimated Total Population in Millions

Year	MOH	CIA	USC	MER	UNICEF
1988		17.583	17.038	–	
1989		18.074	17.568	18.100	
1990		18.782	18.135	–	
1991		19.525	17.490	–	
1992		18.446	17.905	–	
1993		19.162	18.480	–	18,949
1994	20.007	19.890	19.083	–	
1995		20.644	19.713	–	
1996	21.800	21.422	20.367	–	
1997	22.504	22.219	21.037	21.200	

Table A6: Estimated Total Population Under Five Years of Age in Millions

Year	MOH	GCHS	Synthetic Projection
1988			
1989		2.639	2.639
1990	2.997		2.756
1991	3.107		2.921
1992	3.728		3.096
1993	3.445		3.282
1994	3.635		3.479
1995			3.688
1996			3.909
1997			4.144

Appendix B

Table B1: Sheik Omar Health Center, Baghdad

Organization (Reference)	Location	Method	Age Group	Number Sampled	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height) (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Validation Study Done	Access to Original Data
UNICEF(54)	Sheik Omar Health Center, Baghdad	Clinic Users	U3	620 children	1/89-8/90	8	B	B	Only those visiting clinic Not U5 Not national		
Al-Hadi(61)	Sheik Omar Health Center	Hospitalized Patients	U3	620 children	90, pre-sanction	4.5	-	-	Only those in hospital Not U5 Not national		
UNICEF(54)	Sheik Omar Health Center, Baghdad	Clinic Users	U3	1060 children	8/90-12/90	10	B	B	Only those visiting clinic Not U5 Not national		

Organization (Reference)	Location	Method	Age Group	Number Sampled	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Validation Study Done	Access to Original Data
Al-Hadi(61)	Sheik Omar Health Center, Baghdad	Hospitalized Patients	U3	1060 children	90, prewar	4.5	-	-	Only those in hospital Not U5 Not national		
UNICEF(54)	Sheik Omar Health Center, Baghdad	Clinic Users	U3	1412 children	1/91-5/91	11	B	B	Only those visiting clinic Not U5 Not national		
Al-Hadi(61)	Sheik Omar Health Center, Baghdad	Hospitalized Patients	U3	1412 children	5/91	9.2	-	-	Only those in hospital; not U5 Not national		
UNICEF (58)	Sheik Omar Health Center, Baghdad	Clinic Users	U3	1259 children	3/92	12	B	B	Only those visiting clinic		

Organization (Reference)	Location	Method	Age Group	Number Sampled	Survey Dates	Weight for Age (Underweight, Chronic and/or Acute)	Weight for Height (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Validation Study Done	Access to Original Data
									Not U5 Not national		

Table B2: Baghdad

Organization (Reference)	Location	Method	Age Group	Number Sampled	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Validation Study Done	Access to Original Data
International Study Team (57)	Baghdad	Stratified Random Cluster (74)	U5	520	8/91	6.9	3.1	12.2	Clustering Not national	yes	no
Catholic Relief Services (34)	Baghdad	?	U5	315	12/91	17	11	9	Not national Selection criteria unknown		
Naosh and Obeid (61)	Baghdad	19 Schools	6 - 9 year olds	1239 children	5/92	6	1	10	Not national Not U5 Selection criteria unknown		
FAO/NRI (61)	Saddam City, Baghdad	Cluster Sample	U5	194 children	93	35	16	30	Clustering Not national		
FAO/NRI (20)	Saddam City,	Cluster Sample	U5	692 houses	8/95	29	12	28	Clustering Not national		

Organization (Reference)	Location	Method	Age Group	Number Sampled	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Validation Study Done	Access to Original Data
	Baghdad			25 clusters 594 children							
CESR	Baghdad	Cluster Sample	U5	?	4/96				Clustering Not national	yes	no
FAO (40)	Baghdad	Polation Based	U5	900 children	6/97	11.3	3.3	15.7	Clustering Not national	yes	no

Table B3: Other Individual Governorates

Organization (Reference)	Location	Method	Age G r o u p	Number Sampled	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height) (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Validation Study Done	Access to Original Data
Helen Keller/ UNICEF(34)	Basrah	?	U6	231	5/91	40	10	18	Not national Not U5		
Tufts U. (12)	Basrah/Amar a	Convenience Sample	U5	680	6/91	26	4	39	Not national Not representative sampling		
UNICEF (34)	Basrah	?	U5	742	7-8/91	22	7	21	Not national		
W. Al-Doori (61)	Basrah	Urban Health Centers	U5	?	9/91	8	22	22	Possibly Biased Sampling Not national		
CDC (55)	Kurdish Camps in northern Iraq	?	U5	?	5/91	B	4.1	B	Not national Sampling method unknown		
UNICEF (56)	Kurdish	?	U5	900	5/91	32	B	29	Not national		

Organization (Reference)	Location	Method	Age G r o u p	Number Sampled	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height) (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Validation Study Done	Access to Original Data
	Camps in Iran								Sampling method unknown		
Obeid (61)	Muthana	4 health centers	U5	78 children	3/92	19	10	35	Not national; Small sample		
Obeid (61)	Wasit	B	U5	600 urban; 250 rural children	1/92	13u/9r	5u/0r	-	Not comparable with GCHS reference population Sampling method unknown		
FAO (40)	Kerbala	Population Based	U5	158 children	6/97	18.1	5.1	26.8	Not national		

Table B4: The Northern Region

Organization (Reference)	Location	Method	Age G r o	Number Sampled	Survey Dates	Weight for Age (Under	Weight for Height)	Height for Age	Limitations	Validation Study	Access to Original
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			u p			weight, Chronic and/or Acute)	(Wasting Acute)	(Stunting Chronic)		Done	I Data
International Study Team (57)	3 Northern Governorate s	Stratified Random Cluster (300)	U5	606	8/91	19.1	4.5	29.5	Does not include displaced Clustering	yes	no
UNICEF (64)	3 Northern Governorate s	Household Survey	U5	?	12/94	25.8	4.2	37.3			
UNICEF/ CSO/NRI (35)	3 Northern Governorate s	Household Survey	U5	87 Clusters 2175 Homes 1799 children	8/96	19.3	3.8	26.3	Clustering	yes	yes
MOH/ UNICEF (49)	3 Northern Governorate s	Household Survey	U5	90 clusters, 2328 children	11-12/97	15.9	3.2	30.3	Clustering	yes	yes
UNICEF (64)	3 Northern Governorate s	30 PHC Centers	U5	?	4/98	15.1	2.7	25.3			

Table B5: Under One-Year-Olds

Organization (Reference)	Location	Method	Age Group	Number Sampled	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Validation Study Done	Access to Original Data
WFP/ UNICEF (47)	3 Northern Governorates	Stratified Sample of 850 Health Centers	U1	?	4/97	14.7	9.0	15.3	Clinic Users		
UNICEF/ CSO/NRI (35)	15 Central and Southern Governorates	Multistage Stratified Cluster	U1	3,153 children	8/96	14.1	13.1	13.7	Clustering		
UNICEF/ FAO/NRI (48)	15 Central and Southern Governorates	Stratified Sample of 850 Health Centers	U1	3153 children	10/97	14.6	7.5	12.6	Clinic Users	yes	no
MOH/WFP/ UNICEF (59)	15 Central and Southern Governorate	Stratified Sample of 850 Health Centers	U1	About 4000 children	3/98	13.2	8.3	16.2	Clinic users		

Organization (Reference)	Location	Method	Age G r o u p	Number Sample d	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height) (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Vali dation Study Done	Access to Origina l Data
	s										

Table B6: Central and Southern Regions

Organization (Reference)	Location	Method	Age G r o u p	Number Sampled	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height) (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Vali dation Study Done	Access to Origina l Data

Organization (Reference)	Location	Method	Age G r o u p	Number Sampled	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Vali dation Study Done	Access to Origina l Data
Internationa l Study Team (57)	14 Central and Southern Governorate s	Stratified Random Cluster (300)	U5	1484	8/91	10.2	2.9	21.7	Clustering	yes	no
UNICEF/ CSO/NRI (36)	15 Central and Southern Governorate s	Multistage Stratified Cluster	U5	255 Clusters 6392 children	8/96	23.4	11.0	32.0	Clustering		yes
UNICEF/ FAO/NRI (47)	15 Central and Southern Governorate s	Stratified Sample of Health Centers	U5	15,466 children	4/97	24.7	8.9	27.5	Clinic users	yes	no
MOH/WFP/ UNICEF (59)	15 Central and Southern Governorate s	Stratified Sample of 850 Health Centers	U5	87 Health Centers, 15,621 children	3/98	26.7	9.1	22.8	Sample weighted toward younger ages; Clinic users only		

Table B7: The Entire Country

Organization (Reference)	Location	Method	Age G r o u p	Number Sample d	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height) (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Vali dation Study Done	Access to Origina l Data
Internationa l Study Team (57)	17 Governorate s	Stratified Random Cluster (299)	U5	2676	8/91	9.2	3.0	18.7	1 Governorate not included; cluster effect	yes	no
UNICEF/ CSO/NRI (35,36)	18 Governorate s	Multistage Stratified Cluster	U5	6375 children	8/96	23.4	11.0	32.0	Clustering		
UNICEF/ FAO/NRI (47,48)	18 Governorate s	Stratified Sample of 850 Health Centers	U5	15466 children	4/97	24.7	8.9	27.5	Clinic Exit Interview	yes	no

Organization (Reference)	Location	Method	Age G r o u p	Number Sample d	Survey Dates	Weight for Age (Under weight, Chronic and/or Acute)	Weight for Height) (Wasting Acute)	Height for Age (Stunting Chronic)	Limitations	Vali dation Study Done	Access to Origina l Data
MOH/WFP/ UNICEF (49)	18 Governorate s	Stratified Sample of 850 Health Centers	U5	About 4000 children	3/98	22.8	9.1	26.7	Clinic Exit Interview		

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