Civil Wars Kill and Maim People—Long After the Shooting Stops

HAZEM ADAM GHOBARAH *Harvard University*
PAUL HUTH *University of Michigan*
BRUCE RUSSETT *Yale University*

Political scientists have conducted only limited systematic research on the consequences of war for civilian populations. Here we argue that the civilian suffering caused by civil war extends well beyond the period of active warfare. We examine these longer-term effects in a cross-national (1999) analysis of World Health Organization new fine-grained data on death and disability broken down by age, gender, and type of disease or condition. We test hypotheses about the impact of civil wars and find substantial long-term effects, even after controlling for several other factors. We estimate that the additional burden of death and disability incurred in 1999, from the indirect and lingering effects of civil wars in the years 1991–97, was approximately equal to that incurred directly and immediately from all wars in 1999. This impact works its way through specific diseases and conditions and disproportionately affects women and children.

The direct and immediate casualties from civil wars are only the tip of the iceberg of their longer-term consequences for human misery. That civil wars kill and maim people is hardly surprising. But it is not just a matter of direct war casualties during the conflict. Civil wars continue to kill people indirectly, well after the shooting stops. These new deaths (and disabilities) are overwhelmingly concentrated in the civilian population.[1] The health effects during specific civil wars are relatively well known,[2] but the general and longer-term impact is not. Our aim is to examine the systematic longer-term effects of civil wars on public health. This study is part of a larger research program on the comparative analysis of the political determinants of public health conditions in many countries. We believe that politics plays an important role in shaping public health, but there is only limited systematic research by political scientists on the topic (recent examples are Price-Smith 2002 and Przeworski et al. 2000). Here we focus on the impact of political violence on public health by developing and testing hypotheses about the long-term consequences of civil war for civilian populations.

In prior research we found that civil wars significantly reduced aggregate measures of national health performance (Ghobarah et al. 2001). In that study we worked with national-level data on all countries compiled by the World Health Organization (WHO) on DALE, or disability-adjusted life expectancy. This measure takes into account both years of life lost to disease and injury and years of healthy life lost to long-term disability. In this study we build on these initial findings to examine more fully both theoretically and empirically the ways in which civil wars produce longer-term impacts on public health conditions in countries. Specifically, we use another WHO data set: one on DALYs, or disability-adjusted life-years, which contains detailed information on 23 major diseases and conditions on categories of the population distinguished by gender and five age groups. We focus on the effects of civil war in increasing the subsequent incidence of death and disability due to particular infectious diseases and conditions in the different population subgroups.

Overall, WHO (2000, 168, 174) estimates that 269,000 deaths and 8.44 million DALYs were incurred in 1999 as direct and immediate effects of all wars, civil and international. Based on the results we report in this paper, we estimate that nearly as many additional DALYs—another 8.01 million—were lost in 1999 indirectly under various disease groups, as a result of the lingering effects of civil wars during the years 1991–97.

We address two important gaps in existing research on war: (1) the consequences of armed conflict and war for civilian populations (Stein and Russett 1980) and (2) the study of peace building in the aftermath of civil war. Concerning the first gap, the systematic study of war focuses heavily on the onset of armed conflict, with additional literatures addressing various aspects of the

Hazem Adam Ghobarah is Post Doctoral Fellow, Center for Basic Research in the Social Sciences, 34 Krikland St., Harvard University, Cambridge, MA 02138 (hmg@latte.harvard.edu).

Paul Huth is Professor of Political Science, Center for Political Studies, 426 Thompson Street, P.O. Box 1248, University of Michigan, Ann Arbor, MI 48106-1248 (phuth@umich.edu).

Bruce Russett is Dean Acheson Professor of International Relations, Department of Political Science, Yale University, New Haven, CT 06520 (bruce.russett@yale.edu).

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[1] Estimates run as high as 90% of all war deaths in the late twentieth century being civilians (Ahlstram 1991), but such estimates are not reliable (Goldstein 2001, 399–402). Davis and Kuritsky (2002) report that severe military conflict in sub-Saharan Africa cut life expectancy by more than 2 years and raised infant mortality by 12 per thousand.

[2] The one-year impact of infectious disease and health system breakdowns associated with refugees is well established (Toole 1997). War-related deaths from tuberculosis during the war in Guinea-Bissau are documented by Gustafson et al. (2001); Roberts et al. (2001) report war-derived disease deaths in Congo during the war as six times more frequent than those from direct violence. Effects beyond the war period are less clear, though the longer-term risk from tuberculosis, respiratory infections, and malaria is well recognized (Centers for Disease Control and Prevention 1992).

military conduct and outcome of wars in which states and national armed forces are the primary unit of observation. Political scientists rarely address the wartime consequences for civilians, and even more unusual are studies of the postwar consequences for civilian populations. This is an important omission, since the severity of war for civilians in both the immediate and the longer term varies considerably across wars and deserves careful theoretical and empirical analysis. We begin to address this gap by focusing on the civilian consequences of civil wars that extend into postwar periods.

Regarding the second gap, the literature focuses largely on outside intervention into civil wars and its impact on the termination of wars and the prospects for successful peace building in post-civil war periods (e.g., Doyle and Sambanis 2000, Hartzell et al. 2001, Regan 2000, and Walter 2002). This valuable peace-building literature addresses political consequences such as political stability, the recurrence of violence, and democratization. Our work addresses post-civil war developments, but instead of focusing on political outcomes as dependent variables, we concentrate on public health conditions and performance as the outcomes to be explained. These outcomes are important in their own right and also have consequences for more familiar political variables (e.g., Price-Smith 2002, chap. 2).

NEW MEASURES OF PUBLIC HEALTH

WHO's new measure of overall health achievement (DALE) discounts the total life expectancy at birth in each country by the number of years the average individual spends with a major disability as the burden of disease or injury—the gap between total life expectation and expected years without disability. It is estimated from three kinds of information: the fraction of the population surviving to each age level (calculated from birth and death rates), individual-level data on the incidence and prevalence of various diseases and disabilities at each age, and the weight assigned to debilitation from each type of condition. The result is the proportion of the population dying or suffering from disabilities, given the average number of years of healthy life that a newborn member of the population could expect to live.

The measure taps the concept of years of healthy and productive life, and so is expressed in intuitively meaningful units. It varies substantially by region of the world and income level. In rich countries, more disabilities are associated with chronic conditions of old age—and, at that point, relatively short life expectancies. In contrast, in poor tropical countries infant mortality is much higher, and more health problems derive from the burden of infectious diseases, such as malaria and schistosomiasis, which are carried by children and young adults who may live a long time with seriously impaired health and quality of life. Empirically, the share of simple life expectancy lost to disability varies from under 9% in the healthiest regions of the world to over 14% in the least healthy ones (WHO 2000, 28).

This information-intensive measure requires not just vital registration data for births and deaths, but expensive health surveys of death, disease, and disability by age and gender—in principle in each country. These data began to be collected on a global basis by WHO only for the year 1990 (Murray and Lopez 1996), with a comprehensive report being its 1999 survey (WHO 2000). Life tables for 1999 for all 191 WHO members were developed from surveys supplemented by censuses, sample registration systems, and epidemiological analyses of specific conditions. WHO experts provided estimates of their degree of uncertainty about the data's accuracy, subjected it to a variety of statistical tests for incompleteness and bias, and adjusted it accordingly. Then they estimated disease-specific disability rates for all countries in each of 14 regions of the world defined geographically and epidemiologically and used these to adjust available data on death rates at different age levels and life expectancy for each country (Mathers et al. 2000). The index of expected disability-free life ranges from 74.5 (Japan) to 29.5 (Sierra Leone), with a median of 60.9 (Belize).

While the limitations need to be borne in mind, these data are the best that have ever been available and permit us to make some plausible systematic inferences about the influences on health conditions across countries.[3] Our dependent variable is disaggregated by WHO from the summary DALE estimates. This measure (DALY) measures the effect of death and disability on population groupings comprised of each gender in five age groups (zero–four, five–14, 15–44, 45–59, and 60 and older). These breakdowns are valuable because vulnerability to different diseases varies widely by age and gender. The data were initially compiled on the number of deaths in a year from each of more than 100 categories of disease or health condition. To the deaths are added estimates of the years of healthy life typically lost due to disability from the incidence of the condition and the estimated number of new cases in the period. The number of years of healthy life lost is obtained by multiplying the average duration of the condition (to remission or death) by a severity weight for the disability. Thus the DALYs for 1999—aggregated by WHO into 23 major disease categories for analysis—reflect the life-years lost due to deaths from a particular condition contracted during the year plus the expected disability to be incurred by other people who suffered from the same condition in that same year.[4] In other words, these are not disabilities incurred from conditions contracted in earlier years directly from wartime violence.[5]

[3] See Williams 1999, Murray and Lopez 2000, and Filmer and Pritchett 1999, 1312.

[4] More information on the procedures can be found in WHO 2000, 145–46, and DALYs are displayed by disease category, gender, and region in WHO 2000, 170–75. DALE and life expectancy correlate highly ($r = .99$); DALE's attractiveness is its breakdown, in DALYs, of specific disease effects by age and gender.

[5] Though our civil war data stop at the end of 1997, in 10 of the 34 cases the civil war continued as late as 1999, and our analysis takes it into account.

THEORETICAL FRAMEWORK

In developing hypotheses about the longer-term effects of civil war on public health, we draw on a general theoretical framework for studying the causes of public health. Within this framework we begin by discussing the general relationships between politics and public health and then elaborate the more specific causal connections linking civil war to public health. In broad theoretical terms, there are four major influences on public health in societies, and political conditions and processes in turn are important causes of each of these major influences on health. To summarize, health conditions are shaped by the interplay of exposure to conditions that create varying risks of death and disease for different groups in society and the ability of groups in society to gain access to health care and receive the full range of benefits produced by the health-care system. Public health performance thus reflects the political competition among groups over investment and resource decisions regarding the level and distribution of health services.

The Extent to Which Populations Are Exposed to Conditions That Increase the Risk of Death, Disease, and Disability. At the most basic level, populations across and within countries are exposed in varying degrees to the risk of disease, injury, and death. Geography and levels of economic development are basic factors. People in tropical climates are at greater risk of many infectious diseases. In poor countries much of the population lives in rural areas where access to health care and its quality are generally lower than in urban areas. As a result, preventive care is less available and the treatment of disease and injury is less extensive and effective. At the same time, health-care systems often lag in large urban areas experiencing rapid population growth, with the result that some urban populations are at greater risk to a variety of health problems (Foege 2000; Garrett 2001; Shah 1997).

The Financial and Human Resources Available for Addressing the Public Health Needs of Populations. Higher levels of income and wealth provide a larger pool of financial and human resources on which to draw. Public and private actors can afford to spend more on health care needs and to support the development and purchase of more advanced medical technologies. A larger pool of available financial resources will enable greater investments in developing human resources for medical care through training more doctors and health-care specialists. One major influence of politics on the pool of available resources for the public health-care system stems largely from the disruptive effects of political instability on economic growth. Irregular transfers of political power and political unrest in nondemocratic systems reduce growth rates (Przeworski et al. 2000, chap. 4).

The Level of Resources Actually Allocated to Public Health Needs by the Private and Public Sectors. Public health analysts consistently argue that education levels in society affect public health (e.g., Evans et al. 2000a). A more educated population is likely to be more knowledgeable of health risk factors, to support greater investments and expenditures, and to utilize health-care services. But claims to resources for public health compete with other demands, and politics can prove crucial in deciding how resources are allocated. Political leaders wish to retain power. They must form a winning coalition and satisfy a sufficient portion of those who are politically active. To do so they distribute private goods to their supporters and provide collective goods widely for the population. All leaders provide both private and collective goods in some degree. But since democratic leaders have to satisfy a wider range of supporters, not just a small segment of their cronies and the military, they are less able than authoritarian leaders to extract rents for the private benefit of small groups and must respond more to broad demands for public well-being (Bueno de Mesquita et al. 1999; Lake and Baum 2001; Olson 1993). They are more likely to invest in public goods such as better public health services because populations will hold them accountable for failing to address basic and pressing health-care problems. For example, famines are much more common in authoritarian states (Sen 1981), which spend less either to prevent them or to relieve their consequences. Przeworski et al. (2000, 239) report that the strong effect of democracy in lowering infant mortality operates largely through health expenditures, and our previous research found a strong impact of democracy on increasing public health expenditures (also Dasgupta 1993; Ghobarah et al. 2001; Moon 1991, chap. 6).

The Degree to Which Resources Actually Allocated to Public Health Are Efficiently Utilized. Public health services may not be directed to groups with the greatest need. Political institutions and practices increase or decrease health risk factors for populations by influencing their access to services offered by the public health-care system. Political influence plays a crucial role in determining who has full or limited access to the benefits offered by the health-care system. For example, income inequalities in society often translate into political inequalities; consequently the health needs of low-income groups may be neglected (Foege 2000; Moon 1991; Moon and Dixon 1992; Szreter 2001; Wilkinson 1996). Although lower-income groups are often at greater risk of health problems and therefore in need of public health services, such groups are likely to be less effectively represented in the political competition for scarce resources. Consequently, access to health-care services is skewed in favor of wealthy segments of the population that, on average, are healthier and less at risk.

HYPOTHESES ON CIVIL WAR AND PUBLIC HEALTH

This outline of general causal connections between politics and public health allows us to focus specifically on the theoretical linkages between civil war and long-term health. Our central claim is that civil wars produce adverse longer-term consequences for public health that extend well beyond immediate wartime effects to the postwar period. We posit two related hypotheses.

H1: More DALYs are lost with the occurrence and increasing severity of civil wars within a country.

H2: More DALYs are lost if a geographically contiguous state has had a civil war.

The logic behind these hypotheses corresponds to the four major influences on public health identified above.

Civil Wars Raise the Exposure of the Civilian Populations to Conditions that Increase the Risk of Disease, Injury, and Death. Prolonged and bloody civil wars are likely to displace large populations, either internally or as refugees. The Rwanda civil war generated not only 1.4 million internally displaced persons, but another 1.5 million refugees into neighboring Zaire, Tanzania, and Burundi. Often these people do not return to their original homes after the war ends but remain in makeshift camps for years. Epidemic diseases—tuberculosis, measles, pneumonia, cholera, typhoid, paratyphoid, and dysentery—are likely to emerge from crowding, bad water, and poor sanitation in camps, while malnutrition and stress compromise people's immune systems. As a result, in many countries ravaged by civil wars the crude mortality rates among newly arrived refugees were five to 12 times higher than the normal rate (Toole 2000). Children may be especially vulnerable to infection.

Nondisplaced populations are at greater risk, as the camps become vectors for transmitting disease to other regions. Prevention and treatment programs already weakened by the destruction of health-care infrastructure during civil wars become overwhelmed as new strains of infectious disease bloom. For example, efforts to eradicate Guinea worm, river blindness, and polio—successful in most countries—have been severely disrupted in states experiencing the most severe civil wars. Drug-resistant strains of tuberculosis can develop and, in turn, weaken resistance to other diseases. It is likely that the spread of AIDS in Africa has been greatly increased by war-induced refugee movements (Epstein 2001; Reid 1998).

Finally, violence is likely to rise in the aftermath of long and severe civil wars (Bracken and Petty 1998; Pederson 2002). Homicide and other crime rates rise within countries during international wars, tending to peak in the first year after the war (Archer and Gartner 1976; Stein 1980). Gerosi and King (2002) report a significant rise in homicides and suicides, transportation deaths, and other unintentional injuries (both the latter are likely to include misclassed suicides) in the U.S. population immediately following the Korean and Vietnam wars. If international war has this effect, certainly the direct and immediate experience of civil war will do so. These social and psychological changes are magnified by the widespread availability of small arms after many civil wars. The victims as well as the perpetrators may be disproportionately among young men.

Civil Wars Produce Longer-Term Negative Consequences for Public Health by Reducing the Pool of Available Financial Resources for Expenditures on the Health-Care System. Civil war is an extreme form of political instability that reduces economic growth. Poor economic performance cuts the pool of tax revenues that governments can draw upon to finance health care. One study concludes that civil wars typically have a severe short-term (approximately five-year) negative impact on economic growth (Murdoch and Sandler 2002). A weak economy and lower profit margins also decrease the contributions the private sector can devote to employee health and the resources individuals can draw on to compensate for reductions in state or employer contributions to health care.

Civil wars also deplete the human and fixed capital resources needed for a health-care system. For example, heavy fighting in urban areas is likely to damage or destroy clinics, hospitals, and health-care centers; rebuilding this infrastructure is unlikely to be completed quickly in the postwar period. Finally, severe civil wars may induce a substantial flight of highly trained medical professionals, and this loss of human capital may not be reversed by their prompt return or replacement by newly trained health workers until long after the wars end.

Civil Wars Produce Strong Pressures to Constrain the Level of Resources Allocated to the Public Health-Care System in the Aftermath of War. Leaders in post-civil war governments face multiple and pressing competing demands for public expenditures. Long and destructive civil wars produce such fundamental needs (a) for a broad range of economic reconstruction, (b) to reform and rebuild army and police forces, judicial systems, and the state administrative capacity, and (c) for military and security spending in response to continuing military threats. Pressures to devote resources to military capabilities raise the classic question about trade-offs between military spending and nondefense needs such as public health (e.g., Adeola 1996, Ball 1988, DeRouen 2000, and Mintz 1989). Security threats may derive from internal insurgent groups, or from a powerful military force built up by a neighboring state to fight its own civil war. (See Braveman et al. 2000 on Nicaragua and Grobar and Gnanaselvam 1993 on Sri Lanka, as well as Collier and Hoeffler 2001 and Murdoch and Sandler 2002.) Despite needs for better health care, the multifaceted demands of post-civil war peace building and recovery make resource trade-offs involving health-care spending hard to avoid (Collier 1999; Stewart 1993).

Civil Wars Reduce the Efficient Use of Resources That Are Allocated to Public Health, and These Reductions in Efficiency Extend into the Post-Civil War Period. The destruction of a health infrastructure that supported surveillance and control programs for diseases such as tuberculosis, malaria, and yellow fever sows the seeds of both short- and long-term health problems. Civil wars reduce the productivity of the entire economy, especially of facilities needed to maintain previous levels of health care. Wartime destruction and disruption of the transportation infrastructure (roads, bridges, railroad systems; communications and electricity) weakens the ability to distribute clean water, food, medicine, and relief supplies, both to refugees and to others who stay in place. It also means, as previously noted, the destruction of hospitals and other health-care facilities and the departure of medical personnel. Military forces often deliberately target health-care facilities so as to weaken the opposition. Much of this takes years to restore. Shortages and limited access severely strain health-care professionals' ability to deliver treatment and aid efficiently.

These theoretical underpinnings for the causal impact of war on health lead us to the measurement of our key variable: civil wars. For *H1* we use deaths from civil war in the years 1991 to 1997, which becomes a measure of both the existence and the severity of civil war when expressed as the number of deaths per 100 people in the country.[6] Civil wars are defined as armed conflicts resulting in 1,000 or more fatalities per year among regular armed forces, rebel armed forces, and civilians directly targeted by either. Years and fatality figures were derived from the leading data sets on civil war compiled by scholars (Doyle and Sambanis 2000; Licklider 1995; Regan 2000; Singer and Small 1994; Wallensteen and Sollenberg 2000). For most countries the value is 0; for the 34 countries experiencing civil war during the period it ranges from 0.2 to 9.69 (Rwanda).

Using civil war deaths in the years 1991–97 gives us a lag to the DALY rates for 1999. Theory does not tell us that there is a single correct lag. For most infectious diseases—which we hypothesize as the principal cause of indirect civil war deaths—the lag time would seem short (less than five years), while the effects of damage to the health-care system would probably last longer (between five and 10 years). The lag for some cancers could be so long that we cannot reasonably test for many of them.[7]

For *H2* the operational measure is a dichotomous variable, coded 1 if any contiguous state experienced a civil war in the period 1989–98 and 0 if not.[8] Contiguity is defined as sharing a land border or being separated by 12 miles or less of water.

CONTROLLING FOR OTHER CAUSES OF PUBLIC HEALTH

While our primary focus is on the impact of civil wars on public health, we need to control for several other factors that public health scholars and health economists have argued are important causes of cross-national variation in public health.

H3: The higher the level of total health expenditures, the fewer DALYs are lost.

Higher income improves health *through* public and private decisions to spend money on hospitals, preventive and curative health care, sanitation, and nutrition. Earlier work by economists such as Pritchett and Summers (1996) showed that "wealthier is healthier," and we build on their findings with a wider set of countries and a finer-grained causal argument about *how* higher income leads to better health. Per capita income does not directly determine the production of health outputs. Rather, it permits a high level of health expenditures, and though highly collinear ($r = .90$) with income, expenditure levels are also influenced by the political process and institutions. And expenditures are subsequently distributed in a political process that produces actual health outcomes. Thus our full two-stage model, in the economics tradition of production function analysis, treats income as a key variable in explaining the level of health expenditures. In this analysis we follow WHO (Evans et al. 2000a, 13) in using total health expenditures per capita (1998) as a theoretically satisfying variable to incorporate those prior political processes that affect spending, which in turn makes a direct impact on health outcomes.[9]

We use the estimates of total health expenditure compiled by WHO, which began with International Monetary Fund (IMF) and national sources, supplemented by national accounts data from United Nations and Organization for Economic Cooperation and Development (OECD) sources and household surveys and WHO estimates (Pouillier and Hernandez 2000). Total health spending per capita ranges from \$4,055 (United States) to \$11 (Somalia), with a median of \$197 (Thailand). WHO authors estimate that it is very difficult for countries to provide good health outputs below a total expenditure of about \$60 per capita and that it would cost just over \$6 billion per year to bring up to this threshold the 41 countries with lower expenditures (Evans et al. 2000a, 24). Because these distributions are skewed we use the natural logarithms, which also reflect the declining marginal product of additional dollars at higher levels of spending. Following WHO's practice, we use total health expenditures as an

[6] Duration and severity are moderately correlated ($r = .41$). Further research might look for a difference in effects between long but smoldering conflicts and short but intense ones.

[7] We ran several sensitivity checks for the results reported in the section below on data analysis. As expected, very long lag structures such as 1977–90 produce much weaker findings in which the coefficient for the civil war variable is only about one-fourth as large as for 1991–97 and not statistically significant. A break between 1991–95 and 1996–97 shows a greater impact for the latter period, but the standard error is higher. Eliminating all countries whose civil wars extended past 1997 reduces the impact of wars in 1996–97 but not that of earlier wars. It is also possible that victorious rebels may redistribute health-care resources so as to redress previous inequalities in the system, ultimately producing lower death and disability rates. These effects, however, are likely to be "long term and cumulative" (Dixon and Moon 1989, 187), with lags approaching 20 years. With our shorter lags we found no significant beneficial effects from civil wars in any of our estimations.

[8] A better measure, to be explored in further research, might include the proportion of a country's borders occupied by states experiencing civil war, the severity of those wars, and perhaps the permeability of borders (Starr and Thomas 2002).

[9] Note that this comes after the time for which civil wars are measured. Since it picks up the indirect effect of civil war in reducing income and health spending, it probably contributes to understating the full effect of our civil war variable.

explanatory variable in this equation, rather than public or private spending alone. There is some complementarity between public and private health spending in achieving health goals, and the measure of total health expenditures has more explanatory power than either does alone.

H4: The more educated the population, the fewer DALYs are lost.

At higher levels of education, preventive and treatment programs become more widespread and effective; i.e., the demand for better health care rises as does more knowledgeable and affective consumption throughout the population. Education is strongly associated with the health of both children and adults in both rich and poor countries. It constitutes the other independent variable, with total health expenditures, in WHO analyses of health attainment (Evans et al. 2000a, 13).

WHO regards the average level of schooling in the adult population as the most widely available and sensitive measure, logged to correct skewness and to reflect the declining marginal impact of education.[10] It ranges from only 1.04 years of education (Mali) to 11.5 years (United States), with a median of 6.03 years (Costa Rica).

H5: The higher the pace of urbanization, the more DALYs are lost.

New urban residents will be exposed to new disease vectors, and will lack adequate access to care since the supply of health services to large numbers of new residents is likely to lag behind the surge in need (Garrett 2001; Szreter 2001). Surveillance, immunization, and the provision of safe water all become more difficult. A high rate of urbanization often reflects the influx of poor and marginalized people from rural areas. These new city dwellers (largely in urban slums) are underorganized in unions and underrepresented in established political parties. They find it hard to create effective pressure for health care either politically or in the workplace, leaving a gap between need and delivery. Marginal utility analysis predicts that individuals or groups receiving less than an equal supply of health care lose more DALE than is gained by those receiving more than an equal share of care.

Our measure of recent urbanization is the average annual percentage change in the urban portion of the population, 1990–95 (United Nations 1998, 132–35). It ranges from −0.41% (Belize) to 7.35% (Botswana), with a median of 0.88% (Grenada).

H6: The more unequal the distribution of income, the more DALYs are lost.

The more unequal the income distribution, the fewer public resources will be committed to the health-care system and the more unequal will be access to health facilities. Economically advantaged groups will be more able to dominate the political system for their own benefit rather than that of the majority. As a result, state spending is diverted from public to private goods; what is spent is more concentrated on the privileged and politically powerful segments of the population. The large poor segment of the population will have lower incomes, less leverage with employers, and fewer private resources for health. High-quality health care is thus limited to a smaller segment of the general population, producing lower overall levels of health performance. The rich get more access—at low marginal utility—and the poor get less.

The measure of inequality is the Gini index of income distribution in 1997. This common index is derived from a Lorenz curve of the actual distribution of income by households, with the index representing the total area between the curve and the 45° line of a totally equal distribution of income. We have estimates for 111 countries published by the World Bank, supplemented by WHO with multiple imputation estimates using information on socioeconomic development and life expectancy at birth (Evans et al. 2000b). Theoretically the Gini index ranges from 0 (complete equality) to 1.00 (one person has all the income); in practice our national Gini indices for income distribution range from a very equal 0.187 (Slovakia) to 0.609 (Sierra Leone), with a median of 0.374 (Uganda).

H7: Tropical countries will suffer from more DALYs lost.

Tuberculosis, other infectious respiratory and diarrheal diseases, and malaria are often endemic to tropical countries, where conditions for their spread are more favorable despite public health programs to contain them.[11] If civil wars are more likely to occur in such countries, we risk mistakenly identifying civil wars as the cause of diseases that are already prevalent because of these background conditions. To protect against this inferential error we add a dummy variable, *tropical*, with all countries where the majority of the population resides in tropical regions coded 1 and all other countries coded 0.

H8: The more democratic countries are, the fewer DALYs are lost.

H9: The more ethnically and linguistically diverse the population, the more DALYs are lost.

Finally, we include two additional control variables that may be causes of civil wars. One might argue that our measure for the incidence and severity of civil wars is simply a proxy for other economic and political variables likely to be associated with civil wars. To answer this fully we would also need a model to explain the incidence and severity of civil wars. The systematic

[10] Some observations were estimated by multiple imputation from other data on educational attainment. For sources and methods see Evans et al. 2000b.

[11] WHO (2000, 164) reports that, among infectious disease categories, the major causes of deaths in Africa are, in descending order, HIV/AIDS, respiratory infections, malaria, diarrheal diseases, measles, and tuberculosis.

empirical literature lacks consensus, but several influences emerge as probable contributors to the likelihood of civil war. In a cursory overview of this research we discuss some possible variables to control for the structural conditions that may promote civil wars and relate them to variables already in our model.

The influences affecting the initiation of civil war are not necessarily the same as those affecting its continuation or intensity. For our purposes the intensity of war is more relevant than its initiation or mere occurrence. Our measure of deaths over the duration of the war, controlling for size of population, captures duration and, especially, severity. The control for population also addresses the likelihood that large states will have more potentially disaffected groups able to mount a war effort.

The initial level of economic development raises the opportunity costs of violence. In richer countries employment opportunities are better, and governments have more resources to satisfy discontented elements of the population. Whereas some analyses find that a low rate of economic growth contributes to the likelihood of civil war (Collier and Hoeffler 2002), a low level of development seems to be a more robust influence (Elbadawi and Sambanis 2002; Sambanis 2001, 2002). Although we do not include GDP per capita as a direct influence in this model, it makes a prior contribution through its influence on total health expenditures per capita and, also, is closely related to educational attainment. Collier and Hoeffler (2000) also identify low educational level as a key influence. Thus our model already controls for level of development.

Political system affects health as discussed in our initial theoretical framework, and it also probably influences the incidence of civil war—especially for ethnic wars since lack of democratic rights can threaten the core of ethnic identity and reduce the chances for redress of grievances (Gurr 1993, 2000). Whereas there is some evidence that civil wars are more likely to break out in countries that are between the extremes of full democracy and full autocracy (Hegre et al. 2001; Reynal-Querol 2002), that distinction is less important in the continuation of wars (Elbadawi and Sambanis 2002). So a linear measure—better to ascertain the direct effect of democracy on health—should suffice for a first cut.

We measure political system type by the Polity project's average score for 1997 and 1998, using the Polity IV data from their web site (www.bsos.umd.edu/cidcm/polity). For the 22 countries in our sample with no regime score in the Polity database, we imputed a regime score from the Freedom House scores, which correlate highly ($r = .95$) with Polity where both exist. Following common practice (e.g., Maoz and Russett 1993) we create a 21-point index for each state from two scales—one degree of autocracy ranging from -10 (most autocratic) to 0 (least autocratic) and one for democracy from 0 (least democratic) to $+10$ (most democratic)—and then produce the composite index by summing the two components. This scale, which we treat as interval, runs from -10 (e.g., North Korea, Myanmar) to $+10$ (Japan, Norway), with a median of 7 (Ukraine). Other measures of contemporary democracy correlate highly with it (Vanhanen 2000).

Ethnic heterogeneity may contribute to discrimination, which in turn increases the risk of ethnic war. Again, there is some evidence of nonlinearity, in that ethnically polarized societies may be more war-prone than either homogeneous ones or highly fragmented states, whose small minorities may suffer from collective action problems in organizing for violence (Bates 1999; Collier and Hoeffler 2000; Horowitz 1985; Reynal-Querol 2002). As with democracy, using different functional forms might help, but a linear measure serves as an approximation.

We use Vanhanen's (1999) index of racial–linguistic–religious heterogeneity. This index, stable over moderate time periods, measures the percentage of the largest ethnic group identified by each of these three criteria, giving each equal weight by summing the three percentages and subtracting the sum from 300 (a completely homogeneous state by all three criteria). It is conceptually somewhat different from Taylor and Hudson's (1972) index of ethnolinguistic heterogeneity, when logged correlating with an r of .69 with Taylor and Hudson's, but it was created with their effort in mind and covers more countries. It ranges from a high of 177 (Suriname) to a low of 0 (North Korea; completely homogeneous), with a median of 38 (Uzbekistan). Because the index is skewed, we use its natural log.

Other influences on the ability to sustain a dissident group at war may include rugged terrain and the availability of "lootable" natural resources—particularly for nonethnic wars (Collier and Hoeffler 2000). Ethnic wars may derive from a different mixture of influences than do nonethnic wars. But since over 70% of all civil wars between 1960 and 1999 can be characterized as wars between ethnic groups (Sambanis 2001), we pay more attention to the causes of ethnic wars. In sum, we believe that our key explanatory variable—deaths from civil wars—is not simply a proxy for the structural conditions that produce civil wars and that the diseases bringing death and disability after civil wars are not simply a consequence of those conditions.

A MULTIVARIATE ANALYSIS OF ALL DEATHS AND DISABILITIES

We test these hypotheses using cross-sectional least-squares regression analysis on data for 177 countries: nearly all the 191 members of the WHO, omitting only some small states lacking data on several of the explanatory variables. Table 1 shows in separate rows 10 equations for deaths and disabilities from *all causes combined* by the five age groups for each gender. Thus 10 regressions are presented as rows in Table 1. The explanatory variables are listed across the top, and each column gives the estimated coefficient and then the t ratio. Coefficients and t ratios that reach the .05 level of significance (one-tailed) are in boldface. Remember that DALY represents years of healthy life *lost*, so we anticipate positive coefficients for all variables except health expenditures and education.

TABLE 1. DALYs Lost to All Disease Categories

Gender	Age Group	DALYs Lost per Year per 100 People	Statistic	Intercept	Civil War Deaths, 1991–97	Contiguous Civil War	Total Health Spending	Education	Urban Growth	Income Gini	Tropical	Polity Score	Ethnic Heterogeneity	Adjusted R^2	σ
Male	4 or less	63.57	Coefficient	264.89	5.45	2.13	−21.10	−60.27	0.49	11.86	−8.33	0.64	1.58	.72	35.92
			t ratio	**9.38**	**2.02**	0.35	**−6.26**	**−7.44**	0.16	0.30	−1.08	1.35	0.58		
Female	4 or less	58.3	Coefficient	240.63	4.19	4.48	−18.35	−58.02	1.58	5.16	−7.29	0.55	1.77	.72	33.92
			t ratio	**9.02**	1.65	0.78	**−5.77**	**−7.58**	0.56	0.14	−1.01	1.23	0.69		
Male	5–14	9.05	Coefficient	26.51	1.11	0.14	−2.92	−5.34	0.87	11.49	0.14	0.13	0.20	.68	−5.33
			t ratio	**6.33**	**2.78**	0.15	**−5.84**	**−4.44**	**1.96**	**1.99**	0.12	**1.91**	0.50		
Female	5–14	8.31	Coefficient	25.17	1.31	0.59	−2.73	−5.32	0.94	8.96	−0.44	0.12	0.35	.67	5.23
			t ratio	**6.12**	**3.35**	0.66	**−5.56**	**−4.51**	**2.16**	1.58	−0.39	**1.77**	0.89		
Male	15–44	26.1	Coefficient	6.65	2.15	7.84	−2.12	−3.74	5.93	52.24	4.61	0.22	0.62	.46	16.75
			t ratio	0.50	**1.71**	**2.74**	−1.35	−0.99	**4.26**	**2.88**	1.29	0.98	0.50		
Female	15–44	25.67	Coefficient	5.99	2.99	12.52	−1.56	−7.41	8.54	50.10	4.34	0.05	0.59	.44	22.48
			t ratio	0.34	**1.78**	**3.27**	−0.74	−1.46	**4.57**	**2.06**	0.90	0.18	0.35		
Male	45–59	23.95	Coefficient	34.29	1.52	5.60	−4.16	−2.45	4.09	25.73	1.12	0.22	1.11	.50	12.77
			t ratio	**3.42**	1.59	**2.57**	**−3.47**	−0.85	**3.85**	**1.86**	0.41	1.31	1.16		
Female	45–59	30.78	Coefficient	37.48	1.52	2.85	−2.63	−7.21	2.38	10.64	2.73	−0.01	0.70	.62	8.99
			t ratio	**5.30**	**2.25**	**1.86**	**−3.12**	**−3.55**	**3.18**	1.09	1.42	−0.09	1.04		
Male	60+	36.32	Coefficient	48.31	0.33	1.00	−2.75	−2.21	2.02	14.80	−2.09	−0.05	0.69	.26	11.43
			t ratio	**5.38**	0.39	0.51	**−2.57**	−0.86	**2.13**	1.19	−0.86	−0.32	0.80		
Female	60+	39.75	Coefficient	48.54	0.86	0.46	−1.79	−8.57	1.79	24.55	−1.53	−0.42	0.46	.39	12.83
			t ratio	**4.81**	0.90	0.21	−1.49	**−2.96**	**1.68**	**1.77**	−0.56	**−2.44**	0.48		

Note. $N = 177$. Boldface values are significant at the .05 (one-tailed) level.

First, note that most of our hypotheses are supported. For seven of the 10 equations, total health spending has a strong and statistically significant impact in reducing the loss of healthy life expectancy. Only for females and males in the 15- to 44-year age group is there no effect. A high average level of education also strongly reduces DALYs in six of the groups. Rapid urbanization is strongly correlated with increased loss of healthy life expectancy (highly significant in six categories, significant at a lower level in two). So too is high income inequality (five groups at $p < .05$, and three at $p < .06$). The direct impact of democracy is marginal (significant as hypothesized for one group and in the opposite direction for two others). This confirms the findings of our earlier research on the primary effect of democracy on public health; it operates earlier in the causal chain by influencing the level of resources allocated to health expenditures (Ghobarah et al. 2001). Likewise, ethnic heterogeneity has the expected positive sign in every group, but its direct effects are never significant, in accordance with previous research that found that its effects operate largely indirectly, by reducing the total spending allocated to health. Simply being in a tropical country had no discernible impact, which may attest to the success of the public health systems in several tropical countries in neutralizing this risk factor.

These relationships are not, however, the focus of attention in this article—*civil war is.* For that, we do see some strong effects. Experiencing a civil war earlier in the 1990s is strongly associated with a subsequent increased loss of healthy life for six groups ($p < .05$ or better), and $p < .06$ for two others. Only for the aged does civil war have no significant impact. Three of the four most statistically significant impacts are among children. Furthermore, the substantive impact is very severe for the two youngest groups, females and males under five years of age. For instance, the coefficients mean that the impact in 1999 of living in a country that had experienced an intense civil war a few years earlier (such as Bosnia, with 6.8 civil war deaths per 100 people) rather than in a median country with no war at all is a loss of about 28.5 healthy life-years in 1999 per 100 girls under five years of age—long after the war ended in a settlement. In Rwanda's extreme case (9.7 civil war deaths per 100 people, mostly in 1994), the subsequent losses amounted to a staggering 53 DALYs per 100 children under five—and that is in addition to the impact of all the other sociopolitical and economic variables in our model.

Finally, even living in a country adjacent to a state that experienced a civil war made a big difference for four of these groups, together encompassing men and women aged 15–59. These huge impacts on the economically productive parts of the population (substantively, a loss of healthy life-years from about three to over 12 per 100 people, depending on age and sex) are over and above the negative effects they experienced if there had also been a civil war in their own country.[12] We can evaluate this better by looking at the impact of civil wars on the incidence of specific diseases and conditions.

THE WHO AND HOW OF CIVIL WAR EFFECTS

We proceed to do just that. The WHO data on impacts of various diseases by age and gender allow us to compute 210 equations.[13] Using a threshold of $p < .05$ for a one-tailed test of statistical significance, we would expect, purely by chance, to find that 10 or 11 equations produced a "significant" relationship for civil war's impact on an individual grouping. In fact, we find many more than that: 48 equations in which the civil war coefficient is significant at $p < .05$. Furthermore, most of the significant coefficients make sense in terms of our expectations. Table 2 shows the effects of the variable for preceding civil war deaths (using the same model as in Table 1, but listing only the civil war deaths coefficients for clarity). It gives a row for each such equation, arraying the equations by major disease/condition groups and, within groups, in descending order of the t ratios. The columns show the coefficient for the effect of civil wars first, followed by the t ratio.

By far the most common impact is through infectious diseases, as is consistent with our theoretical expectations and our review of the case study material on the effects of civil wars. Seven of the 10 age–gender groups are affected by malaria, essentially all but those aged 60 years and over. In fact, by t value, five of the 25 groups most impacted by civil wars are from the increased incidence of malaria. At their highest, the coefficients for impact indicate 15 years (per 100 people in the case of Rwanda) of healthy life lost in 1999 by very young children, controlling for all other factors. Regrettably, that is the lingering impact of civil war for only one disease of 23; the misery accumulates with each of the other 22 categories of disease.

The three other most affected disease groups are tuberculosis, respiratory infections, and other infectious diseases—each reaching statistical significance for six of 10 possible age and gender groups. The age and gender group effects are strikingly similar, for each category affecting older children and adults 15–59 more than the very young or the old. The coefficients for the impact of war on tuberculosis are generally much lower (ranging around 0.1) than for malaria. Almost exactly the same pattern applies to respiratory infections, with coefficients of about 0.1 for civil wars and 0.4 to 0.8 for the dummy variable. For other infectious diseases—something of a catch-all category—the impact of civil

[12] Conflict involving a neighbor is a strong predictor of subsequent conflict at home (Ward and Gleditsch 2002). Nevertheless, this analysis shows the effect of an adjacent civil war whether or not the country itself had a civil war. Previous analysis (Ghobarah et al. 2001) found that the effect is robust to the inclusion or exclusion of countries that themselves experienced civil war.

[13] Twenty-three disease or condition groups, times five age groupings and two genders, would give 230 equations. Some categories, however, are empty: for males, five each for maternal conditions, breast cancer, and cervical cancer; three for maternal conditions for females under 15 and over 44; and two for suicide by children under five years. The equations are too space-consuming to print here but are available with the data at the web site noted in the title-page footnote.

TABLE 2. The Long-Term Impact of Civil Wars: DALYs Lost by Disease Category

			Civil War Deaths per 100 People (1991–97)		
Cause Name	Gender	Age Group	Coefficient	*t* Ratio	Adjusted R^2
Malaria	Female	0–4	1.3706	2.07	0.53
Malaria	Male	0–4	1.5259	2.33	0.52
Malaria	Female	5–14	0.2945	2.44	0.51
Malaria	Male	5–14	0.2978	2.38	0.51
Malaria	Female	15–44	0.0370	3.03	0.57
Malaria	Male	15–44	0.0528	2.49	0.56
Malaria	Female	45–59	0.0080	2.08	0.54
Tuberculosis	Female	5–14	0.0910	2.80	0.56
Tuberculosis	Male	5–14	0.0782	2.37	0.54
Tuberculosis	Female	15–44	0.1089	2.33	0.58
Tuberculosis	Male	15–44	0.1198	2.00	0.61
Tuberculosis	Female	45–59	0.0996	1.70	0.58
Tuberculosis	Male	45–59	0.1387	1.81	0.69
Respiratory diseases, infectious	Female	5–14	0.1196	2.20	0.65
Respiratory diseases, infectious	Male	5–14	0.1196	2.31	0.63
Respiratory diseases, infectious	Female	15–44	0.1012	2.69	0.58
Respiratory diseases, infectious	Male	15–44	0.1024	2.10	0.54
Respiratory diseases, infectious	Female	45–59	0.1081	2.37	0.57
Respiratory diseases, infectious	Male	45–59	0.1040	2.09	0.61
Other infectious	Male	0–4	1.8168	1.79	0.72
Other infectious	Female	5–14	0.4344	2.94	0.64
Other infectious	Male	5–14	0.3374	2.43	0.66
Other infectious	Female	15–44	0.3803	2.43	0.65
Other infectious	Male	15–44	0.3615	1.88	0.60
Other infectious	Female	45–59	0.2681	2.29	0.62
Other infectious	Male	45–59	0.2127	1.91	0.65
Transportation accidents	Female	5–14	0.0695	4.08	0.28
Transportation accidents	Female	15–44	0.0492	3.78	0.23
Transportation accidents	Male	15–44	0.1523	2.12	0.34
Transportation accidents	Female	45–59	0.0609	1.99	0.17
Transportation accidents	Male	45–59	0.0962	1.76	0.19
Homicide	Female	5–14	0.0256	5.30	0.33
Homicide	Male	15–44	0.1414	2.23	0.41
Other unintentional injuries	Male	15–44	0.1913	1.79	0.33
Other unintentional injuries	Female	45–59	0.1068	1.70	0.11
Suicide	Female	15–44	0.0316	2.26	0.10
Maternal conditions	Female	15–44	0.6577	2.82	0.64
Maternal conditions	Female	45–59	0.0509	2.26	0.53
Respiratory disease, chronic	Female	5–14	0.0340	1.80	0.03
Cervix cancer	Female	5–14	0.0001	1.86	0.46
Cervix cancer	Female	45–59	0.0389	2.15	0.65
Cervix cancer	Female	60+	0.0618	2.01	0.60
Breast cancer	Female	0–4	0.0007	1.95	0.33
Liver cancer	Female	45–59	0.0170	1.83	0.54
Liver cancer	Female	60+	0.0301	1.70	0.55
Other malignant neoplasms	Male	5–14	0.0174	2.78	0.45
Cardiovascular disease	Female	5–14	0.0362	2.83	0.54
Digestive disease	Female	5–14	0.0121	2.25	0.30

wars is greater (from about 0.2 to 1.8). Together, the four groups of infectious disease account for 26 of the 48 equations showing a significant effect of civil wars.

The next most common effect is from transportation accidents and may in part reflect the deterioration of roads and vehicles. But it is also consistent with our expectations of an increase in stress and a breakdown of law and order in post-civil war societies. We cannot satisfactorily map the causal relationships without detailed micro-level analysis. Nonetheless, while the impact is small (0.05 to 0.15 years), it affects five of the 10 groups: mostly young and middle-aged adults. More obvious from an expectation of a breakdown of social order is the elevated homicide rate, the victims being girls between five and 14 years old and, especially, men between 15 and 44. The substantive effect (0.02 on girls and 0.14 on men) is similar to that of transportation accidents.

The two entries for unintentional injuries may also derive from stress and may include unreported suicides. With a lower level of statistical significance ($p < .12$), three more adult age groups would make it into the

TABLE 3. The Long-Term Impact of Contiguous Civil Wars: DALYs Lost by Disease Category

			Contiguous Civil War		
Cause Name	Gender	Age Group	Coefficient	t Ratio	Adjusted R^2
AIDS	Female	0–4	3.624	3.69	0.29
AIDS	Male	0–4	3.531	3.78	0.30
AIDS	Female	5–14	0.200	3.90	0.30
AIDS	Male	5–14	0.204	4.03	0.30
AIDS	Female	15–44	9.275	3.51	0.24
AIDS	Male	15–44	6.839	3.35	0.25
AIDS	Female	45–59	1.960	3.35	0.27
AIDS	Male	45–59	3.837	3.65	0.27
AIDS	Female	60+	0.113	3.53	0.27
AIDS	Male	60+	0.267	3.59	0.27
Homicide	Male	0–4	0.141	1.67	0.03
Homicide	Female	5–14	0.019	1.76	0.33
Homicide	Male	5–14	0.020	2.36	0.45
Homicide	Male	15–44	0.248	1.72	0.41
Homicide	Male	45–59	0.137	2.03	0.17
Other unintentional injuries	Female	0–4	0.494	2.01	0.21
Other unintentional injuries	Male	0–4	1.100	2.27	0.05
Other unintentional injuries	Female	5–14	0.229	2.06	0.37
Other unintentional injuries	Male	5–14	0.271	2.43	0.50
Digestive disease	Female	0–4	0.611	1.85	0.05
Digestive disease	Male	0–4	0.780	1.79	0.08
Digestive disease	Female	5–14	0.038	3.09	0.30
Digestive disease	Female	15–44	0.091	2.21	0.31
Cervix cancer	Female	0–4	0.056	1.67	−0.01
Lung cancer	Female	0–4	0.012	1.78	−0.02
Lung cancer	Male	0–4	0.031	1.74	0.00
Cancer of mouth, esophagus	Female	0–4	0.016	1.85	−0.02
Stomach cancer	Male	0–4	0.034	1.90	0.03
Other malignant neoplasms	Male	0–4	0.162	1.68	0.05
Other malignant neoplasms	Female	5–14	0.025	1.86	0.23
Liver cancer	Female	5–14	0.001	2.20	0.50
All other diseases	Female	5–14	0.187	1.99	0.07

table for unintentional injury. Notice also the item for suicides of women of childbearing age, perhaps reflecting the trauma of rape. They also are subject to postwar maternal ills. Chronic respiratory diseases not included elsewhere (such as tuberculosis and respiratory infections) for girls aged 5–14 may reflect a stress-induced loss of resistance.

We also find an apparent effect of civil wars in raising the rate of cervical cancer for three of the four female groups above age four (plus the other, weakly, at $p < .16$, for women aged 15–44). While cervical cancer may develop too slowly for the time lag used in our analysis, there may be two possible connections to civil wars. First, it fits our expectation of a breakdown in social norms, in these cases norms against forced sexual relations, though the coefficients are very low (no larger than 0.06). Second, recent medical research indicates that in low-income countries infection plays an important etiologic role in cancer and our other results show that civil wars increase the incidence of infectious disease.[14] It is also likely that other sexually transmitted diseases of women in traditional societies are reported as cervical cancer.

The six remaining statistically significant groupings show little pattern, and with this lag we have no explanation. Overall, females constitute 33 of the 54 affected groups, and the two gender groups of children aged five to 14 account for 15 (chance would mean nine or 10 groups). *Whomever the actual combat deaths during the war may represent, in their long-term impact the greatest victims are women and children.*

CONTIGUOUS CIVIL WARS

Finally, Table 3 shows the effect of civil war in a contiguous country, above any effect of civil war at home. The presentation corresponds to that in Table 2. Our initial analysis found that having a civil war in an adjacent

[14] Research in sub-Saharan Africa suggests that the human papilloma virus (HPV) is linked to cancer of the cervix (Feachem, Jamison, and Bos 1991, 17). HPV infection is necessary for development of low-grade squamous intraepithelial lesions (LSIL), which in turn may develop into cervical cancer. Every new sexual partner greatly increases the risk of HPV, with the risk of developing LSIL in the first three years after HPV infection (Moscicki et al. 2001); however, further progression to cancer is slower.

country was itself a major contributor to loss of healthy life expectancy overall. The disease-specific analysis finds 32 disease–age–gender groups for which a contiguous civil war significantly increased death and disability. This too is well above the 10 or 11 we would expect by chance to cross the line of statistical significance in 210 equations.

The enormous impact of a neighboring civil war on HIV/AIDS is immediately apparent, as it occupies all top 10 slots of statistical significance in Table 3. If anything, the *t* ratios understate the impact. For the susceptible age groups of both genders (very young children, infected through their mothers, and young and middle-aged adults), the coefficients are higher than for any other DALY disease or condition in the table. For these groups the average loss of healthy life ranges from more than two years to nearly 10 years (for women aged 15–44).[15]

Recall that, in contrast with the effects of civil wars at home on most infectious diseases, we found no impact of a civil war at home in raising AIDS rates in that state. This is true even in an equation without the variable for contiguous civil war. However, most civil wars have a neighboring civil war as well. A civil war at home may have some decelerating effects—such as war deaths among young males—on HIV transmission. Infection may be slowed as communities become isolated by war and the disruption of commerce and transportation, but following the war, the resumption of normal interactions within and across borders may spread the disease to neighboring states that did not experience the initial reduction (Mock and Mathys 2002; Davis and Kuritsky [2002] report lower HIV rates for countries in civil conflict). Also, most DALYs from HIV/AIDS are derived from reports of HIV infections rather than deaths. Infections likely are underreported in countries themselves undergoing civil wars. At this stage in the analysis, collinearity and data questions make it impossible to sort out fully the relative impact of own and neighboring civil wars in HIV/AIDS rates.

After AIDS, another major effect of neighboring civil war is in raising the incidence of homicide. Males of all but the oldest age group are the principal victims, with a coefficient of 0.25 per men aged 15–44. Unintentional injuries (other than transport) have a serious impact on young children of both sexes and, to a lesser extent, on older children (about 0.3 to 1.1 years per 100 people). This too probably reflects political and social tensions in the society. Digestive disease may also be a product of stress. Cancers of various types show up eight times among children, but the coefficients are usually small. They do not fit any of our expectations, and it is too soon to attribute much importance to them without further research.

Overall, the strongest effect of civil war in a contiguous country is to boost drastically the rate of infection from HIV/AIDS. Its devastating impact is concentrated in the most economically productive age groups and in very young children, striking both genders more or less equally. When we tally all the effects in Table 3, both genders are affected more or less equally (17 female groups, 15 male), but with 10 in the two gender categories for children aged five to 14 and 13 more for children zero to four. As with civil wars at home, many of the long-term victims of contiguous civil wars are the young.

[15] One-third of all DALYs lost from communicable disease in Africa are due to HIV/AIDS (WHO 2000, 170). Of course not all such losses stem from civil war. Conditions of urbanization and income and ethnic inequality—included in our model—may be causally related to both AIDS and civil war.

CONCLUSION

We developed the argument that civil wars should produce long-term damage to public health-care systems that extend well beyond the period of active warfare and tested it in the context of a more general political–economic model of conditions affecting death and disability cross-nationally. Using newly available data on DALYs lost from various diseases and conditions by age and gender groups, we found that, controlling for the other influences, civil wars greatly raise the subsequent risk of death and disability from many infectious diseases, including malaria, tuberculosis, and other infectious respiratory diseases. We have some evidence, though weaker, that civil wars increase the risk of death and disability through the breakdown of norms and practices of social order, with possible increases in homicide, transportation accidents, other injuries, and cervical cancer. The disability and death from AIDS are much greater if a neighboring country recently experienced a civil war.

Overall, women and children were the most common long-term victims. For all categories we estimate that 8.01 million disability-years were lost in 1999 from civil wars during the period 1991–97. This is only slightly below WHO's estimate for the immediate losses from all the wars fought in 1999. The victims will bear these burdens for the rest of their lives. Moreover, our estimate of death and disability from previous civil wars applies only to those incurred in 1999. Since that is a single cut into a lag structure of new deaths and disabilities that probably extends over a decade, the total could be an order of magnitude higher yet.

These results are intriguing though not conclusive. Certainly we need to comprehend better the micro-level political, social, and epidemiological processes. We also must elaborate theories that accommodate complex interrelations and drive backward in the full system of influences to understand how civil wars may interact with income inequality, ethnic diversity, and type of political system to affect people's health and well-being. One improvement in subsequent research should be a more nuanced and medically informed consideration of appropriate lag times. Our rather crude one-size-fits-all lag, of civil war deaths from 1991 to 1997 to explain DALYs 1999, is not a bad fit to the descriptive literature on the spread of many diseases, and it gives the best empirical fit for DALE overall. Still, something more fine-grained is necessary for further analysis of specific diseases, notably AIDS and long-term noninfectious conditions (e.g., cancers) that are slow in developing. Cross-temporal analysis will provide better guidance when the necessary data become available.

The kind of information analyzed here must be combined with more contextual information and field reports from countries that have experienced civil wars. Further analyses could provide projections on the likely effect of major civil violence that could be used by peacekeeping and postconflict peace-building missions, national governments, and nongovernmental organizations. They could help in predicting the effects of civil violence and may suggest possible key interventions, such as in caring for refugees and assessing priorities for postconflict efforts to rebuild devastated and overburdened health-care systems. They indicate the number of long-term deaths and disabilities to be anticipated from various diseases, which in turn can be used, in cost–benefit analyses, to estimate the price of averting each death or disability through the best postconflict allocations to prevention and treatment. Knowing the type and magnitude of the effects is an essential step in preventing or mitigating the misery.

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