

THE GLOBAL BURDEN OF DISEASE 2000 IN AGING POPULATIONS

Research Paper No. 01 .22

Armed Conflict as a Public Health Problem

**Christopher JL Murray
Gary King
Alan D Lopez
Niels Tomijima
Etienne Krug**

**HARVARD BURDEN OF DISEASE UNIT
NATIONAL INSTITUTE ON AGING GRANT 1-P01-AG17625**

THE GLOBAL BURDEN OF DISEASE 2000 IN AGING POPULATIONS

This research paper series reports on research supported by the National Institute on Aging program grant entitled The Global Burden of Disease 2000 in Aging Populations (1-P01-AG17625). The purpose of the grant is to strengthen the methodological and empirical bases for undertaking comparative assessments of health problems, their determinants and consequences in aging populations.

Since the publication of the Global Burden of Disease Study 1990, there has been increasing interest in comparative analyses of health outcomes, determinants and consequences. A major revision of the Global Burden of Disease Study has been launched for the year 2000 with the full commitment of the World Health Organization (WHO). The Global Programme on Evidence for Health Policy at WHO has developed a Global Burden of Disease Network, which operates in parallel to the research conducted as part of the program project. The program project will strengthen the scientific basis for the large-scale undertaking led by WHO at the global, regional and national level.

The purpose of this series is to present original research that emerges from the various project components of this program grant. The views expressed in these research papers are those of the author(s) and do not necessarily reflect the views of the Harvard Burden of Disease Unit, the World Health Organization nor the National Institute on Aging.

THE HARVARD BURDEN OF DISEASE UNIT

The Harvard Burden of Disease Unit was established to design, test, and implement methodologies to aid in the effective allocation of health resources. To achieve this end, the Unit conducts research in collaboration with national governments, international agencies and other researchers and policy-makers. The Unit's research has two main foci:

- to forge the theory, design, and implementation of approaches to the combined measurement of mortality and non-fatal health outcomes, in order to develop valid, reliable, comparable and comprehensive measures of population health and comparative assessments of the burden of diseases, injuries and risk factors; and
- to investigate the costs, efficacy and effectiveness of major health interventions applied in diverse settings, toward the goal of establishing a broad database on cost-effectiveness.

Harvard Burden of Disease Unit
Center for Population and Development Studies
9 Bow Street
Cambridge, MA 02138
www.hsph.harvard.edu/organizations/bdu

Armed Conflict as a Public Health Problem¹

Christopher JL Murray,² Gary King,³ Alan D Lopez,⁴ Niels Tomijima,⁵ Etienne Krug⁵

¹ This work has been supported by the National Institute on Aging Grant 1-P01-AG17625. This paper has been published in BMJ (9 February 2002).

² Executive Director, Evidence and Information for Policy, World Health Organization and Director, Harvard Burden of Disease Unit

³ Professor of Government, Harvard University, and Senior Advisor, Global Programme on Evidence for Health Policy, World Health Organization, Center for Basic Research in the Social Sciences, Harvard University, Cambridge, MA 02138

⁴ Coordinator, Epidemiology and Burden of Disease, Global Programme on Evidence for Health Policy, World Health Organization

⁵ Global Programme on Evidence for Health Policy, World Health Organization

Armed conflict as a public health problem

C J L Murray, G King, A D Lopez, N Tomijima, E G Krug

Armed conflict is a major cause of injury and death worldwide, but we need much better methods of quantification before we can accurately assess its effect

Evidence and Information for Policy, World Health Organization, 1211 Geneva 27, Switzerland

C J L Murray
executive director

A D Lopez
coordinator, epidemiology and burden of disease

N Tomijima
technical officer, epidemiology and burden of disease

Center for Basic Research in the Social Sciences, Harvard University, Cambridge, MA, USA

G King
professor of government

Noncommunicable Diseases and Mental Health, World Health Organization, Geneva

E G Krug
director, injuries and violence prevention

Correspondence to: C J L Murray
murrayc@who.int

BMJ 2002;324:346-9

Armed conflict between warring states and groups within states have been major causes of ill health and mortality for most of human history. Conflict obviously causes deaths and injuries on the battlefield, but also health consequences from the displacement of populations, the breakdown of health and social services, and the heightened risk of disease transmission. Despite the size of the health consequences, military conflict has not received the same attention from public health research and policy as many other causes of illness and death. In contrast, political scientists have long studied the causes of war but have primarily been interested in the decision of elite groups to go to war, not in human death and misery.

We review the limited knowledge on the health consequences of conflict, suggest ways to improve measurement, and discuss the potential for risk assessment and for preventing and ameliorating the consequences of conflict.

Assessing the public health impact of conflict

The impact of war on populations arises both from the direct effects of combat—namely, battle deaths—and from the indirect consequences of war, which may occur for several years after a conflict ends.¹ Indirect effects of conflict on mortality can be formally defined as the number of deaths following a war minus the number of deaths that would have occurred in the same period if the war had not occurred. For most wars, these indirect effects will be positive, indicating an increased mortality for several years after the start of war. In some cases, however, these indirect effects can be negative. For example, a war might cause a sudden increase in both direct and indirect mortality but might result in fewer deaths in the long term if it led to the deposition of a regime whose policies caused high mortality.

The fundamental challenge in quantifying the health impacts of conflict is that health information systems, particularly civil registration systems that record the event and cause of death, often cease to function in populations affected by conflict. For example, Bosnia and Herzegovina reported vital registration data on causes of death to the World Health Organization until 1991 but ceased since the start of conflict. Most conflicts are also highly politicised, so that available information may be intentionally misrepresented. Given the difficulty of measuring the basic phenomenon, it is important to ask how a death or injury due to conflict can be detected.

Methods of measuring direct mortality (battle deaths)

Figure 1 shows the ways that direct deaths from conflict can now be measured. In the absence of functioning civil registration systems, conflict related deaths could be detected through demographic analyses of census

Summary points

Conflict related death and injury are major contributors to the global burden of disease

Information systems break down during conflict, leading to great uncertainty in the magnitude of mortality and disability

The World Health Survey may provide a reliable and valid basis for assessing conflict related mortality and disability

Forecasting models may provide a plausible basis for assessing risk of conflict and thus prevention

Improved collaboration between political scientists and experts in public health would benefit measurement, prediction, and prevention of conflict related death

data before and after conflicts or through indirect mortality measurements such as survey questions on survival of siblings, parents, or spouses.²⁻⁵

Most published analyses of deaths from conflict have relied on press reports of eyewitness accounts and official announcements of combatants.⁶⁻¹¹ Many reviews cite figures from other reviews, making estimates of mortality difficult to validate. Exacerbating the problem is a wide range of definitions of conflict used by the databases.¹² Table 1 lists the 10 conflicts with the largest number of deaths reported for the 1990s by these sources. The wide range of total war deaths—from 1 440 000 to 7 370 000—illustrates the problem.

Media reports are often far too numerous to read and code accurately, but new computer programs can perform this task as well as or better than humans.¹³ For example, the VRA Reader program has been applied to all Reuters news reports for the year 2000¹⁴ and used to calculate conflict intensity in each country (fig 2). The map shows that countries with more conflict are less likely to have working civil registration systems that record conflict related deaths.

For assessing the burden of war and conflict in the *World Health Report 2001*, the WHO used median assessments of the size of direct mortality, with some modification using available vital registration data.¹⁵ Given the severe limitation of estimates based primarily on the qualitative analyses of media reports, conservative estimates have been used for several major conflicts.

Indirect mortality from conflict

For at least a decade, the ratio of indirect to direct conflict deaths has been quoted as 9:1.¹⁶ However, when we traced this figure to the original citation we found that

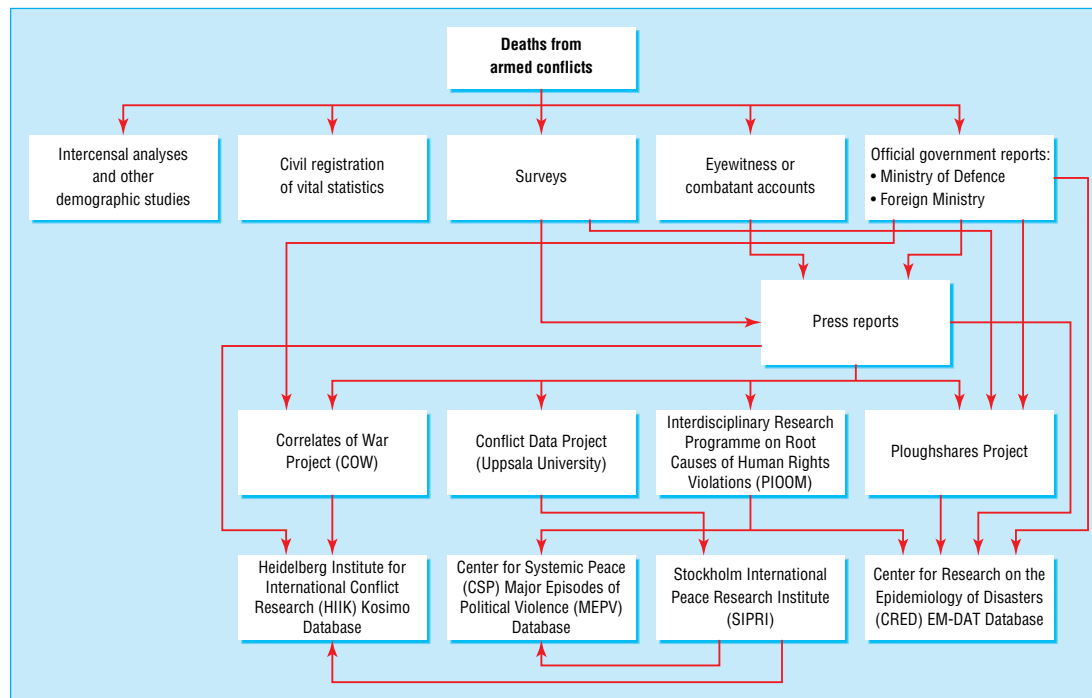


Fig 1 Sources of information on deaths from conflict and their interrelations

the empirical basis had not been reported.¹⁷ To assess the indirect effects of conflict, some type of explicit counterfactual assessment is essential, in which the health consequences in the absence of conflict are measured. One statistical assessment, based on a cross sectional analysis, indicates that the total disability adjusted life years lost in 1999 due to the indirect effects of military conflicts occurring between 1991 and 1997 was about the same as the number lost due to the direct effects of all wars in 1999.¹ Alternatively, time series analysis of vital registration may provide a basis for this type of estimation. Considerably more research is needed on this question before the global results on the indirect effects of conflict on mortality can be assessed.

Non-fatal outcomes and conflict

The burden of conflict includes a wide range of non-fatal health injuries. While some variation in disability is to be expected from conflict to conflict, difficulties in measuring the incidence of non-fatal outcomes means there is substantial uncertainty about the true level. In most cases disabilities due to war have been assessed from patients attending health facilities.^{18 19} Even though these sources may underestimate

the non-fatal health outcomes, the overall impact of these health effects is likely to be substantial. The reported ratio of people injured to those killed in modern conflicts ranges from 1.9 to 13.0.²⁰ In 1990 the *Global Burden of Disease* study estimated that non-fatal outcomes of war resulted in 4.8 million disability adjusted life years worldwide, about the same as fires and more than half that caused by road traffic injuries.²¹

Estimates of the burden of conflict

Given the necessary caveats about the accuracy of epidemiological assessment, table 2 puts the potential size of mortality directly related to conflict in context. Globally, conflict is estimated to have caused 310 000 deaths in the year 2000, with more than half taking place in sub-Saharan Africa. About a fifth of deaths from global conflict were in South East Asia. The remaining conflict deaths were largely distributed in the Balkans, central Asia, and the Middle East. Direct mortality from

Table 1 Ten most deadly conflicts originating in the 1990s, range of values for deaths from major published sources

Conflict	Years	Estimated No of deaths (range)
1 Rwanda	1994	500 000-1 000 000
2 Angola	1992-4	100 000-500 000
3 Somalia	1991-9	48 000-300 000
4 Bosnia	1992-5	35 000-250 000
5 Liberia	1991-6	25 000-200 000
6 Burundi	1993	30 000-200 000
7 Chechnya	1994-6	30 000-90 000
8 Tajikistan	1992-9	20 000-120 000
9 Algeria	1992-9	30 000-100 000
10 Gulf war	1990-1	4 300-100 000

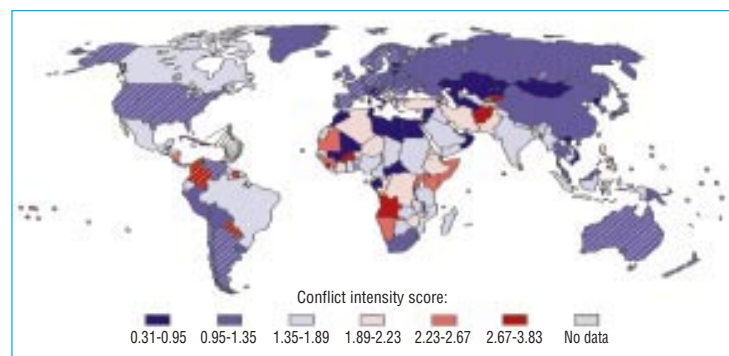


Fig 2 Level of military conflict targeted at each country (from other countries or from within the country) based on systematic review of media reports by country for the year 2000 (increasing redness indicates more conflict) and availability of civil registration data (indicated by cross hatching). (Adapted from the output of the VRA Reader^{13 14})

Table 2 Burden of conflict reported in *World Health Report 2001*¹⁵

WHO region	Deaths			Disability adjusted life years		
	Number due to war (1000s)	% of total due to war	% of total	Number due to war (1000s)	% of total due to war	% of total
African	167.5	53.96	1.58	5 476.2	53.07	1.55
Americas	2.1	0.66	0.04	69.9	0.68	0.05
Eastern Mediterranean	39.0	12.56	0.97	1 365.9	13.24	1.02
European	36.7	11.83	0.38	1 043.1	10.11	0.68
South East Asia	63.2	20.35	0.45	2 210.3	21.42	0.52
Western Pacific	2.0	0.63	0.02	1 54.3	1.50	0.06
World	310.4	100	0.56	10 319.9	100	0.70

conflict accounts for 0.5% of all mortality. We have not included an estimate of indirect mortality from conflict because of the limited evidence available.

Figure 3 shows the distribution of direct deaths from conflict by age and sex. Particularly notable is the large number of deaths of children and adolescents. There is excess mortality in men aged 15-44, but nearly a quarter of war mortality is among women. Direct deaths from conflict occur in soldiers and civilians. If male and female civilians were at equal risk, the estimated age and sex distribution suggests that for every military death there is at least one direct civilian death.

Conflict also causes considerable disability, with the disabling effects of landmines being one manifestation.¹⁸⁻²² Based on limited follow up studies, the WHO estimated that 0.70% of the global burden of disease in the year 2000 was due to conflict, including years of life lost and years of life lived with disability.¹⁵ Conflict related death and disability is a smaller portion of the overall global burden than that of road traffic injuries (2.80%), self inflicted injuries (1.31%), or homicide (1.09%). At the global level, the ratio of years of life lost due to premature mortality caused by conflict to years lived with disability from conflict is 4.75. Not surprisingly, this burden is distributed across regions in similar proportions to direct deaths from conflict.

New methods of quantifying health effects

To better quantify the health consequences of conflict, we need more reliable data. A promising new approach is to include in household health surveys questions on deaths of siblings and household members from conflict. Similar approaches developed to quantify maternal mortality have proved useful.²³

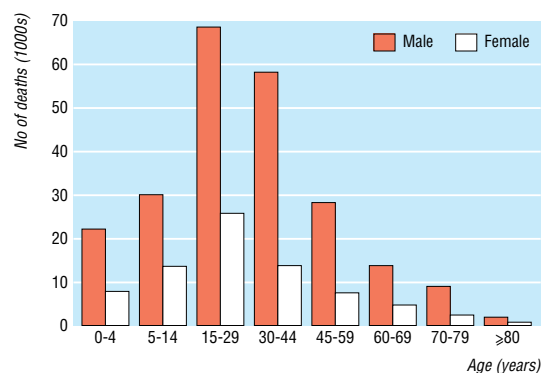


Fig 3 Estimated age and sex distribution of deaths due to conflicts in the year 2000

The World Health Survey, which will begin in more than 65 countries in 2002, will provide a platform in which this type of information will begin to be collected.²⁴ The development of standardised data collection tools such as injury surveillance guidelines for landmine injuries will also greatly improve future monitoring of ill health and death.

Prospects for forecasting and preventing conflict

Measuring the health consequences of conflict may provide the much needed evidence base on which to undertake risk assessments. Lately, political scientists have had some notable successes in forecasting international and intranational conflicts.²⁵⁻²⁶ Similarly, the first reliable forecasts of state failure have also recently become available.²⁷ These studies are useful, but they are carried out only annually and are based on data sources that tend to be out of date upon completion. We need forecasts of the risk of conflict updated on the basis of events as they occur, perhaps automatically coded from news stories or eyewitness accounts. That way, better measurement will become feasible, validated forecasts can be produced, and the public health community can fulfil its mission in assessing risk.

Accurate assessments of the risk of conflict and the magnitude of possible consequences would raise the possibility of preventing the health consequences of conflict. Since political scientists have long studied the causes of war, discovering the effects of deterrence and the pacifying effects of democracies in the international system, a collaboration between political scientists and public health researchers could provide a firmer basis for attempts to prevent conflicts. Unfortunately, the two professions seem to have little connection.²⁸ Combining their research would give both sides a more complete approach and would help focus the attention of the international community on efforts to protect populations from the consequences of conflict.

Conclusion

More reliable data are needed to quantify the health effects of armed conflict. Better forecasts of war are also needed to enable public health workers to prepare for refugee problems and the numerous other public health consequences and to inform foreign policy. Reducing the uncertainties of life by providing better forecasts of war directly improves the human condition. Indeed, "human security" has at its core a concern about providing reasonable assurances about the future.²⁹

We thank Mie Inoue and Doris Mafat for their contribution of mortality data and Scott Bennett and Phil Schrodt for helpful suggestions. The boundaries shown in figure 2 do not imply the expression of any opinion by the WHO on the legal status of any territory or frontier.

Funding: We are supported by grants from the National Institute on Aging, National Institutes of Health (PO1 AG17625-02), and the Weatherhead Center for International Affairs at Harvard University.

Competing interests: None declared.

- 1 Ghobarah H, Huth P, Russett B. Civil wars kill and maim people—long after the shooting stops. (Draft 29 Aug 2001). Center for Basic Research in the Social Sciences. www.cbrrs.harvard.edu/programs/hsecurity/papers/civilwar.pdf (accessed 14 Jan 2002).
- 2 Central and East European Law Initiative of the American Bar Association and the Science and Human Rights Program of the American Association for the Advancement of Science. *Political killings in Kosovo/Kosovo, March-June 1999*. Washington, DC: ABA Central and East European Law Initiative, 2000.
- 3 Hill K, Trussel T. Further developments in indirect mortality estimation. *Popul Stud* 1977;31:75-81.
- 4 Chandramohan D, Mande G, Rodrigues L, Hayes R. Verbal autopsies for adult deaths: their development and validity in a multi-centre study. *Trop Med Int Health* 1998;3:436-46.
- 5 Spiegel PB, Salama P. War and mortality in Kosovo, 1998-1999: an epidemiological testimony. *Lancet* 2000;355:2204.
- 6 Seybolt TB. Major armed conflicts. In: *SIPRI yearbook 2001: armaments, disarmament and international security*. Oxford: Oxford University Press, 2001:15-51.
- 7 *Armed conflict report 2001*. Waterloo, Canada: Project Ploughshares, 2001.
- 8 Singer JD, Small M. *The wages of war, 1816-1965: a statistical handbook*. New York: John Wiley and Sons, 1972.
- 9 Wallensteen P, Sollenberg M. Armed conflict, 1989-2000. *J Peace Res* 2001;38:629-44.
- 10 *EM-DAT: The OFDA/CRED international disaster database*. Brussels: Université Catholique de Louvain, 2001.
- 11 Marshall M. Measuring the societal impact of war. In: Hampson FO, Malone D, eds. *From reaction to conflict prevention: opportunities for the UN system*. Boulder, CO: Lynne Rienner, International Peace Academy, 2001:63-104.
- 12 Euroconference: identifying wars: systematic conflict research and its utility in conflict resolution and prevention. 2001. www.pcr.uu.se/ident.html (accessed 14 Jan 2002).
- 13 Bond J, Bond D, Silva J, Oh C. *The VRA reader*. Weston, MA: VRA Press, 1999. (www.vranet.com/products.html)
- 14 King G, Lowe W. An automated information extraction tool for international conflict data with performance as good as human coders: a rare events evaluation design. 1 Nov 2001. <http://gking.harvard.edu/files/infoex.pdf> (Accessed 14 Jan 2002).
- 15 World Health Organization. *World health report 2001*. Geneva: WHO, 2001.
- 16 Levy BS, Sidel VW, eds. *War and public health*. New York: Oxford University Press, 1997.
- 17 Sivard RL. *World military and social expenditures, 1991*. 14th ed. Washington, DC: World Priorities, 1991.
- 18 Coupland RM, Korver A. Injuries from antipersonnel mines: the experience of the International Committee of the Red Cross. *BMJ* 1991;303:1509-12.
- 19 Garfield RM, Frieden T, Vermund SH. Health-related outcomes of war in Nicaragua. *Am J Public Health* 1987;77:615-18.
- 20 Coupland RM, Meddings DR. Mortality associated with use of weapons in armed conflicts, wartime atrocities, and civilian mass shootings: literature review. *BMJ* 1999;319:407-10.
- 21 Murray CJL, Lopez AD. *The global burden of disease*. Cambridge, MA: Harvard University Press, 1996.
- 22 International Campaign to Ban Landmines. *Landmine monitor report 2001: toward a mine-free world*. New York: Human Rights Watch, 2001.
- 23 Stanton C, Abderrahim N, Hill K. An assessment of DHS maternal mortality indicators. *Stud Fam Plann* 2000;31:111-24.
- 24 Ustün TB, Chatterji S, Villanueva M, Bendib L, Sadana R, Valentine N, et al. *WHO multi-country household survey study on health and responsiveness, 2000-2001*. Geneva: WHO, 2001. (GPE discussion paper.)
- 25 Beck N, King G, Zeng L. Improving quantitative studies of international conflict: a conjecture. *Am Political Sci Rev* 2000;94:21.
- 26 Russett B. International relations. In: Kempf-Leonard K, ed. *Encyclopedia of social measurement*. San Diego: Academic Press (in press).
- 27 King G, Zeng L. Improving forecasts of state failure. *World Polit* 2001;53:623.
- 28 Valentino BA, Huth P, Balch-Lindsay D. "Draining the sea": mass killing, genocide, and guerrilla warfare (31 Aug 2001). Center for Basic Research in the Social Sciences. www.cbrrs.harvard.edu/programs/hsecurity/papers/draining.pdf (accessed 14 Jan 2002).
- 29 King G, Murray CJL. Rethinking human security. *Political Sci Q* 2002.