War and mortality in Kosovo, 1998–99: an epidemiological testimony

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Summary

Background The total number, rates, and causes of mortality in Kosovo during the last war remain unclear despite intense international attention. Understanding mortality that results from modern warfare, in which 90% of casualties are civilian, and identifying vulnerable civilian groups, are of critical public-health importance.

Methods In September 1999 we conducted a two-stage cluster survey among the Kosovar Albanian population in Kosovo. We collected retrospective mortality data, including cause of death, for the period of the conflict.

Findings The survey included 1197 households comprising 8605 people. From February, 1998, through June, 1999, 67 (64%) of 105 deaths in the sample population were attributed to war-related trauma, corresponding to 12 000 (95% CI 5500–18 300) deaths in the total population. The crude mortality rate increased 2·3 times from the pre-conflict level to 0·72 per 1000 a month. Mortality rates peaked in April 1999 at 3·25 per 1000 a month, coinciding with an intensification of the Serbian campaign of "ethnic cleansing". Men of military age (15–49 years) and men 50 years and older had the highest age-specific mortality rates from war-related trauma. However, the latter group were more than three times as likely to die of war-related trauma than were men of military age (relative risk 3·2).

Interpretation Raising awareness among the international humanitarian community of the increased risk of mortality from war-related trauma among men of 50 years and older in some settings is an urgent priority. Establishing evacuation programmes to assist older people to find refuge may prevent loss of life. Such mortality data could be used as evidence that governments and military groups have violated international standards of conduct during warfare.

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Introduction

War is one of the critical determinants of the health status of populations in many parts of the world. In terms of loss of disability-adjusted life years (DALYs), war was ranked sixteenth by WHO in the global burden of disease in 1990, and by the year 2020 it is expected to rank in eighth place (www.who.int/eha/emergenc/sue/sld008.htm, accessed April 20, 2000). Although the frequency of civil wars is increasing,[1] the direct and indirect effects of war on the civilian population commonly remain poorly documented. In complex emergencies in Rwanda, Iraq, Sierra Leone, Chechnya, and the Balkans, basic measurements such as total number of deaths, mortality rates, causes of death, and risk factors, remain inadequately recorded.[1–5]

The proportion of all war casualties that are civilian has increased from about 14% in the First World War to 67% the Second World War, and to 90% in the 1990s.[4] The targeting of civilians in modern warfare has become an objective of war. The pattern of human-rights abuses termed "ethnic cleansing" may include individual and mass killings, sporadic or systematic rape, the destruction of civilian residences and institutions, and commonly the violation of medical neutrality. This pattern has been documented previously in the former Yugoslavia, where by late 1994 there were an estimated 150 000 war-related casualties in Bosnia and Herzegovina,[2] and it appears to have been repeated in Kosovo in 1998 and 1999.[6,7]

Long-standing conflict in Kosovo, a province in the Federal Republic of Yugoslavia, between the majority ethnic Albanian population and the Yugoslav military of primarily Serbian forces, escalated at the end of February 1998. After clashes between Serbian forces and the newly formed Kosovo Liberation Army (KLA), a UN resolution was passed in September 1998 that paved the way for a partial withdrawal of Yugoslav military from Kosovo and the deployment of unarmed observers by the Organization for Security and Cooperation in Europe (OSCE). By the time the aerial bombardment of the former Republic of Yugoslavia led by the North Atlantic Treaty Organisation (NATO) began on March 24, 1999, more than 260 000 people in Kosovo were estimated to be internally displaced and an additional 100 000 people were displaced within the region.[8] After an intensification of the "ethnic cleansing" campaign, about 800 000 Kosovar Albanians fled to neighbouring countries such as the former Yugoslav Republic of Macedonia, Albania, and Montenegro, as well as to other countries (www.nnhcr.ch/news/media/kosovo.htm, accessed April 20, 2000). After signing the peace agreement, all of the Serbian forces finally withdrew from Kosovo on June 20, 1999, and the largely spontaneous repatriation of refugees began. By the end of July, more than 770 000 refugees had already returned to Kosovo (www.unhcr.ch/world/euro/fryugo.htm, accessed April 20, 2000).

The large number of civilian deaths was used as a partial justification for the NATO-led intervention.

However, debate concerning the number of dead in Kosovo has continued, with wide variation in estimates (www.state.gov/www/global/human_rights/kosovoii/homepage.htm#exe, accessed April 20, 2000).[6,9–11] We did a systematic population-based survey to determine mortality rates, causes of death, and risk factors among the entire Kosovar Albanian population, including refugees and internally displaced people, from February, 1998, to June, 1999.

The survey was a collaborative effort between the non-governmental organisation International Rescue Committee, the Kosovo Institute of Public Health, the WHO, and the Centers for Disease Control and Prevention.

Methods

We did a two-stage cluster survey in Kosovo between Sept 8, and Sept 17, 1999 with households as the primary sampling unit. The sample size was calculated to achieve a 95% CI of 0·5% around an estimated cumulative incidence of mortality of 1·16% for the study period between February, 1998, and June, 1999. This estimate assumed a doubling of the mean baseline crude mortality rate of 0·31 per 1000 a month (3·72 per 1000 a year) for the period between 1994 and 1996.[12,13] The design effect is the factor by which the sample size calculated for a simple random sample needs to be multiplied to account for the dependence of a given variable within a cluster. Assuming a design effect of four, we calculated a total sample population of 6440. On the basis of a mean family size of six,[14] we had to sample a minimum of 1073 households, but we increased the number to 1200 to allow for possible non-response and refusals.

A population sampling frame for the Kosovar Albanian population was determined by adjusting the 1991 census data on the basis of more recent estimates by the UN High Commissioner for Refugees (UNHCR), the Kosovo Force (KFOR, the NATO intervention force), and Action Against Hunger. An adjustment factor for each municipality (geographic subunit of the province) was then applied to each of the 1991 municipal population data. Four predominantly Serbian municipalities were excluded (data on the Serbian population will be reported elsewhere). We also excluded the northern half of the Mitrovica municipality and half of the divided towns of Orahovac and Mitrovica. This left 25 of the possible 29 municipalities to be sampled. Any village with a population size of less than 100 people was excluded because the 1991 census combined these populations with the nearest larger village. For the purposes of a larger study, the population was then apportioned into four strata: urban destroyed; urban non-destroyed; rural destroyed; and rural non-destroyed, according to relative population size. This separation allowed comparisons between the strata for certain variables (these data will be reported elsewhere). Within each strata, clusters were then assigned by means of the calculated sampling interval.

50 clusters with 24 households per cluster were chosen for the survey according to the standard methods used by the Expanded Programme on Immunisation.[15] In the first stage, clusters were assigned proportionally to the village or neighbourhood populations within each strata. In the second stage, households were chosen by randomly choosing a direction from the centre of the cluster and recording the distance (at 1/10 km intervals measured by an odometer in a vehicle) or number of houses from that point to its perimeter. A specific distance (and nearest house to that point) or house was randomly chosen as the first house. The next dwelling to the right of the house was consecutively chosen until 24 households were surveyed. A household was defined as a group of people who normally live under the same roof and share meals. If more than one household was present in the same dwelling, one was randomly selected. The questionnaire was given to the head of household or another adult member. If no adult member of the household was home at the time of the survey, the survey team returned to that household later in the day. If there was still no one at home, the team selected the next house. There were no instances of household representatives refusing to be interviewed. 14 teams consisting of two Albanian-speaking people each had 2 days of training and a half-day field trial.

We did a household census, including age and sex, of all family members present during January 1998. Surveyors were instructed to record any births and possible deaths of any children between February, 1998, and June, 1999. Each family member was categorised as "alive at home", "alive away from home", dead, or missing. Any person whose whereabouts was not known at the time of the survey was defined as missing. For those people listed as dead, we questioned the interviewee to identify the exact date of death and its circumstances. Structured questions were then used to assign cause of death into seven broad categories: war-related trauma (excluding deaths caused by landmines)—landmine injury, chronic disease, infectious disease, suicide, unknown causes, and other—with a space to record the cause. When calculating rates and relative risks, we have reported only two aggregate categories: deaths occurring as a direct result of war-related trauma, and deaths occurring from all other causes, which includes chronic diseases, infectious diseases, unintentional injuries (ie, motor vehicle accidents), natural deaths (ie, deaths from old age), and unspecified causes. War-related trauma was defined as any death occurring as a direct result of an injury sustained during the conflict. War-related trauma included summary and arbitrary killings by gun fire, shrapnel, or other munitions, or by the burning or collapsing of buildings, bridges, and other structures. Age categories were chosen that would allow for differentiation between people likely to be of military age (15–49 years) and those likely to be civilians (0–14 years and 50 years and older).

Analysis was done with EpInfo (version 6.04b), which includes C-sample for determining CIs and standard errors for cluster survey methodology. The war period was defined as the 17 months between February, 1998, and June, 1999, inclusive. Data from other months (January 1998, and July to September 1999) in conjunction with data from the former Republic of Yugoslavia Ministry of Health[12] and the Kosovo Institute for Public Health[13] provide a baseline comparison for mortality rates before and after the conflict.

Results

We completed a standardised questionnaire for 1196 households comprising 8605 people (mean household size included 6·9 individuals). No households refused to participate, although four clusters included only 23 households. We selected villages from 21 of 25 eligible municipalities. Demographic characteristics of the sample population are listed in table 1. The mean age of the sample population was 27·1 years and the average sex ratio was 1·04:1·00 (female:male) in all age-groups.

Of the 105 deaths recorded, 67 (64%) were due to war-related trauma and 20 (19%) were caused by chronic disease. There were no reported deaths as a consequence of suicide or landmine injuries (table 1, figure 1). 79 (75%) of the total deaths were in men, as were 60 (90%) of the war-related trauma deaths, and 19 (50%) of the

	Female (%) (n=4383)	Male (%) (n=4222)	Total (n=8605)
Age-groups			
0–14 years	1323 (50·0)	1324 (50·0)	2647
15–49 years	2400 (51·8)	2232 (48·2)	4632
50+ years	660 (49·8)	666 (50·2)	1326
Deaths			
Total	26 (24·8)	79 (75·2)	105
War related	7 (10·4)	60 (89·6)	67
Other	19 (50·0)	19 (50·0)	38
Missing people	1 (4·5)	21 (95·5)	22

Table 1: **Household demographics for the survey population**

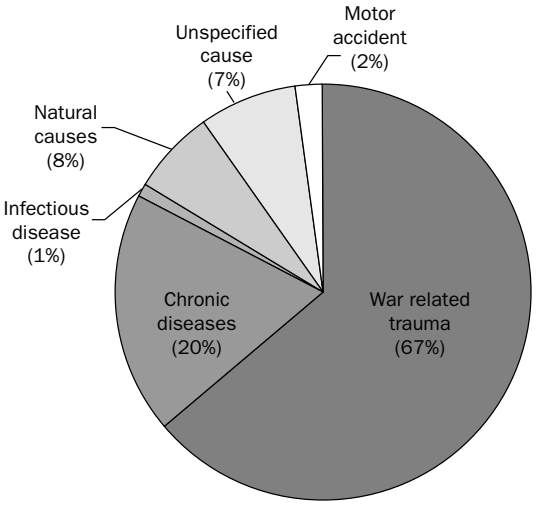

Figure 1: **Proportionate causes of death (February, 1998, to June, 1999)**

deaths from other causes. Of the 22 reported missing people 21 (96%) were men 17 (77%) were men between the ages of 15–49 years, and 17 (77%) were reported missing between March and June 1999.

During the 17-month period from February, 1998, to June, 1999, the crude mortality rate was 0·72 deaths per 1000 a month (95% CI 0·48–0·98), and the war-related trauma mortality rate was 0·46 deaths as per 1000 a month (0·21–0·70). The missing person rate—the number of people expressed as a rate per 1000 a month who disappeared within the 17-month period and remain unaccounted for by families surveyed—was 0·15 people per 1000 a month (0·05–0·25). Extrapolating these rates to the total Kosovar Albanian population of 1 536 764, we estimate that there were 18 800 [12 000–25 600] total deaths, 12 000 [5500–18 300] deaths from war-related trauma, and 3900 [1300–6500] people who went missing during this period. Figure 2 shows the variation in monthly mortality rates for war-related trauma and other causes, as well as the missing-person rates and plots their association with political and military events that occurred between January, 1998, and September, 1999. The crude and war-related mortality rates peaked in April 1999 at 3·25 and 2·79 deaths per 1000 a month, respectively. Rates of missing individuals also peaked in April 1999 at 1·28 missing individuals per 1000 a month. Deaths due to "other" causes increased between March and June 1999, the most intense period of the conflict.

Figure 3 and table 2 show the causes of mortality by sex-specific and age-specific rates. Men were 8·9 (95% CI 3·0–26·4) times more likely to die from war-related trauma than women. We compared sex-specific rates within the age strata and found that men and women aged 0–14 years had a similar mortality rate from war-related trauma, whereas men of military age (15–49 years) and men 50 years and older were 10·8 (2·7–42·2) and 9·6 (2·4–37·6) times more likely to die of war-related trauma than were women in their respective age-groups.

For women, age-specific mortality rates caused by war-related trauma did not differ significantly. However, men of military age were 17·8 (2·2–146·9) times more likely to die from war-related trauma than men in the 0–14 age-group, and men 50 years and older were 3·2 (2·0–5·2) more likely to die from war-related trauma than were men of military age. The trend for the group of men older than 50 years shows an increasing risk with increasing age; men aged 60–69 years and men aged 70 years and older were 4·3 (2·6–7·2) and 5·1 (2·4–10·9) times, respectively, more likely to die of war-related trauma than men of military age.

There was no significant difference in mortality from other causes between men and women. People aged 50 years and older had a significantly increased risk of dying from other causes than the other two age-groups (figure 3).

We did not know if those classified as missing were alive or dead at the time of the survey. The missing-person rate was disproportionately high among men aged 15–49 years. To find out if the higher mortality rates caused by war-related trauma for the subgroup of men older than 50 years compared with men aged 15–49 years was a consequence of the exclusion of missing people from the mortality analysis, we combined the missing-person rate with the war-related trauma mortality rate for each age-group and compared the results. Although the relative risk of dying from war-related trauma or being reported as missing for men older than 50 years, compared with that of men of military age, decreased slightly when the two groups were aggregated, it was still significantly increased at 2·8 (1·9–4·1).

Discussion

Between February, 1998, and June, 1999, the crude mortality rate (0·72 deaths per 1000 monthly) in Kosovo was 2·3 times higher than the pre-conflict baseline. Mortality rates were highest between the months of March and June 1999, coinciding with the NATO bombing and the intensification of the Serbian campaign of "ethnic cleansing". The largest increase in the crude mortality rate occurred in April and is of a similar order of magnitude than that reported in previous complex emergencies in the Balkans where civilians were targeted. Between April, 1992, and March, 1993, the crude mortality rate in a muslim enclave under siege in Bosnia-Herzegovina was four times the baseline rate.[2] Complex emergencies in more-developed countries differ substantially from those in less-developed countries that usually have much higher crude mortality rates and increases in mortality from baseline. Crude mortality rates have reached as high as 20–35 deaths per 10 000 daily (61–107 deaths per 1000 a month) in recent emergencies in less-developed countries.[16,17] The increase in crude mortality rates has ranged from 8·1–15·2 times[18] the baseline rate among Cambodian refugees in Thailand (1979), Ethiopian refugees in Somalia (1980) and eastern

	Mortality rates* (95% CI)			Missing person rate (number/ 1000 a month)
	All cause	War related	Other	
0–14 years				
Male	0·13 (0·00–0·28)	0·04 (0·00–0·13)	0·09 (0·00–0·21)	0
Female	0·09 (0·00–0·21)	0·05 (0·00–0·13)	0·05 (0·00–0·13)	0·05 (0·00–0·13)
15–49 years				
Male	0·90 (0·35–1·44)	0·80 (0·25–1·33)	0·11 (0·004–0·21)	0·50 (0·14–0·86)
Female	0·06 (0·05–0·29)	0·07 (0·00–1·15)	0·10 (0·00–0·19)	0
50+ years				
Male	3·71 (2·15–5·27)	2·56 (1·07–4·06)	1·15 (0·51–1·78)	0·16 (0·00–0·42)
Female	1·52 (0·73–2·30)	0·27 (0·00–0·65)	1·25 (0·60–1·90)	0

*Deaths per 1000 per month.

Table 2: **Age-specific and sex-specific mortality rates**

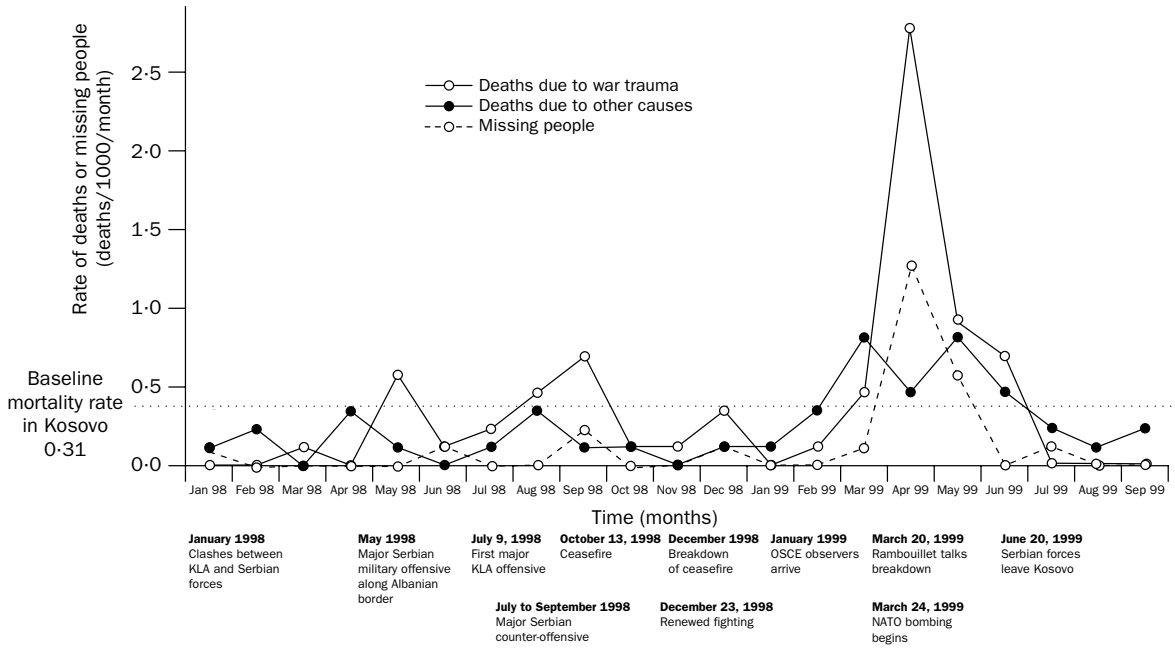

Figure 2: **Total and monthly mortality rates and missing individuals (January, 1998, to September, 1999)**

Sudan (1985), to more than 30 times the baseline rate among Rwandan refugees in Goma, Zaire in 1994.[17]

Our estimate of 12 000 deaths directly related to war trauma between February, 1998, and June, 1999, represents the first epidemiological estimate to be obtained for the entire Kosovar Albanian population. It is consistent with other estimates proposed by Physicians for Human Rights (9269 deaths during a 1-year period),[6] the International Criminal Tribunal for the Former Yugoslavia (11 334 deaths, exact time period not specified),[9] and the US Department of State (at least 10 000 deaths, exact time not specified, www.stat.gov/www/global/human_rights/kosovii/homepage.html#exe, accessed April 20, 1999). Although it is not possible to differentiate completely between civilian and military casualties because of the nature of the conflict and the sensitivities of gathering this type of information, the age distribution of casualties in our survey, together with information derived from interviews with survivors, suggests that most deaths were civilian.

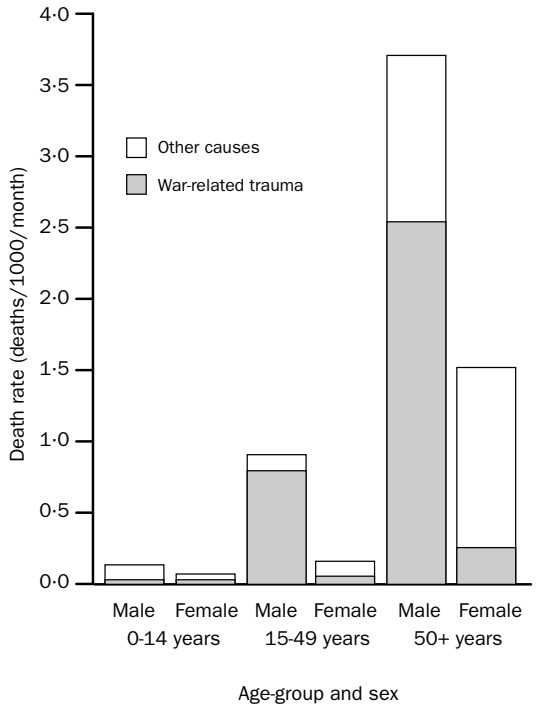

Figure 3: **Age-specific and sex-specific mortality rates (February, 1998, to June, 1999)**

The number of missing people during this 17-month period was estimated to be 3900. Our survey was done in September 1999, by which time most displaced families had returned to Kosovo and were reunited. The age distribution and time of disappearance of the missing people supports the hypothesis that those individuals still missing are likely to be dead or in detention in Serbia.[19] Other sources indicate that approximately 2000 people are thought to be in detention.

The differing causes and magnitudes of mortality between less-developed and more-developed countries reflect the differing pre-emergency health status and epidemiological disease profiles of the population, the mode and distance that the displaced people must travel to reach a safe haven, the accessibility of the safe haven, and the local and international humanitarian response. In complex emergencies in less-developed countries, infectious diseases, commonly in association with malnutrition, are the largest cause of mortality.[20,21] For example, in Somalia between April, 1992, and January, 1993, deaths caused by war-related trauma accounted for only 4–11% of all mortality.[21] Yet during recent conflicts in developed-country settings in Kosovo and Bosnia-Herzegovina,[3] war-related trauma has been the major cause of death. Besides the direct effects of war-related trauma, there were also indirect effects on mortality as a result of the war. The second leading cause of death during the Kosovo conflict was chronic disease. Mortality from other causes peaked between March, 1999, and

June, 1999, the same period as the peak in war-related mortality. Pre-existing illnesses during this period may have been exacerbated by physical and psychological stress, limited access to health care, or lack of medications for chronic diseases. As would be expected, older men and women made up the majority of all deaths from other causes during this intense time of conflict. The increased vulnerability of older civilians in populations under siege has been suggested previously in the Balkans, as well as in the current conflict in Chechnya, and deserves further investigation.[2,22]

Men who were 15 years and older were more likely to die from war-related trauma than were women of the same age, and this risk increased with age. Thus, our data concur with other reports which indicate that men, and particularly Kosovar Albanian men of military age, were systematically targeted by the Serbian forces.[6] Men 50 years and older, however, had the highest age-specific mortality rates for war-related trauma.

There are a number of potential explanations why men 50 years and older were at increased risk of dying due to war-related trauma compared with men of military age during the Kosovar conflict. Young men, anticipating that they would be targeted, may have fled from their homes in advance of the arrival of the Serbian forces, or they may have left to join the KLA. The older population were generally less mobile and may have been less willing or able to leave their homes.[23] This premise is supported by demographic data from the refugee camps in the former Yugoslav Republic of Macedonia, where people 60 years and older constituted only 5·9% of the total refugee population[24] compared with 10·3% of those people in our sample population in Kosovo who were never displaced during the conflict. Older adults, therefore, may have been over-represented among the population remaining in villages when Serbian forces began shelling residential areas. Nevertheless, two factors suggest that older men were targeted by the Serbian forces in a more deliberate campaign. Firstly, the magnitude of the increased risk of war-related trauma for older men compared with men of military age, and secondly, the fact that older men were nearly ten times more likely to have been killed by war-related trauma than were older women. Serbian forces may have targeted older men, who are traditionally the heads of households, to weaken the social and cultural integrity of the Kosovar Albanian society and to encourage abandonment by the family of their land, or to decrease the likelihood of relatives returning from neighbouring countries to care for them when the conflict ended. The targeting of older men represents a new facet of "ethnic cleansing."

There are a number of limitations to our study. Recall bias represents a limitation in any retrospective study of mortality, and this bias is particularly relevant when recall periods are long. However, in our study all informants reporting a death in the family were able to remember the exact date of death. Because of inaccurate population census data and the lack of reliable information on population demographics, a situation that is the norm in war-torn countries, selection bias may have occurred. We partially accounted for this by applying an adjustment factor based on more recent population estimates. There may still be a bias in our study, however, because villages with fewer than 100 individuals were not available for selection for our survey, and there is evidence that the more rural, isolated areas were targeted by Serbian forces. Furthermore, only households present on the day of the survey were sampled. These factors could have biased the study, since households in which all members had died during the war could not have been selected, resulting in an under-reporting of deaths (survivor bias). Both of these factors would have led to an underestimation of mortality but would not have altered our major conclusions. Lastly, the small number of deaths and missing people in our study has resulted in wide CIs.

UN agencies, together with donor agencies and non-governmental organisations must recognise and respond appropriately to the different epidemiological profiles of mortality in complex emergencies in more-developed countries and in less-developed countries. Requirements for personnel and medical supplies may need to be adjusted, and planning and response may be quite different. Effective treatment of war-related trauma, available whenever humanitarian organisations have access to affected populations, may save lives.[25] Older men, not previously thought to be at high risk for war-related trauma, may be vulnerable and in need of protection in some settings. Protection measures may include assistance in evacuation, if feasible. Protection of older civilians may have immediate relevance for Serbian and other minority groups in Kosovo.[26] Although the response of the Serbian forces could not have been predicted if alternative political or military strategies by western governments and NATO had been pursued, achieving the objective of minimising civilian casualties may require us to consider interventions other than only aerial bombardment in similar future emergencies.

One reason for the poor documentation of war-related mortality in most conflicts is the lack of simple and reliable epidemiological tools that can be used in the field. Methods which may not be representative of the entire population, such as interviews with refugees and returnees, may be limited by substantial selection bias, and thus results may not be generalisable to the whole population.[27] Counting bodies retrieved from mass graves may lead to gross underestimates; there is evidence that Serbian forces in Kosovo attempted to burn or remove bodies in an effort to eliminate potentially incriminating evidence.[23] Current population-based methodologies, such as cluster surveys, require technical expertise and considerable logistic support and may lack precision when documenting rare events such as deaths. Therefore, there is a need to improve upon and standardise practical epidemiological methods for the systematic collection of information, such as mortality data, during and after periods of conflict. These epidemiological methods should provide reliable data for the use of appropriate international judicial authorities charged with determining whether international humanitarian laws have been systematically violated during times of conflict as well as holding the responsible parties accountable for their actions. The ultimate objective, however, is to prevent or minimise unnecessary loss of life in the future. Attaining this goal will require a renewal of our collective public health efforts to prevent war.

Contributors

Both investigators contributed to the conception and design of the study, data collection, analysis, interpretation of the data, and drafting and reviewing of the paper.

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