

EPIDEMIOLOGY

Calculating Iraq's Death Toll: WHO Study Backs Lower Estimate

A team led by the World Health Organization (WHO) has produced a new estimate of the number of Iraqis who died violently in the first 40 months following the U.S.-led invasion: between 104,000 and 223,000. This figure, published online last week by the *New England Journal of Medicine*, hews close to some other attempts to quantify the toll but comes in far below a controversial 2006 study led by researchers at Johns Hopkins University in Baltimore, Maryland. That group estimated approximately 600,000 violent deaths during the same period. The discrepancy has prompted critics to renew their charge that the Johns Hopkins results are not credible.

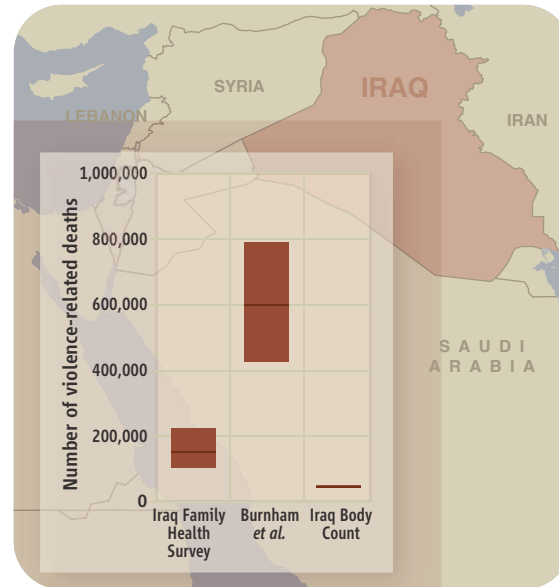
Data from a war zone are never fully reliable; the best researchers can hope for is “getting the numbers roughly right,” says Fritz Scheuren, a statistician at the University of Chicago in Illinois and past president of the American Statistical Association. Escalating violence in Iraq after 2003 put a limit on quality control, but researchers do have a quantitative starting point: the casualty tally made by Iraq Body Count, a non-profit advocacy group based in London. By controlling for multiple accounts of the same car bombs and shootings, the group estimates from media reports that between 81,000 and 88,000 violent deaths have occurred in Iraq since the invasion. The figure is useful as “a lower bound on the true number,” says Jon Pedersen, a statistician at the Fafo Institute for Applied International Studies in Oslo, Norway.

To get the upper bound, says Pedersen, you have to knock on doors in what is known as a two-stage cluster survey. That's the method used by the WHO and Johns Hopkins teams, among others. Researchers divide the country into regions and then sample clusters of households within each. Finally, they extrapolate mortality rates from those clusters to the total population.

Epidemiologists Les Roberts and Gilbert Burnham of Johns Hopkins published the first Iraq cluster study in November 2004 in *The Lancet*. They used data collected by Roberts and an Iraqi team, which, in September 2004, surveyed 988 households in 33 clusters across the country. They arrived at a figure of 98,000 “extra” deaths since the invasion, about half due to violence. Soon after this, a team led by Pedersen and the

United Nations Development Programme, which had used a much larger sample of 21,668 households in 2200 clusters, produced an estimate for roughly the same period of about 25,000 violent deaths.

As the invasion gave way to occupation and insurgency, Roberts and Burnham



Human cost. The WHO-led Iraq Family Health Survey estimated as many as 223,000 deaths since the Iraq invasion, far fewer than a survey by Burnham and Roberts estimated.

mounted another study. This time they left the surveying entirely to the Iraqi team, communicating from abroad. Published in October 2006 in *The Lancet*, the second survey—based on 1849 households in 47 clusters—estimated that 601,000 Iraqis died violent deaths between the 2003 invasion and July 2006. To many, the number seemed unrealistically high. Some also faulted the authors for not fully answering questions about the survey's methods (*Science*, 20 October 2006, p. 396).

Now comes the WHO survey. Conducted with the help of the Iraqi government, it is by far the most comprehensive mortality assessment to date. Interviewers visited 9345 homes in more than 1000 clusters. But its estimate of 151,000 violent deaths has come in for some criticism, too. Unlike other Iraq casualty surveys, this one includes an upward adjustment of 35% to account for “underreporting” of deaths due to migration, memory lapse, and dishonesty. “That is

really an arbitrary fudge factor,” says Debarati Guha-Sapir, an epidemiologist at the WHO Collaborating Centre for Research on the Epidemiology of Disasters in Brussels, Belgium. But the number falls squarely within the range produced by a meta-analysis of all available mortality studies by Guha-Sapir and fellow centre epidemiologist Olivier Degomme. The Johns Hopkins figure is an outlier, she says.

Why the Hopkins study came up with such a high figure is not clear. Criticism of the study has in fact intensified since Burnham and Roberts released a data set to selected peers last year. “It did not include the standard kinds of data,” says Seppo Laaksonen, a statistician at the University of Helsinki in Finland and a specialist in survey methodology. For example, he says, it was impossible “to check the objectivity and randomness of cluster selection.” Scheuren, who also received the data, wanted to compare results obtained by different interviewers to “get a handle on noise” and check for fabrication by surveyors. Roberts declined to provide all the details, according to Scheuren, saying that he was concerned that this would risk the safety of the interviewers.

Burnham told *Science*, however, that the Johns Hopkins team does not have such detailed information. “Our goal was to reduce any type of risk to the community and the participants,” says Burnham. “While we have much of the raw data, we requested that anything designating the interviewers or the location of the neighborhoods visited not be sent to us.” Laaksonen responds that he would not have published “any figures for the country” if he didn't have direct access to such raw information from surveyors.

Burnham is not retreating. Because the WHO survey was conducted by Iraqi government personnel, “people may have been hesitant to answer honestly,” he says. He claims that unlike those in the WHO study, nearly all of the deaths tallied by the 2006 *Lancet* study were verified with death certificates. Even if the debate may be drawing to a close about whether the number of violent deaths in postinvasion Iraq could be as high as 600,000, the argument about methods is clearly far from settled.

—JOHN BOHANNON