

# Towards Collation and Modelling of the Global Cost of Armed Violence on Civilians

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A method is described which translates qualitative reports about armed violence into meaningful quantitative data allowing an evidence-based approach to the causes and effects of the global health impact of armed violence on unarmed people. Analysis of 100 randomly selected news reports shows that the type of weapon used, the psychological aspect of the violence, the number of weapons in use and the victims' vulnerability independently influence the mortality of victims. Data collated by the same method could be analysed together with indicators of poverty, development and health so illuminating the relationship between such indicators and degradation of peoples' physical security through acts of armed violence. The method could also help uphold the laws of war and human rights.

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Armed violence and its effects constitute the stuff of our daily news. The human cost of this largely preventable phenomenon is moving up the global health agenda.<sup>1</sup> The psychological aspect of the violence itself, the type and number of weapons in use and the vulnerability of the victims have been postulated as necessary but not sufficient determinants of the effects of any act of armed violence.<sup>2</sup> But there is no established methodology to report, collate and analyse the effects of armed violence together with their determinants. Further, these determinants could also be labelled as 'risk factors' for a given effect.

We aimed to establish whether media reports of real events in which people are killed or wounded with weapons can be translated into meaningful data usable for statistical analysis.

## Methods

A retrospective cohort study of events involving armed violence was conducted by randomly selecting reports of armed violence over a five-year period; each report pertained to one event only.

Twenty-five percent of the data in the pilot study was double-entered by the authors. The results for each variable were compared and any discrepancies were resolved. The data also underwent logical data checks to ensure data accuracy.

### *Data Sources, Search Criteria and Sample Selection*

LexisNexis Academic was used to obtain media reports on armed violence. The search terms used to construct the pilot database were a combination of weapon search terms, such as ‘gun’ or ‘missile’, and weapon’s effects search terms such as ‘killed’ or ‘injured’ in the headline or lead paragraph of a report (see Appendix 1). A random sample of twenty reports per year over the five-year period from 1 May 1998 through 30 April 2003 was selected for a total sample size of 100 reports. The random sample was selected by randomly choosing 20 days from each year, then randomly selecting five events from within three days of each selected day, giving a seven-day period. If the selected report was excluded then the next report was evaluated until a report that met all the criteria was found. If there were less than five reports during the seven-day window, the events would be obtained within the next window. This continued until 100 reports were selected.

### *Definition of Armed Violence*

Armed violence was defined as: the intentional use – threatened or actual – against oneself, another person, or a group or community, of any material thing designed or used or usable as an instrument for inflicting bodily harm that results in or has the likelihood to result in injury or death, psychological harm, maldevelopment or deprivation.<sup>2</sup>

### *Inclusion and Exclusion Criteria*

An event involving armed violence was characterised in epidemiological terms by time, person and place. An event is defined as: at least one act of armed violence occurring at a specific place such as a city or a neighbourhood, over some time interval. As soon as the armed violence ceases then the event is over. For example, if a timed bomb is set off, and the police subsequently pursue the perpetrator and, in attempting an arrest later, shoot the individual, the explosion and shooting are two separate events. Two or more events are related if and only if the occurrence of at least one of the events is a sufficient cause of every other event. In the example above the bomb blast is a sufficient cause for the police pursuit. Therefore the bomb blast and police shooting the perpetrator are two related events.

A report was included only if:

- the headline or lead paragraph contains the specified search terms;
- the event meets the definition of an event;

- the event is the same event referred to in the headline or the lead paragraph.

A report was excluded only if:

- the date and place of the event is not specified;
- the weapon causing the effect is not specified;
- the report contains multiple unrelated events as indicated by the headline or lead paragraph;
- the report refers to an event more than 60 days prior to the report date (such as a court trial about an event that occurs 60 days after the event occurred);
- large discrepancies in effect estimates, for example, number killed, such that the ratio of the maximum estimate to the minimum estimate is greater than two.

### *Reporting Estimates*

In many reports the effects of armed violence on health are quantified as a lower limit of the true number, for example ‘at least ten people wounded’. In these cases we sought out a more accurate estimate of the effects by reviewing all stories related to the event within seven days of the occurrence of the event.

### *Measuring Risk Factors*

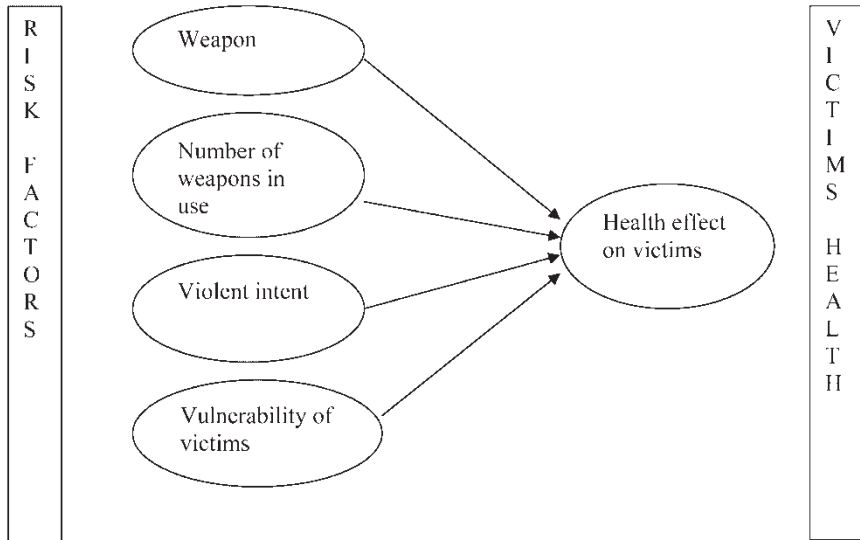
Coupland<sup>2</sup> proposed that the risk factors for the health effects of armed violence can be categorised into four main constructs (see Figure 1):

- potential of the weapon to cause the effect;
- number of potential armed users;
- vulnerability of the victim (potential to suffer the effect);
- intentional use of physical force (users’ potential for violence).

‘Weapon’ was quantified as a categorical variable (explosive, firearm, other). A surrogate for the number of armed users was quantified as a categorical variable (military, non-military armed group, police, civilian). ‘Vulnerability’ was quantified by assessing if the victims’ vulnerability was increased or not, which yields a binary variable. For example, if the report stated that the victims were herded into a small area then the victims’ vulnerability was increased.

‘Intentional use of force’ was quantified as a categorical variable as follows: did the user of the weapon intend to cause all, some, or none of the effects suffered by the victims? For example, if a person used a firearm to kill one person, but another person was hit unintentionally, then the user intended to cause some of the effects.

FIGURE 1  
PUBLIC HEALTH MODEL OF ARMED VIOLENCE



### *Reporting the Effect Details*

The reports were assessed for details of the health effects or the severity of the damage inflicted on the victim. For example if a reporter includes statements such as: 'I saw a young girl being put into an ambulance with her arm and leg blown off. If she is still alive it's a miracle', then this would be coded as 'yes', effect details given.

### *Follow-up*

Also recorded was the word count of the reports and whether there was any follow-up or investigation to the event. For example, did the report mention looking for the perpetrators?

### *The Armed Violence Mortality Index*

Mortality due to armed violence or the 'Armed Violence Mortality Index' (AVMI) can be defined as the ratio of the number of victims killed to the total number of victims that are either wounded or killed. This quantity is defined as long as there is at least one person that is either wounded or killed in the event. An AVMI value of zero can occur only if many people were wounded and nobody was killed, or none of the victims involved were either killed or wounded; in both cases nobody was killed, hence mortality is zero.

### *Statistical Analysis*

Summary statistics were generated for the risk factors and other variables of interest. The median and inter-quartile range (IRQ), being the difference

between the 75th percentile and the 25th percentile, of the AVMI were calculated. The Wilcoxon rank sum tests were used for comparing group means, and all p values calculated are exact. All statistical analyses were done using SAS 8.02.

## Results

Of the 100 events selected, 60 involved unarmed victims. In these 60 events, of the perpetrators, 19 (32%) were civilian, 19 (32%) were of unknown status, 15 (25%) were non-military armed groups, and seven (12%) were military. Of the victims, 56 (93%) were reported as civilian, and four (7%) were of unknown status (but unarmed). The median AVMI was 0.50 (IQR = 1.0, n = 19) when civilians were perpetrators, 0.21 (IQR = 0.35, n = 4) for military perpetrators, 0.04 (IQR = 0.42, n = 15) when the status of perpetrators was unknown and 0.08 (IQR = 0.18, n = 13) when perpetrators were non-military armed groups (p = 0.47).

Of the 60 events, 27% (n = 16) were related to armed conflict or political violence; 57% (n = 34) were unrelated to armed conflict or political violence, for example a domestic murder; and for 17% (n = 10) this could not be determined.

Of weapons used in the 60 events, 35 (58%) events involved explosive weapons, 17 (28%) events involved firearms, and six (10%) involved other weapons. Firearms and explosives were used in two events (3%). In nine of the 60 events the AVMI is missing, owing to either the number of wounded or killed not being reported. The median AVMI for all reports is 0.11 (IQR = 0.57, n = 51). The median AVMI associated with use of explosive weapons is 0.08 (IQR = 0.20, n = 29) compared to 0.75 (IQR = 1.0, n = 16) for use of firearms (P = 0.027). Two reports involved the use of both explosives and firearms with a median AVMI 0.49, and four events involved the use of other weapons such as a knife, with a median AVMI 0.50.

When the perpetrators were civilian, 73% of the events involved firearms. Perpetrators who were military, from non-military armed groups, or of unknown status used explosive weapons in 100%, 93% and 68% of the events respectively.

In 42 (70%) events the perpetrators intended to kill or wound 'all' their victims; intent was 'unknown' in seven (12%) events; 'some' of the health effects were intended in six (10%) events and 'none' of the effects intended in five (8%) events. When perpetrators intended to cause 'all' of the effects, the median AVMI is 0.11 (IQR = 0.59, n = 40). When combining events in which 'some' or 'none' of the effects were intended, the AVMI is 0.0 (IQR = 0.21, n = 8) (P = 0.09).

With respect to victims' vulnerability, in only two events was vulnerability intentionally elevated by the perpetrators. Prior warning was given in one event. When explosive weapons were used, the median AVMI were 0.10

(IQR = 0.20, n = 21) when victims were not in a building and 0.04 (n = 8, IQR = 0.11) when victims were in a building (P = 0.54).

By region, 16 (27%) reported events occurred in the Middle East, 13 (22%) in Western Europe, 11 (18%) in Asia, 10 (17%) in North America (USA and Canada), seven (11%) in Latin/South America and three (5%) in Africa. The environments in which the victims were killed or injured were: outdoors 28 (47%), a building 23 (38%), a vehicle four (7%), other four (7%), and a crowded area one (2%).

The median word count in the reports is 216 (IQR = 334). Details of the health effects were reported in 28 of the 60 articles (47%) of articles, and perpetrator follow-up was discussed in 50 of the 60 (83%) articles. Of the 10 articles from North America seven (70%) discussed details of the health effects, and nine (90%) discussed follow-up; in 16 articles from the Middle East four (25%) discussed health effect details, and 11 (69%) discussed perpetrator follow-up.

## Study Limitations

### *Media Bias*

Most epidemiological and public health approaches to armed violence must rely on, for example, monthly, quarterly or yearly data from government sources, yet armed violence occurs on a daily basis. Information pertaining to the character of the violence, such as victim vulnerability or perpetrator intention, is usually not captured as part of this data. Moreover, many countries where armed violence is a serious daily issue, such as Iraq, Afghanistan and Haiti, do not even have national statistical agencies. However, journalists write stories about armed violence in every country throughout the world, and many of these stories become part of a searchable large database of general news reports. A standard criticism of using media reports as a data source is that the media is both inaccurate and biased. King and Lowe reflect our position:

[Media] accounts constitute an imperfect summary . . . coverage is not uniform, and it varies according to the needs of the reporters rather than the scholarly need for representativeness . . . it is imperfect, and much additional research could and should be done to identify and correct the biases, but journalism is the source of most information that academics have about the international community outside of official government sources. And there should be no controversy over the claim that the immense volume of reportage . . . constitutes an enormous, and insufficiently mined, treasure of information.<sup>3</sup>

### *Language*

Only English language reports or reports translated into English were used. Bias introduced because of this could be reduced if reports from local

newspapers or other media services in other languages could be similarly collated.

### *Quantifying Risk Factors*

We recognise that other investigators might select different surrogate variables to quantify the four constructs proposed by Coupland.<sup>2</sup> However, we feel that the surrogate variables chosen are canonical surrogate variables for two reasons. Firstly, the surrogate variables chosen are amenable to standard statistical analyses, and secondly, we discussed these variables with a number of people having long experience of working in armed conflict with the International Committee of the Red Cross (ICRC). There was agreement that the variables chosen are valid measures of the four constructs.

## Discussion

Our method permits any act of armed violence using any weapon with any effect to be reported consistently. The unit of analysis is then an individual event for which there is information about the violence *and* the effects. It therefore becomes possible to translate qualitative reports into meaningful quantitative data about the global cost of armed violence on unarmed people.

Some of the results from this initial study are striking and deserve comment. First, a common phenomenon of people using explosives against civilians as a means to express their grievances could be highlighted.<sup>4,5</sup> To our knowledge, this has not been expressed or examined as a discrete policy issue or in public health terms. From our analysis on average ten civilians are injured for every person killed (95% CI: 5.5–14.7); this has implications for training in emergency services, triage and surgical care. The second interesting finding is that when firearms are used to kill unarmed people, the perpetrators tend to be civilian. The third finding relates to the regional difference in the number of reports; it is clear which regions do and which regions do not hold the attention of the media.

The type of weapon used and the chosen surrogates for the psychological aspect of the violence, the number of weapons in use and the victims' vulnerability seem independently to influence the AVMI. This supports the proposed relationship between the effects of armed violence and their risk factors.<sup>2</sup>

A report of an event of armed violence is incomplete unless it contains a discussion of major health effects, such as the number of killed and injured; this speaks more coherently to the nature of the armed violence.<sup>6</sup> The AVMI is a good index in this respect. However, effects of concern could also include, for example, the number of people displaced, arrested, beaten and raped. A larger sample size in conjunction with more sophisticated statistical techniques would bring us towards a more detailed analysis of the true

global cost of armed violence and could provide the basis of a predictive model. We are in the process of building a more extensive database for the ICRC.

### Conclusions

It is possible to collate and analyse information in media reports pertaining to armed violence and its effects. The method described could be useful for predicting effects and assessing risk factors; this would clarify a context when information is incomplete or questionable and so help the application of the laws of war or human rights.<sup>5,6</sup> Indicators of poverty, development, health, or other context variables could be analysed together with data generated by our method with a view to establishing the relationship between such indicators and degradation of peoples' physical security through acts of armed violence. For example, the relationship between successful implementation of HIV or malaria programmes and the number of people who are threatened, wounded or killed by firearms could be examined. The implications of undertaking this kind of study are considerable.

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### Appendix 1

The following search terms were used to search LexisNexis Academic for reports of armed violence. The term gun\* means that a report must contain gun, guns, gunned, etc. The terms 'or' and 'and' are logical (Boolean) operators, and the two sets of brackets indicate that at least one weapon term and one health effect term must appear in the headline or lead paragraph. Several terms, such as 'rock star', were excluded in the search in order to minimise the false-positive rate involved in identifying armed violence articles.

Search Criteria:

(gun\* or firearm\* or rifle\* or 'machine gun\*' or missile\* or bomb\* or grenade\* or mortar\* or artillery or mine\* or knife or knives or weapon\* or rock\* or poison\* or

shoot\*) and (assassinate or dead or death\* or kill\* or murder\* or massacre\* or wound\* or injure\* or torture\* or mutilate\* or maim\* or mangle\* or hurt\* or survive\* or uninjured) and not (rock star or rock film or rock n roll or miner\* or mine worker or tornado or rocky or atomic or nuclear)

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