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ARMED VIOLENCE AND DEVELOPMENT

Issue Brief

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Tracking National Homicide Rates

Generating Estimates Using Vital Registration Data

Introduction

Violent deaths make up a substantial proportion of global mortality and morbidity. While reliable data is not available from much of the world, estimates from international studies suggest that between 526,000 (Geneva Declaration Secretariat, 2011) and 600,000 (WHO, 2008) violent deaths are committed annually, accounting for around one per cent of global deaths. Among young adult males, deaths from intentional interpersonal violence (hereafter referred to as 'homicides') account for over ten per cent of all deaths globally. In addition to deaths, interpersonal violence leads to substantial disability resulting from non-fatal injuries. Together, these deaths and injuries account for 1.3 per cent of the total global burden of disease and injury (WHO, 2008).

National homicide counts are usually available from the records of law enforcement and criminal justice systems. Many attempts have been made to systematize cross-national crime statistics (Archer and Gartner, 1984; Bennett, 1987; Gurr, 1981). The Survey on Crime Trends and the Operations of Criminal Justice Systems (CTS)—conducted by the United Nations Office on Drugs and Crime (UNODC) and disseminated via their website (UNODC, 2011)—is to date the most comprehensive global crime data collection. The latest release, CTS-10, contains data from 86 countries, for 2005–06. The database contains demographic information about offenders (their age and sex), but not about victims. While information about the homicide 'mechanism' (i.e. the method used to commit the homicide, such as by firearm or poisoning) is not available yet, CTS-11 is expected to include information about homicides by firearms.

Conducting cross-national analysis of crime data can be challenging for several reasons. First, the data only represents crimes reported to national

A Pakistani police officer at the mortuary of a hospital in Karachi, Pakistan, June 2009. © Shakil Adil/Associated Press

authorities and can involve under-reporting, due to the reliance on dockets being completed and inevitable conflicts of interests related to crime rates. Second, national legal systems can differ substantially on what constitutes a homicidal crime. Finally, significant differences exist in the recording practices among countries. For example, some countries report criminal events in their official statistics, while others report victim counts. Consequently, it is often impossible to compare crime data among countries (Liem and Pridemore, 2012, p. 5).

Those national vital registration systems that include cause of death, as reported on death certificates, provide an alternate source for estimating national homicide statistics. As demographic methods can be applied to test for the completeness of such data, they can provide explicit estimates of under-reporting. Causes of death are reported using the International Statistical Classification of Disease and Related Health Problems (ICD) (WHO, 1992), a standardized framework used for collecting and reporting mortality statistics (Mahapatra et al., 2007). These attributes make the homicide statistics derived from death registration data more easily comparable across countries than the equivalent of those derived from criminal justice data.

Furthermore, because death registration systems typically report additional information (such as the victim's age and sex and the mechanism of homicide), they facilitate epidemiological investigations into the social and environmental determinants of violence. Consequently, statistics based on death registration can, in theory at least, provide substantial insight into cross-national variations in the incidence of homicides.

This *Issue Brief* analyses the regional availability and quality of death registration data for estimating the national incidence of homicides. Key findings include:

- While death registration data is available for most high-income countries, its availability is erratic in other regions. Data is available for many countries from the Caribbean, Latin America, Eastern Europe, and Central Europe. However, little or no death registration data is available from countries in Africa, South Asia, and South-east Asia.
- Death registration-based homicide estimates provide useful insight into the global distribution of violence:
  - Homicide rates are substantially higher in Eastern Europe, the Caribbean and the four Latin American regions, as compared with other regions of the world.
  - Homicide rates are relatively low in high-income countries, the notable exception being the United States.
  - Homicide rates are relatively stable in many regions and declining in Central and Eastern Europe.
  - Homicide rates are lowest among the youngest and oldest age groups in most countries. However, homicide rates peak among young adults (15–29 years) in some regions and among older adults (45–59 years) in others.
  - Firearms and sharp objects are the two most common mechanisms of homicide. Firearms are the most common mechanism of homicides in the most violent countries (those with the highest total homicide rates).

The following section describes how death registration data is collected and presents a method with which to test certain aspects of its quality. The results of applying such quality tests to global death registration data are outlined. Finally, this *Issue Brief* discusses the implications of these findings for future research on improving estimates of national and regional homicide rates using data from the health sector.

Vital registration data

National civil registration systems often form the only data system that can provide continuous and comprehensive data about the vital statistics of the population of a country. The primary function of these systems is to provide an official, legal record of births and deaths. However, because vital registers typically report causes-of-death too, they can be an invaluable resource for monitoring the mortality patterns of a population. Consequently, in countries with a long history of high-quality death registration data, the data has been used widely to guide public health policy and practice (Mahapatra et al., 2007). In these countries, the data has also been used extensively in the estimating of homicide mortality (Liem and Pridemore, 2012; WHO, 2008; WHO, 2012a).

Causes of death in vital registration systems are typically coded using ICD rules. The rules require the coding of the underlying causes of death, defined as 'the disease or injury which initiated the train of morbid events leading directly to death, or the circumstances of the accident or violence which produced the fatal injury' (WHO, 2011).

In the case of injuries, as this corresponds to the external cause of injury rather than the medical diagnosis, the opportunity to use the data for estimating the population incidence of homicide arises. The ICD cause-of-death coding framework evolved over the course of a century. It is currently in its 10th revision and contains over 10,000 conditions for classifying causes-of-death, including 35 for classifying mechanisms of homicides.

Cross-national cause-of-death tabulations, disaggregated by age and sex, are available from the World Health Organization (WHO), whose mandate includes collecting, compiling, and publishing vital statistics. The WHO Mortality Database (WHOMDB) is the largest single repository of international data on causes of death reported by national vital registration systems (WHO, 2011). As the database depends on official reporting from countries, occasionally, more recent data may be available from national statistical offices (Mahapatra et al., 2007). Since the WHOMDB only includes data from countries that report deaths adhering to the ICD framework, those countries using different conventions to collect their data may be excluded (WHO, 2012b).

Table 1 **ICD definitions for mechanisms of deaths due to intentional interpersonal violence**

Mechanism of death	ICD-10 codes	ICD-9 codes
Fall	Y01	E968.1
Drowning	X92	E964
Other threats to breathing	X91	E963
Fire	X97-X98	E968.0
Mechanical forces - firearm	X93-X95	E965.0-4, E968.6
Mechanical forces - sharp object	X99	E966
Poisoning - gas	X88	E962.2
Poisoning - pesticide	X87	-
Poisoning - other drug	X85-X86, X89-X90	E961, E962.0/1/9
Other	X96, Y00, Y02-Y08	E960, E965.5-9, E967, E968.2-5, E968.7-8

Notes:

Homicide is defined here in terms of the ICD codes shown in the table. The title of the code-block X85-Y09 is 'Assault' in ICD-10. Y09 corresponds to assault by unknown mechanism. Injuries due to legal intervention (Y35.-) and operations of war (Y36.-) are excluded. ICD defines assault as injuries inflicted by another person with intent to injure or kill, by any means. These ICD-based external cause definitions were developed for the GBD-2010 project by the GBD-Injury Expert Group (Bhalla et al., 2010).

The quality of death registration data can vary substantially among countries (Mathers et al., 2005). Three key aspects influence quality, as regards the estimating of cause-specific mortality: the completeness of the registration, the specificity of cause of death, and the reliability of the cause-of-death attribution. When national death registration is incomplete (in that it contains information about a relatively low proportion of all deaths occurring in the country), cause-specific mortality estimates can become substantially biased.

The completeness of data can be tested by comparing registered deaths to estimates of deaths, referring to alternate data sources such as decennial censuses and national household surveys. The specificity of cause-of-death attribution can be assessed by examining the proportion of deaths assigned to cause codes that are less specific than the classification allows. For example, deaths may be allocated to partially specified causes (such as injuries of undetermined intent and homicides of unknown mechanism). When these proportions are large, estimates can become substantially biased. In a recent paper, the Injury Expert Group of the Global Burden of Disease (GBD) 2010 study provided a framework for assessing the quality of injury data available from death registration systems (Bhalla et al., 2010). Formal evaluation of the reliability of cause-of-death attribution should be conducted by obtaining access to a sample of the records and conducting investigations into their validity. However, as administrative barriers and costs for such studies tend to be high, such studies are uncommon in academic literature. Because of variations in ascertainment and specificity, death registers do not directly provide reliable estimates of homicides. Even in certain industrialized countries, the quality of cause-of-death attribution can be poor (Bhalla et al., 2010). Consequently, estimates of homicides should be generated after adjusting for completeness and after the statistical reattribution of deaths, coded to partially specified causes, takes place.

The purpose of the public data collection of the GBD-Injury Expert Group, analysed in this report, is to make global death registration data more accessible to injury researchers (Bhalla et al., 2011a, 2011b). The primary source of the data collection comprises the WHOMDB and additional ICD-9 coded data for seven countries also obtained from WHO (but excluded from the WHOMDB). The current data collection contains injury deaths aggregated to ten mechanisms of homicide (see Table 1). Several countries that report causes using a condensed tabulation list have been excluded, because their data cannot be classified accordingly. A test of the quality of the data for estimating injury mortality is included for all countries. The dataset includes estimates of cause-specific injury mortality after reattributing deaths assigned to partially specified causes of death, using proportional redistribution within the categories of age, sex, and cause.

Identifying countries with high-quality data for estimating homicides

In 2010, the Injury Expert Group of the GBD-2010 study assessed the quality of vital registration data for estimating global injury mortality in the GBD-2010 project (Bhalla et al., 2010). They developed a standardized method that assesses the completeness of national death registration by comparing total registered deaths with national mortality, as estimated by the UN Population Division (UNPD, 2003). The quality of cause-of-death attribution is then tested by comparing the proportion of deaths coded to partially specified cause-of-death categories, which may contain deaths from homicide, with a quality threshold. Although these thresholds (as described below) are ad hoc, they are based on the need to develop a standardized method that facilitates comparative, cross-national analysis of national injury and mortality rates.

Following this method, a country is considered to have high-quality death registration data for estimating homicides if the data for the most recent year meets all of the following requirements:

- The data should manifest a completeness of more than 80 per cent;
- Less than 20 per cent of all registered deaths should be coded to the broadest unspecified cause of death category (ICD10:R95-R99);
- Less than 20 per cent of all deaths coded to injuries should be coded to unspecified mechanism and intent (ICD10:Y89.9); and
- Less than 20 per cent of all deaths coded to injuries should be coded to

Table 2 **Global availability of national death registration data for estimating homicide mortality**

Region[a]	Death registration data available	High-quality homicide data available[f]
	Country (most recent year with data available, number of years of data availability)[b, c]	Country
Asia, Pacific, high-income countries	Japan (2009, 15), South Korea (2009, 13), Singapore (2003, 13); Brunei (2009,3) Country with no data: none	Japan, South Korea
Asia, Central	Armenia (2009, 3), Azerbaijan (2007, 5), Georgia (2009, 8), Kazakhstan (2009, 6), Kyrgyzstan (2006, 10), Uzbekistan (2005, 2); Countries with no data: Mongolia, Tajikistan, Turkmenistan	Kyrgyzstan,[e] Uzbekistan
Asia, East	Hong Kong (2009, 9) Countries with no data: North Korea, China[d]	Hong Kong
Asia, South	Countries with no data: Afghanistan, Bangladesh, Bhutan, India,[d] Nepal, Pakistan	
Asia, South-east	Malaysia (2006, 7), Maldives (2008, 8), Mauritius (2010, 13), Philippines (2008, 6), Seychelles (2009, 9), Sri Lanka (2006, 8), Thailand (2006, 15) Countries with no data: Cambodia, Indonesia, Laos, Myanmar, Timor-Leste, Vietnam	Mauritius
Australasia	Australia (2006, 9), New Zealand (2007, 11); Countries with no data: none	Australia, New Zealand
Caribbean	Antigua and Barbuda (2008, 9), Bahamas (2005, 7), Barbados (2007, 6), Belize (2008, 12), Bermuda (2008, 12), Cuba (2008, 9), Dominica (2009, 10), Dominican Republic (2005, 9), Grenada (2009, 8), Guadeloupe (2008, 8), Guyana (2006, 10), Haiti (2003, 5), Martinique (2008, 8), Montserrat (2007, 2), the Netherlands Antilles (2000, 13), Saint Kitts and Nevis (2008, 13), St. Lucia (2005, 10), St. Vincent and the Grenadines (2008, 10), Suriname (2005, 8), Trinidad and Tobago (2006, 7), Virgin Islands (US) (2005, 6) Country with no data: Jamaica	Bahamas, Barbados, Belize, Cuba, French Guiana, Guadeloupe, Guyana,[e] Martinique, the Netherlands Antilles, Puerto Rico, St. Lucia,[e] Trinidad and Tobago, Virgin Islands (US)
Europe, Central	Bulgaria (2008, 4), Croatia (2009, 15), Czech Republic (2009, 16), Hungary (2009, 14), Montenegro (2009, 6), Poland (2009, 11), Romania (2010, 12), Serbia (2009, 12), Slovakia (2009, 16), Slovenia (2009, 25) Countries with no data: Albania, Bosnia and Herzegovina, Slovakia, Slovenia, former Yugoslav Republic of Macedonia	Croatia, Czech Republic, Hungary, Poland, Romania,[e] Slovakia, Slovenia
Europe, Eastern	Belarus (2009, 5), Estonia (2009, 13), Latvia (2009, 14), Lithuania (2009, 12), Moldova (2010, 15), Russian Federation (2009, 11), Ukraine (2009, 4) Countries with no data: none	Estonia, Latvia,[e] Lithuania, Moldova
Europe, Western	Austria (2010, 12), Belgium (2005, 8), Cyprus (2009, 9), Denmark (2006, 13), Finland (2009, 14), France (2008, 12), Germany (2010, 13), Greece (2006, 9), Iceland (2009, 14), Ireland (2009, 13), Israel (2008, 13), Italy (2008, 11), Luxembourg (2009, 12), Malta (2010, 16), Netherlands (2010, 15), Norway (2009, 14), Portugal (2009, 8), San Marino (2000, 6), Spain (2009, 13), Sweden (2010, 15), Switzerland (2007, 13), United Kingdom (2009, 11) Countries with no data: Andorra, Monaco	Austria, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel,[e] Italy, Luxembourg, Malta, Netherlands, Norway, Portugal,[e] Spain,[e] Sweden, United Kingdom
Latin America, Andean	Ecuador (2009, 13), Peru (2007, 3) Country with no data: Bolivia	Ecuador
Latin America, Central	Colombia (2007, 10), Costa Rica (2009, 13), El Salvador (2008, 12), Guatemala (2008, 9), Mexico (2008, 11), Nicaragua (2006, 10), Panama (2008, 10), Venezuela (2007, 12) Country with no data: Honduras	Columbia, Costa Rica, El Salvador, Mexico, Panama
Latin America, Southern	Argentina (2008, 12), Chile (2007, 11), Uruguay (2004, 6) Countries with no data: none	Argentina, Chile, Uruguay
Latin America, Tropical	Brazil (2008, 13), Paraguay (2008, 12) Countries with no data: none	Brazil, Paraguay
North Africa and the Middle East	Bahrain (2009, 13), Egypt (2010, 11), Iraq (2008, 1), Jordan (2008, 1), Kuwait (2009, 15), Morocco (2008, 1), Oman (2009, 1), Qatar (2009, 7), Saudi Arabia (2009, 1) Countries with no data: Iran, Lebanon, Libya, Morocco, Syria, Tunisia, Turkey, United Arab Emirates, Yemen	Kuwait
North America, high-income countries	Canada (2004, 8), United States (2007, 11) Countries with no data: none	Canada, United States

Oceania	Fiji (2009, 2), Kiribati (2001, 11) Countries with no data: Cook Islands, Marshall Islands, Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu	
Sub-Saharan Africa Southern	South Africa (2008, 13) Countries with no data: Botswana, Lesotho, Namibia, Swaziland, Zimbabwe	
Sub-Saharan Africa Central	Countries with no data: Angola, Central African Republic, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon	
Sub-Saharan Africa Eastern	Countries with no data: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Mozambique, Rwanda, Somalia, Sudan, Uganda, Tanzania, Zambia	
Sub-Saharan Africa Western	Countries with no data: Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, São Tomé and Principé, Senegal, Sierra Leone, Togo	

Notes:

[a] Regions are as defined by the 2010 Global Burden of Diseases, Injuries and Risk Factors Study (http://www.globalburden.org/)

[b] Country mortality data is from the WHOMDB (November 2011 update) (WHO, 2011) as analysed and reported in the mortality data collection (April 2012 update) of the GBD Injury Expert Group (Bhalla et al., 2011a, 2011b).

[c] For example, after exclusion criteria were applied to death registration data from Japan, 15 years of death registration data was available, for which 2009 was the most recent year.

[d] China and India have nationally representative sample registration systems that report the cause of death.

[e] Mechanism-specific homicide rates cannot be estimated in these countries, because more that 20 per cent of homicides do not have a mechanism specified.

[f] Quality assessment of vital registration data for assessing national homicide rates mortality data is described in detail by Bhalla et al. (2010).

Source: ICD, International Statistical Classification of Diseases

undetermined intent (ICD10:Y10-Y34, Y87.2).

In order to have high-quality data for computing mechanism-specific homicide rates, the data must meet the following additional requirement:

- Less than 20 per cent of all deaths coded to homicide should be classified to unspecified mechanism (ICD10:Y09, Y87.1).

It should be noted that many countries report data using a condensed tabulation list of the ICD. As the condensed version of ICD-10 provides a single category for assaults (homicides), the data cannot be disaggregated by mechanism. Furthermore, this condensed tabulation indiscriminately combines less specific, 'other injury' categories and partially specified ones. Because these categories cannot be separated, the quality of the death registration data for estimating homicides cannot be assessed.

Global availability of high-quality death registration data

Table 2 summarizes the availability of global death registration and identifies the countries in which such data meets the quality threshold for estimating homicide mortality. In all, data from 118 countries was available for this assessment. However, high-quality data for these purposes is only available from 65 countries. Among them, it is possible to compute mechanism-specific homicide rates for only 51 countries.

Recent death registration data is available for estimating homicide mortality from most countries in high-income regions, except for a few notable exceptions: Switzerland uses a basic tabulation list and in Singapore, more than 20 per cent of injury deaths are classified as having undetermined intent. In several high-income countries, mechanisms of homicide cannot be estimated because a high proportion of homicides are coded to unspecified mechanism: Portugal (27 per cent), Spain (22 per cent), and Israel (43 per cent) (Bhalla et al., 2010, p. 833).

As compared with high-income countries, the availability of death registration data for estimating homicides in low- and middle-income regions is found to be less regular(Bhalla et al., 2010, p. 832):

Two of the four Asian regions, South and South-east Asia, are severely underrepresented: less than 15 per cent of the regional population is accounted for by death registration systems (Bhalla et al., 2010, p. 832). Only one country from these two regions, Mauritius, met the quality threshold for estimating homicide.

The continent of Africa is covered even less adequately. Data from sub-Saharan Africa is available for only one country, South Africa. However, it did not meet the quality threshold for estimating homicide mortality, because a large proportion of injury deaths were assigned to undetermined intent.

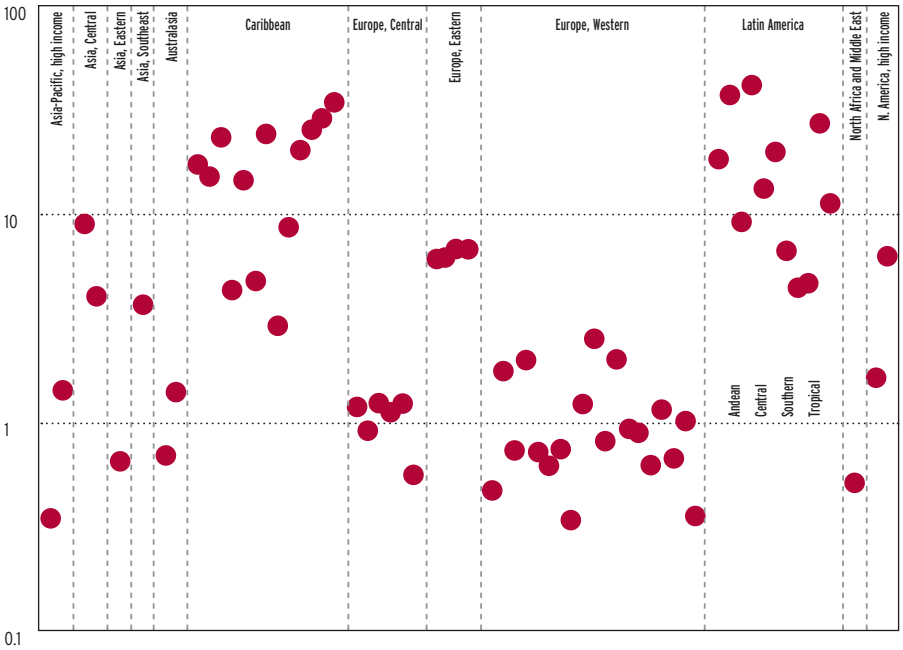
Latin America and the Caribbean are well represented: more than 80 per cent of the population is accounted for in global death registration data. Homicides can be estimated reliably for many countries in these regions.

The availability of injury data from Eastern Europe, Central Europe, and Central Asia is limited, primarily because basic tabulation lists are used.

Homicide estimates from death registration

Figure 1 illustrates national homicide rates in all global regions. Figure 2 presents estimates of national homicide time trends; Figure 3 age distribution of victims, and Figure 4 the distribution of mechanisms in Central Europe and Latin America. Results for other global regions are available in Annexes 1–3 (online). Only countries with data that satisfies the quality criteria for estimating homicides are included in these results.

Figure 1 **Homicide rates (most recent year) in countries with high-quality death registration data**



Note: Each dot represents a country. Rates are standardized to the WHO World Standard Population (Ahmad et al., 2001).

Total homicide rates and trends

Homicide rates vary substantially across regions (see Figure 1):

- Homicide rates are relatively low in all countries in the five high-income regions (Asia Pacific, Asia East; Australasia, Europe Western, and North America), the notable exception being the United States. Homicide rates in the United States (6.4 per 100,000) are more than double those of any other high-income country.
- Homicide rates are much higher in the Caribbean, the four Latin American regions, and Eastern Europe. Rates exceed 10 per 100,000 in many countries in these regions.

Homicide trends (see Figure 2 and Annexe 1) are relatively stable in most regions, the notable exceptions being Eastern and Central Europe, where rates have been declining steadily for over a decade.

Age pattern of homicides

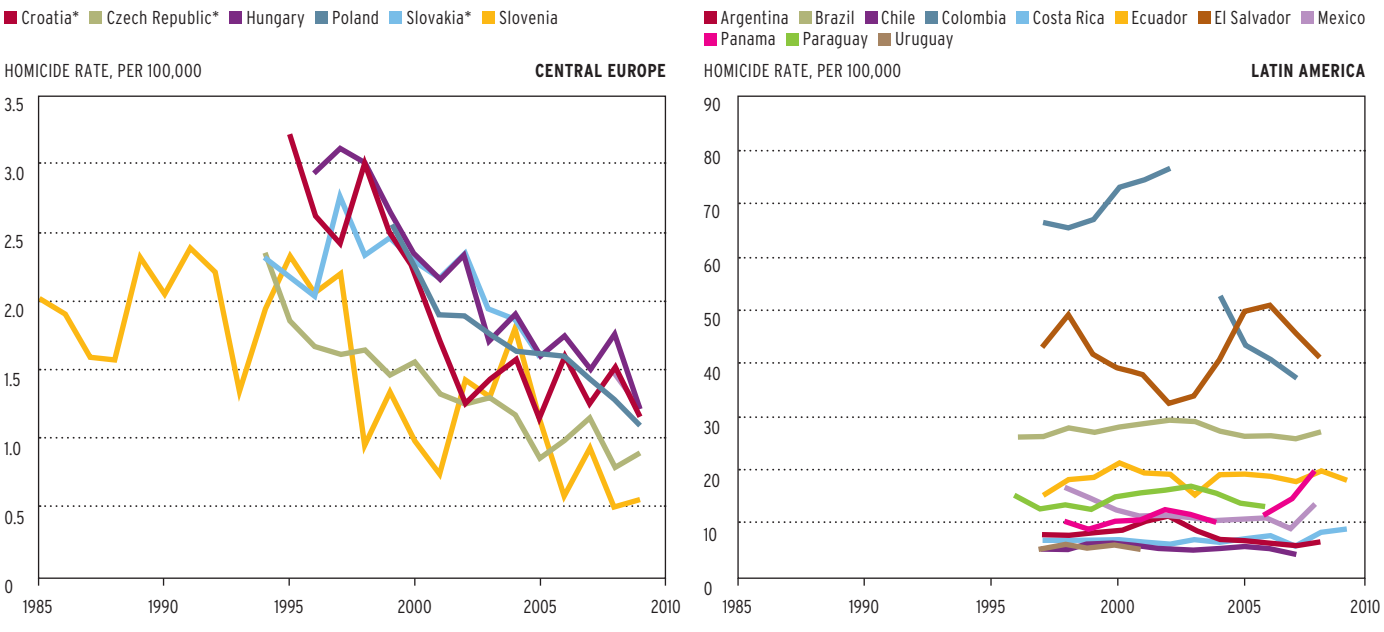
In most countries, homicide rates tend to be lowest in the youngest ages, to peak among adults, and then decline. However, the age composition of national homicides can vary substantially (see Figure 3 and Annexe 2). In some regions, such as Latin America, most victims tend to be young adults (younger than 30 years). In others, such as Central Europe, older adults comprise a larger proportion of all homicide victims. For Figures 2–4, similar results for countries in other global regions are included in the Annexes (online).

Mechanism of homicide

Globally, contact with sharp objects and firearms are the two most common mechanisms of homicide (see Figure 3 and Annexe 3), usually accounting for more than half of all homicides. Other threats to breathing, including strangulation, are a common mechanism in some countries too. The residual category (other mechanisms) is also large in some regions, notably the three European regions.

Firearms are the leading cause of homicides in regions with the highest homicide rates (Eastern Europe,

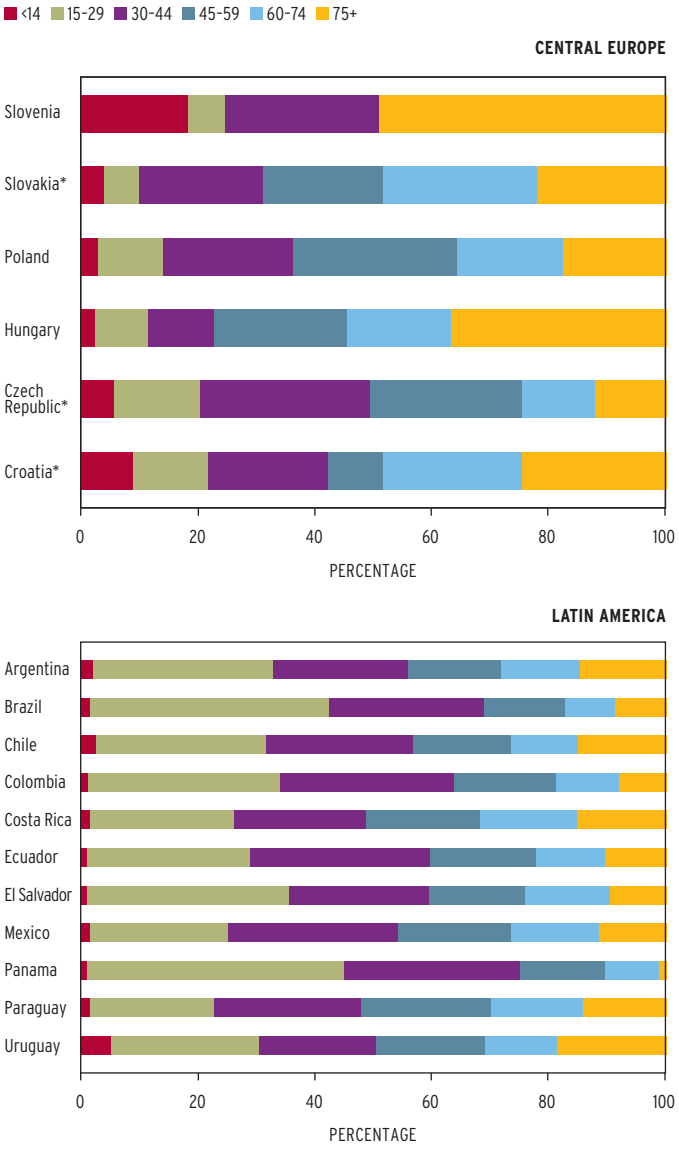
Figure 2 **Time trends in homicide rates in Central Europe and Latin America**



Note: Results for countries with fewer than 100 annual homicides should be interpreted with caution.

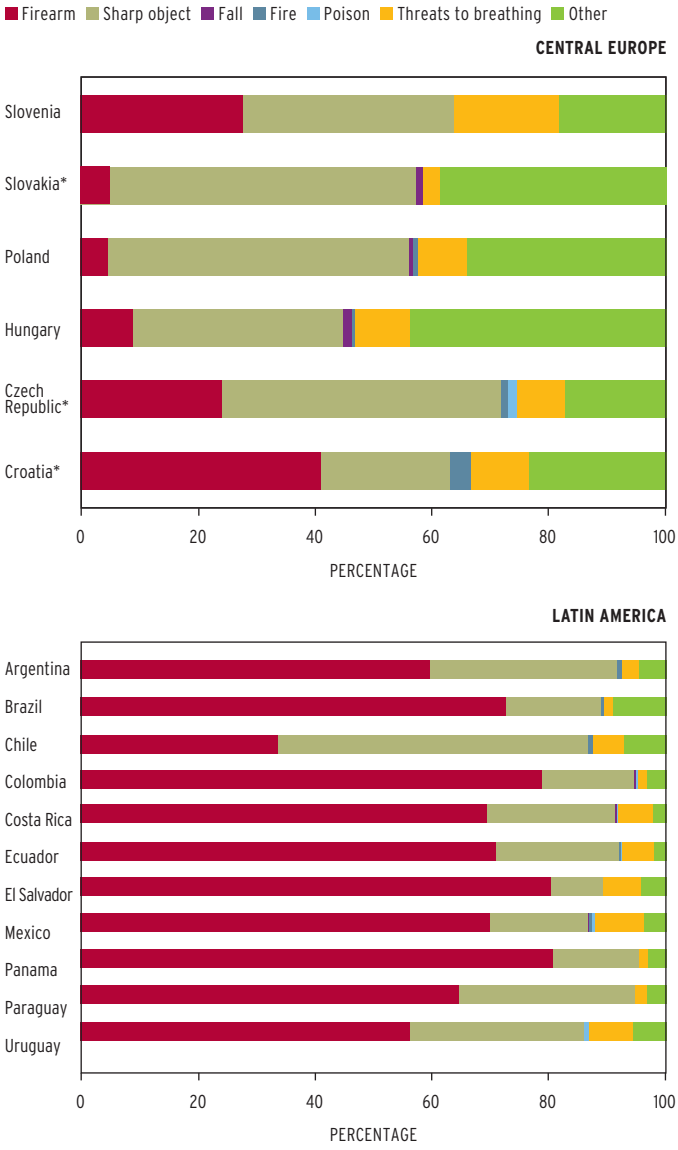
Note: Death registration data for Colombia was not available for 2003 from the WHOMDB.

Figure 3 **Age distribution of homicide victims in Central Europe and Latin America**



Note: Results for countries with fewer than 100 annual homicides should be interpreted with caution.

Figure 4 **Distribution of mechanisms of homicide in Central Europe and Latin America**



Note: Results for countries with fewer than 100 annual homicides should be interpreted with caution.

Caribbean, and the four Latin American regions). The total homicide rate in countries in general is closely associated with the rate of firearm homicides (see Figure 5). More violent countries (those with higher total homicide rates) have higher rates of firearm homicides while sharp object homicide rates show less variation in countries that manifest varying levels of violence.

Discussion

Advantages and disadvantages of using death registration data

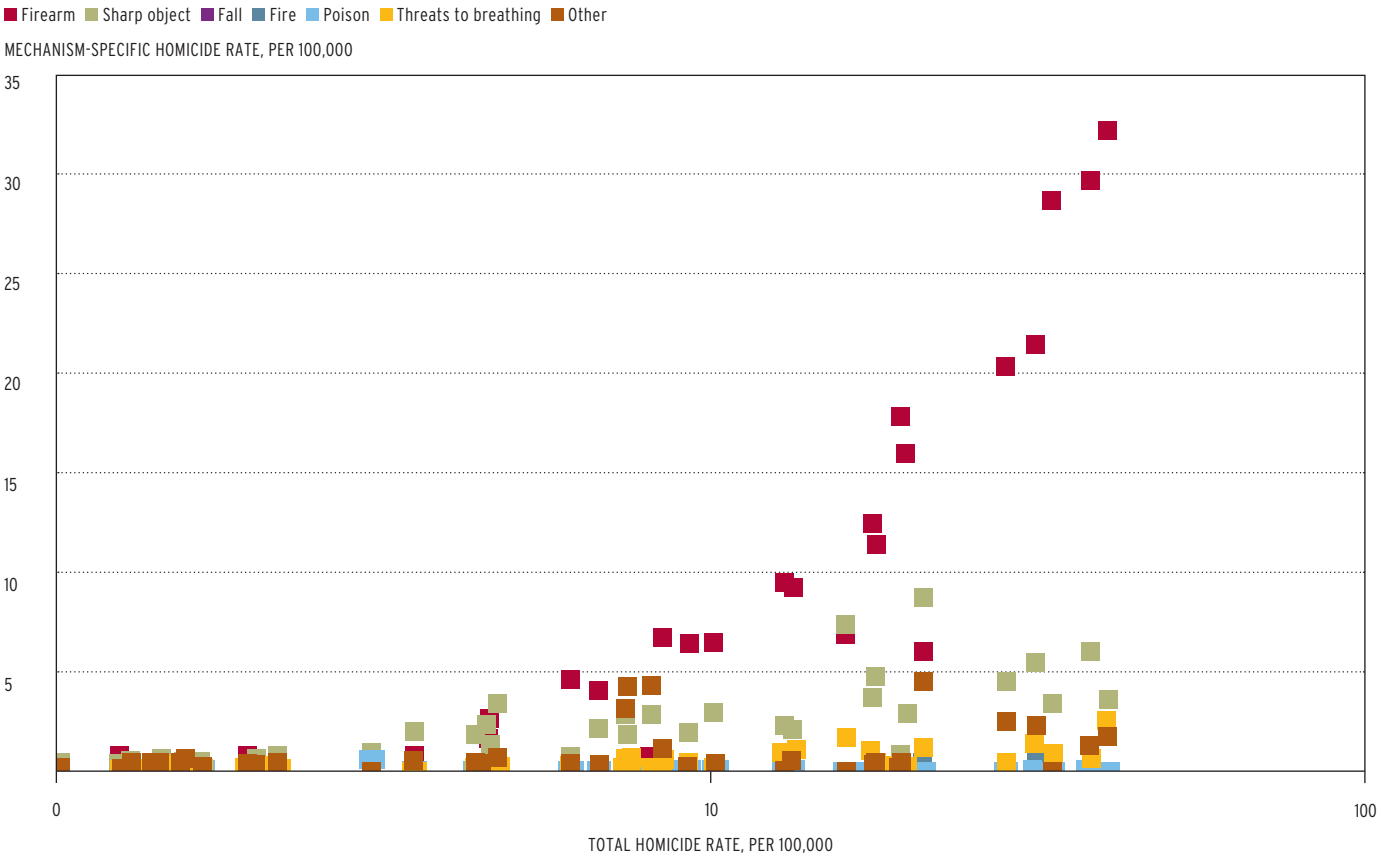
Reliable estimates of homicides are essential for the defining of national and global health priorities. At present, national crime statistics are the most commonly used source of homicide data in national and cross-national research. As crime statistics are typically the source of official government statistics, they are widely disseminated via national and supra-national agencies. Unfortunately, political motivations can lead to biased official crime statistics in some countries that otherwise enjoy good statistical infrastructure (Pridemore, 2003).

It is therefore important for researchers to validate official statistics of reported crimes by comparing them with estimates calculated using alternate sources. When such comparisons reveal under-reporting, the ensuing public dialogue about homicide statistics can be used to incentivize governments to improve the quality of their official statistics. In addition, such analyses help to identify high-quality data sources that are useful for further research into the causes of violence.

National vital registration systems that record causes of death provide researchers and governments with a second source of data which can be used to generate national homicide statistics. Unlike crime statistics, which are based on crime *reports*, death registration data facilitates the generation of *estimates*. The underlying data is sourced from administrative systems in which quality varies and adjustments are based on incomplete information.

The analysis of vital statistics presented in this report accounts for incomplete data and classification to partially specified causes of death, but

Figure 5 **Relationship between total homicide rates and mechanism-specific homicide rates**



Note: Homicide rates are standardized to the WHO World Standard Population (Ahmad et al., 2001).

it does not account for systematic misclassification of causes, which occurs in certain settings. Furthermore, the classification of intent as homicide is a legal concept. Delays in legal investigations can lead to death registration records listing many deaths as undetermined intent or unknown cause, resulting in homicide estimates of lower reliability.

This *Issue Brief* demonstrates that high-quality death registration data is available in many parts of the world, including all high-income regions and several low- and middle-income regions. Notably, these regions include much of Latin America, the Caribbean, and Central Europe. Consequently, estimates based on death registration in these regions should be used to test official government statistics. This *Issue Brief* reveals vast gaps in global death registration coverage. In several regions of the world (including most of Africa, South-Asia, East-Asia, and South-east Asia), the vital registration infrastructure is too weak to provide any information of use for the estimating of homicide mortality.

High-quality death registration data, where available, provides a means to test the validity of national crime statistics. The authors of this *Issue Brief* have undertaken such a systematic cross-national comparison of death registration and crime statistics, which is to appear in a forthcoming publication (Bhalla et al., 2012). In addition to its use in validating official crime statistics, death registration data provides additional information about homicides that is otherwise unavailable from crime statistics.

This *Issue Brief* shows that the cross-national death registration tabulations contain substantial detail that is unavailable from cross-national crime tabulations, specifically regarding the demographics (age and sex) of the victim and the mechanism of homicide. At the national level, death registers usually contain other useful variables regarding the victim (such as ethnicity, education, income, and location of death). National death registration data thus has the potential to provide substantial insight into national and cross-national variations in homicides.

It should be noted, however, that information derived from death registration lacks numerous important aspects of homicides that are typically captured in crime data. Vital registration typically does not include information about the perpetrator. Nor can it distinguish among various types of homicide (such as disputes and robbery) and it only captures completed homicides. Data from vital registration systems may thus supplement criminal justice data, but not replace it.

The way forward

Ideally, all countries would provide high-quality and complete death registration data. Because of the considerable value of such systems to health metrics, substantial global efforts are currently underway to help boost the statistical capacity of countries to produce comprehensive vital statistics (AbouZahr et al., 2007). As building and maintaining such infrastructure calls for sizeable financial investment, over the past half-century in most countries, national death registration

Rows of body bags, many of which contain unidentified remains which can take years to be correctly identified, in Tucson, Arizona, December 2009. © Matt Nager/Redux

systems have improved little and in certain cases have even declined in quality (Mahapatra et al., 2007). Given the state of national vital registration systems, as described in this *Issue Brief*, complete and high-quality death registration data is unlikely to be available globally for decades to come. The violence research and advocacy community cannot afford to wait for such data systems to develop. A global strategy to improve the quality of homicide statistics rapidly is sorely needed. Such a strategy should prioritize regions based on data needs and draw upon the existing information architecture and human and financial resources available in each country.

This *Issue Brief* shows that many countries with highly developed vital registration systems do not produce reliable statistics for estimating homicides. As described in detail elsewhere (Bhalla et al., 2010), nine countries with fairly complete death registration data classified a relatively large proportion of the injury deaths under undetermined intent. In an additional nine countries, a considerable proportion of homicides did not specify a mechanism.

For these countries, it would be beneficial to use advanced analytical techniques and local knowledge about data collection and coding processes when estimating homicide rates. Although statistical techniques, such as multinomial logistic regressions and Bayesian inference—using additional information in national death registers to improve cause-of-death attribution—already exist, they have not been applied to the estimating of national homicide rates. In addition to analytical solutions, relatively small field studies can be conducted to reduce the uncertainty in homicide estimates. For instance, field studies of a random sample of registered deaths can provide information with which to assess the degree of misclassification of causes of death, identify causes for deaths as having unknown causes, and develop correction algorithms to improve estimates of homicides from death registration statistics.

Similarly, several countries have fairly complete vital registration systems but use a condensed version of ICD for reporting causes of death (Bhalla et al., 2010). In the framework of this analysis, the use of condensed versions leads to two problems. First, the quality of this data cannot be evaluated because of the manner in which the cause categories are aggregated. Second, the condensed versions contain a single category for homicides that does not allow disaggregation by mechanism. These problems can be addressed by conducting in-depth country studies.

As Pridemore (2003) demonstrates with Russian vital registration data, sub-national analyses—driven by local knowledge of the biases induced by recording and reporting practices—can provide significant insight into the homicide rates of a country. Such studies should be developed and extended to other regions. It is also likely that additional information pertaining to registered deaths is lost during aggregation and reporting. For instance, it is possible that death certificates provide more detailed information about causes than data presented in final tabulations does. Such information could

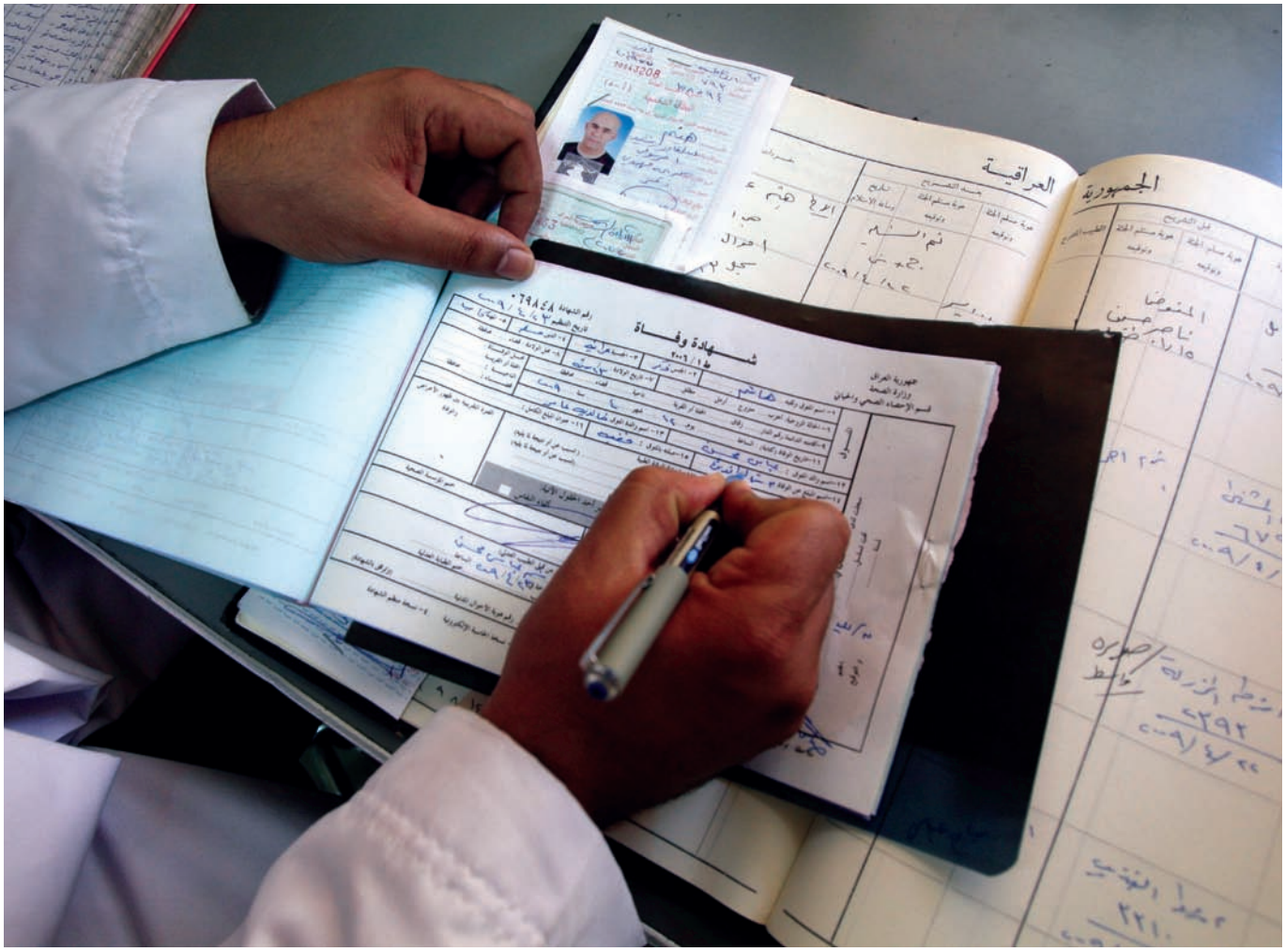
be recoded for a statistical sample to construct adjustment factors that could be used to correct national datasets.

Two of the most populous countries worldwide, India and China, have vital registration systems that record information for only a small and non-representative proportion of national deaths (Rao et al., 2005; Jha et al., 2006). Both countries, however, have sample registration systems that report causes of death using verbal autopsy for a sample of deaths that is representative of the population (Rao et al., 2005; RGI, 2009; Yang et al., 2005). Although these methods are widely used in the global health metrics community to estimate cause-specific mortality, the validity of verbal autopsy for injuries, particularly intentionality, has received little attention. Such validation studies should be built into future verbal autopsy measurements and the results should be used to refine the measurement instruments.

Most importantly, an alternative strategy is needed for the estimating of homicides in the many countries in which vital registration and sample registration systems simply do not exist. Inventories of existing data sources in these countries are likely to identify yet other data sources, ones that can be used to construct homicide estimates. For instance, in most countries, unnatural and sudden deaths require forensic investigation for legal reasons. Such investigations are typically conducted at mortuaries, which often keep paper or electronic records. With relatively little effort, analysis of these existing records can provide important understanding about the demographic patterns and mechanisms of homicide.

The estimating of population homicide rates would require field studies to determine the denominator population and the completeness of death reporting for this population. The existence of a legal framework for investigating causes of unnatural deaths creates an opportunity to develop mortuary-based surveillance systems at low cost. WHO has developed mortuary surveillance guidelines (Bartolomeos et al., 2012), including a standardized instrument with several categories for the mechanism of homicide. The implementation of this tool can provide valuable insight into the epidemiology of homicides taking place in cities based in otherwise information-poor settings. Recently, health researchers have made great progress in measuring cause-specific mortality patterns in such settings (Hill et al., 2007).

Forensic technicians examining an x-ray of an unidentified body, Clark County, Las Vegas, September 2011. © Julie Jacobson/AP/Press Association Images



A morgue employee writing out a death certificate, in Baghdad, Iraq, April 2009. © Karim Kadim/AP/Press Association Images

The interim substitutes for full-population measurements include demographic surveillance of rural populations, questions in population decennial censuses, and the use of sibling mortality modules in national household surveys. These methods have the potential to provide high-quality estimates of homicide mortality. However, at present this research focuses primarily on the causes of childhood deaths, maternal mortality, and deaths from infectious diseases. The field of criminology and violence research would benefit substantially from partnering with health researchers engaged in such measurements. The availability of high-quality homicide estimates from the health sector can facilitate the validation of crime data and the appropriate prioritization of violence prevention in national health policy. In addition, the availability of comparable international data will allow cross-national explorations to improve understanding of the social and environmental determinants of violence. ■

Annexes

Annexes are available online at www.smallarmssurvey.org/?issue-briefs

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