

Methodological Annex to The Global Study on Homicide 2019

Definition and data sources on intentional homicide

The *Global Study on Homicide 2019* makes extensive use of the UNODC Homicide Statistics (2019) dataset,¹ which has been compiled to provide users with comprehensive data covering patterns and trends of homicide discussed in this study. In total, the UNODC Homicide Statistics (2019) dataset presents data for 202 countries and territories. One particular feature of the 2019 release of the UNODC Homicide Statistics is the publication of extended time series (1990-2017), thus improving the time coverage of global data series on homicide. This methodological annex describes the compilation, processing and assessment of this dataset.²

In an effort to compile as accurate and comparable statistics as possible, homicide data from a variety of national and international sources were collected and considered for inclusion in the database. In doing so, the paramount consideration was that the data selected conformed as closely as possible to the definition of intentional homicide provided in the International Classification of Crime for Statistical Purposes (ICCS). The ICCS is a global statistical standard for crime data collection adopted by the United Nations Statistical Commission in 2015. In the same year the implementation plan for the ICCS was endorsed by the Commission on Crime Prevention and Criminal Justice (CCPCJ).³ The ICCS defines intentional homicide as an “unlawful death inflicted upon a person with the intent to cause death or serious injury”.⁴

According to the ICCS, an act of killing qualifies as an intentional homicide when it fulfils three basic criteria:

1. Causing the death of a person (objective criterion)
2. Intentionality (subjective criterion)
3. Unlawfulness (legal criterion)

Data included in the UNODC Homicide Statistics (2019) dataset are sourced from either criminal justice or public health systems. In the former, data are generated by law enforcement or criminal justice authorities in the process of recording and investigating a crime event, whereas in the latter, data are produced by health authorities certifying the cause of death of an individual.⁵ Ideally, a comprehensive

¹ The UNODC Homicide Statistics (2019) dataset is available at <https://www.unodc.org/unodc/en/data-and-analysis/global-study-on-homicide.html>

² This document was produced by the Data Development and Dissemination Unit of UNODC (main authors: Karen Avanesyan, Enrico Bisogno, Michael Jandl, Alexander Kamprad and Mateus Rennó Santos)

³ See <http://www.unodc.org/unodc/en/data-and-analysis/statistics/iccs.html>

⁴ This definition is substantively the same as the definition used in the last Global Study on Homicide 2013 which defined intentional homicide as “unlawful death purposefully inflicted on a person by another person”, but it expressly adds “serious assault leading to death” to the description of acts qualifying as intentional homicide. “Serious assault leading to death is understood as unlawful death due to an assault committed with the knowledge that it was probable that death or serious injury would occur”, International Classification of Crime for Statistical Purposes. Version 1.0, p.33

⁵ For a thorough discussion on the two sources, see: UNODC, *Global Study on Homicide 2011*.

forensic investigation by law enforcement authorities will take all three basic criteria listed above into account when qualifying a death as intentional homicide. In contrast, the certification of causes of death by public health authorities normally takes into account only the first two criteria, while not giving full consideration to the unlawfulness of the death.⁶ For this reason, and taking into account criteria of data availability, timeliness and comprehensiveness, preference in the selection of data is generally given to criminal justice data, unless there are objective reasons to prefer public health data for a particular country.⁷

Criminal justice data

The primary source of Criminal Justice data used in the UNODC Homicide Statistics (2019) dataset are official administrative data regularly collected by UNODC through the United Nations Survey of Crime Trends and Operations of Criminal Justice Systems (also called UN Crime Trends Survey or UN-CTS)⁸. As previous editions of the Global Study on Homicide (2011/2013), reference is usually made to *police-recorded* data on intentional homicides (rather than data provided by prosecution or court authorities). These data include the total number of homicide victims, as well as relevant disaggregations of homicide victims by sex and age, by killing mechanism (firearms, sharp objects and others) and by perpetrator/context of the crime (family/intimate partner, organized crime, gang, robbery, other, unknown context). For the first time, the homicide dataset also presents data on homicide victims in the three most populous cities of each country, as well as detailed disaggregations of suspected homicide perpetrators (e.g. by sex, age and by intoxication status) as recorded by the police.

Additional criminal justice data collected through publicly available sources and produced by national governmental institutions (police, national statistical office, ministry of interior, ministry of justice, etc.) have been used to complete data series for countries for which UN-CTS data were not available, and for data not included in the regular UN-CTS data collection, such as sub-national data.

Criminal justice data collected and compiled by other international and regional agencies have also been reviewed and used, where appropriate. These include data from Eurostat, the Organization of American States and the United Nations Department of Peacekeeping Operations (DPKO) and as well as historic data collected by the Inter-American Development Bank (through the Regional System of Standardised Indicators in Peaceful Coexistence and Citizen Security (RIC) project) and various other United Nations agencies, such as the United Nations Economic Commission for Europe (UNECE).

⁶ For example, a killing in self-defence is likely to be counted as an intentional homicide in mortality statistics, but not according to the ICCS.

⁷ Detailed information on sources used at country level is provided in the published statistical tables.

⁸ The UN-CTS collects national administrative statistics on a number of conventional crimes, criminal justice operations and criminal justice system resources, which are provided by police, prosecution, court and prison authorities, as well as survey data from crime victimization surveys reported by National Statistical Offices (NSOs).

Public health data

At the country level, all deaths should be recorded, and their cause assessed and certified, by public health authorities. National definitions and classifications used for this purpose are usually in line with the World Health Organization (WHO) International Classification of Diseases (ICD), the international standard diagnostic classification for epidemiological and clinical use. The most widely used version of the ICD currently (ICD-10)⁹ offers a detailed framework for the classification of causes of death, covering all known diseases and external factors, including violence. Deaths coded with ICD codes X85-Y09 (injuries inflicted by another person with intent to injure or kill), and ICD code Y87.1 (sequelae of assault), generally correspond to the definition of intentional homicide discussed above.

Data on homicide from public health sources were primarily obtained from the WHO Mortality Database.¹⁰ This dataset is a comprehensive collection of mortality data by cause of death, sex, and age group conducted yearly by the WHO with Member States. In addition, specific classifications of the ICD enable the identification of homicides by their mechanism of killing, including deaths caused by firearm discharge (X93-X95), and by assaults committed using a sharp object (X99). Complementary mortality data were also collected from WHO regional offices, specifically the Pan American Health Organization (PAHO)¹¹, and the WHO Regional Office for Europe¹².

In previous editions of the Homicide Statistics Dataset, model-based estimates of homicide from the World Health Organisation (WHO)¹³ and the Institute of Health Metrics and Evaluation (IHME)¹⁴ were used to complement data on the total homicide count, and on the number of victims by sex for countries where no actual data were available from any reliable source. These estimates are generated using a regression model, which uses the statistical correlation between data on homicides and other social indicators to estimate homicide counts based on the known characteristics of a country.¹⁵ In the current version of the Homicide Statistics (2019) dataset all homicide counts at country level are sourced from national sources and no model-based estimate is used. This is due to improvements in the coverage of homicide data produced at country level and reflects the determination to give priority to data produced at country level, when meeting minimal quality criteria, and to increase transparency of the validation and publication process of homicide data published by UNODC.

⁹ The most recent version (ICD 11) is available but not yet widely implemented at country level.

¹⁰ Last accessed in January 2018. Available at: http://www.who.int/healthinfo/mortality_data/en/

¹¹ Last accessed in August 2017. Available at: <https://hiss.paho.org/pahosys/idc.php>

¹² Last accessed in November 2017. Available at: <http://data.euro.who.int/dmdb/>

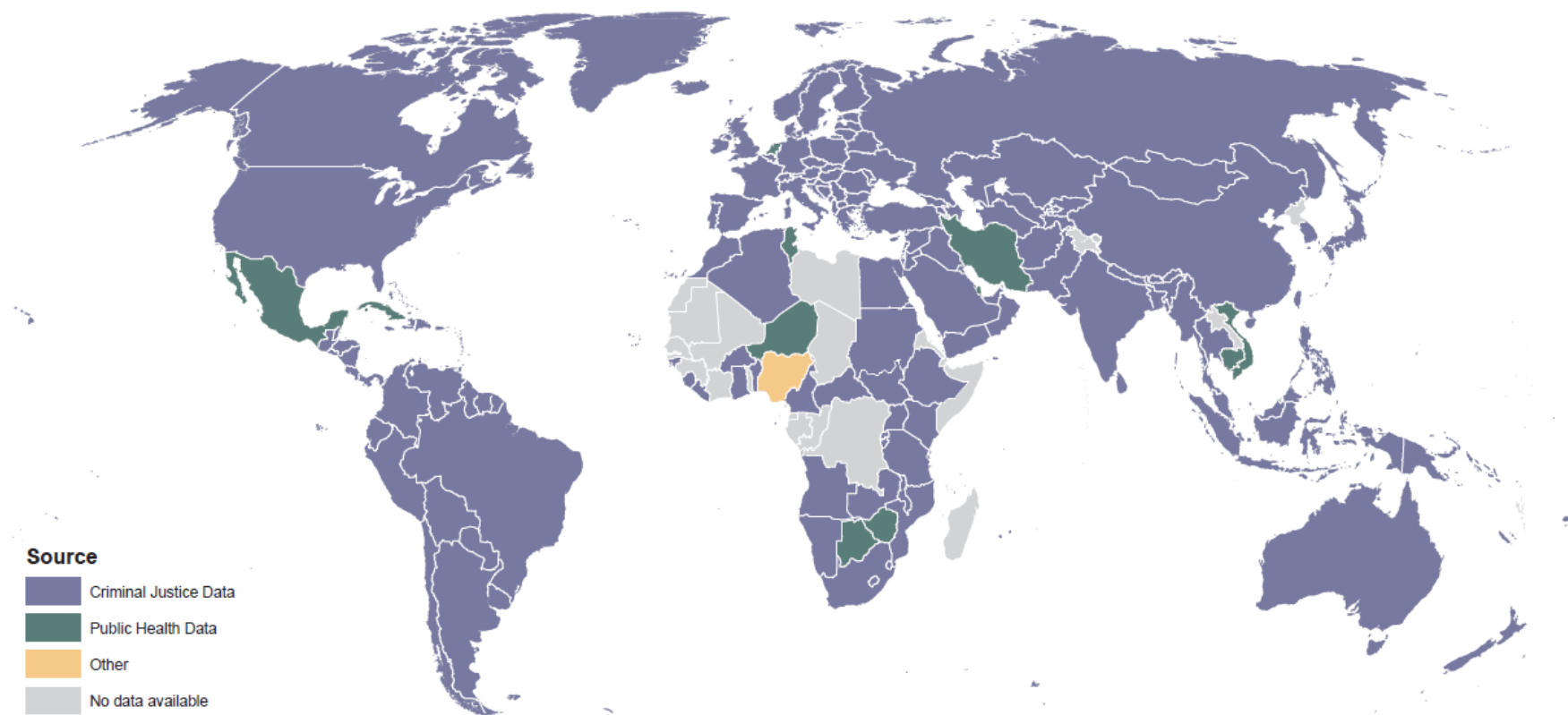
¹³ Last accessed in January 2018. Available at:

<http://apps.who.int/gho/data/view.main.VIOLENCEHOMICIDEv>

¹⁴ A list of sources is published online by the IHME at <http://ghdx.healthdata.org/data-sites-we-love>

¹⁵ These characteristics include countries' infant mortality rate, Gini index, percent of urban population, HIV prevalence, alcohol drinking prevalence, among other indicators. A detailed description of the estimation process can be in the "Global status report on violence prevention 2014" (WHO, 2014, p.62ff), and is also available at: <http://apps.who.int/gho/data/node.wrapper.imr?x-id=4464>

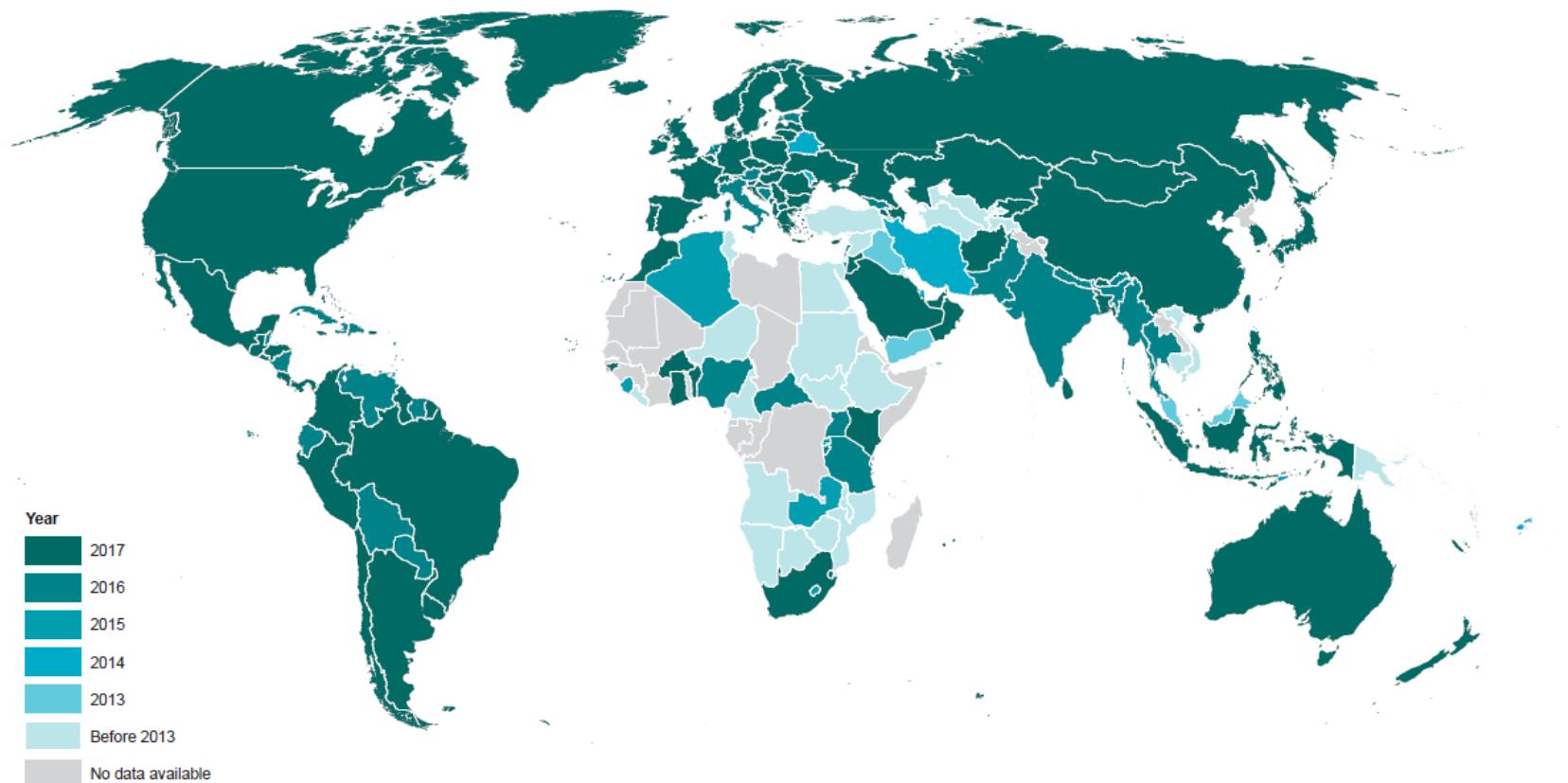
Map A.1: Countries/territories, by type of source for homicide counts (2017 or latest year)



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dashed lines represent undetermined boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. The final boundary between the Sudan and South Sudan has not yet been determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

Source: UNODC Homicide Statistics (2019).

Map A.2: Countries/territories, by latest year available for homicide count



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dashed lines represent undetermined boundaries. Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties. The final boundary between the Sudan and South Sudan has not yet been determined. A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

Source: UNODC Homicide Statistics (2019).

Population data

To improve the comparability of the prevalence of homicide of population groups of different sizes (e.g. regions, countries, age groups), rates of homicide per 100,000 population are computed. For this, data on total population, population by sex, and by age group have been integrated into the UNODC Homicide Statistics (2019) database. Data from the World Population Prospects of the United Nations Population Division (UNPD)¹⁶ were used as reference source. Data on the population of the three most populous cities were mostly collected from the UN-CTS or, in some cases, from global databases on cities or from other external sources. In addition, in some cases data by sex and/or by age for some years were estimated by applying the sex and/or age ratio of one year to other years.

¹⁶ <https://esa.un.org/unpd/wpp/>

Data validation process

A comprehensive search for available data sources was carried out and data and metadata¹⁷ from all sources found were processed and uploaded in a database containing time series from several sources of data on homicides for the period 1990-2017.

The ensuing data validation process aimed to assess each individual data point, and to use that assessment to select the best data among all available sources for each country and year as the preferred data source. For countries and years where no data meeting the quality requirements were available, none were selected as preferred values, and preferred value fields were left empty.

Validation of total homicide counts

The validation of each indicator (e.g. total victims, female victims, male victims, victims by firearms) was conducted separately, starting with the validation of the total count of homicide victims. In order to validate the data, the following quality requirements were taken into account, namely:

1. Consistency with the standard definition of intentional homicide in the ICCS (e.g. do the data exclude non-intentional homicide such as involuntary manslaughter, do the data include terrorist activities leading to death, do the data include serious assault leading to death)
2. Data availability and length of time series (the percentage of years with data on homicides)
3. Availability of documentation (is there a clear description of the data in the metadata)
4. Coverage (geographical: do the data cover all parts of the country as stated in the metadata, institutional: do the data include data collected by all institutions recording homicides in the country)
5. Quality of recording (e.g. are there indications that the recording system does not account for many cases of intentional homicide, leading to significant undercoverage).¹⁸
6. Counting unit (is the counting unit victims of homicide, rather than cases, offences or investigations)
7. Counting rules (e.g. do the data include only completed homicides, excluding attempted homicides)
8. Timeliness (availability of data on more recent years)
9. Available disaggregations (are data also available for homicide victims by sex and by age, situational context and mechanism and are these disaggregations consistent with the totals)

¹⁷ Metadata are data about other data. In this context they provide information about the content of quantitative data on intentional homicide, such as definitions used, sources of data, geographical and institutional coverage, counting rules etc.

¹⁸ Such indications could come, for example, from comparison with similar countries and other official sources of information. Issues of under-coverage are likely to occur in jurisdictions with poor recording systems, as is the case in some countries in Western, Eastern and Middle Africa.

10. Data generation (are the data based on real counts of homicide victims, such as police records or mortality records, or are they model-generated public health estimates, in which case they have been excluded as source for total homicide counts)
11. Other relevant factors that may influence the relevance and validity of the data (e.g. potential overlap with conflict-related deaths in situations of armed conflict).

The results of the data validation were then used for selecting the most appropriate time series (or parts thereof) for inclusion in the UNODC Homicide Statistics (2019) dataset. If more than one set of data on homicide totals or disaggregations were available that all fulfilled the above quality criteria, priority was given to data where the primary source of data was an official governmental institution.¹⁹ If data were available for the same indicator and year from more than one official governmental institution, priority has been given to official data reported through the United Nations Survey of Crime Trends and Operations of Criminal Justice Systems (UN-CTS). If no data have been reported to UNODC through official channels, data published by official governmental institutions (such as the Police, Ministry of Interior, Attorney General or the National Statistical Office) were used.

Validation and adjustments of homicide disaggregations

The preferred series for each of the major disaggregations in the homicide data (i.e. homicide victims by sex, age, and mechanism)²⁰ were each validated considering the same criteria as for the total number of homicide victims (definition, availability, documentation, coverage, etc). For example, if it was determined that a set of disaggregations of homicide by mechanism for a particular country and year did not conform to the validation criteria, this particular set of data was not chosen as the preferred value.

In addition, all disaggregations were validated considering their consistency with the total number of homicide victims. When there were differences between the previously validated total count of homicide victims and the sum of all disaggregations, statistical adjustments were carried out to ensure the consistency between the subtotals and the preferred totals²¹. For example, in cases where the sum of the reported male and female homicide victims was smaller than the preferred total, the numbers of male and female victims were adjusted to conform to the preferred total by applying the sex ratio of reported victims to the preferred total number of victims of intentional homicide.²² All published disaggregations have been

¹⁹ The application of this criterion resulted in the selection of data from only three non-governmental sources from respected violence observatories.

²⁰ Data on victims of homicide by age and sex, as well as data on homicide victims by mechanism of killing (firearms, sharp objects, other) have been compiled mostly from the UN-CTS plus some other sources, such as public health data provided by WHO in the Mortality Database.

²¹ The underlying assumption behind this adjustment was that the difference between the sum of the disaggregation and the total was distributed in the same proportion as the reported data.

²² As an example, the adjustment procedure for data on male and female homicide victims to the total number of homicide victims can be summarized as follows:

Adjustment factor for Sex=(Total Homicide Victims)/(Primary Male Victims+Primary Female Victims)

Adjusted Male Victims=Primary Male Victims*Adjustment factor for Sex

Adjusted Female Victims=Primary Female Victims*Adjustment factor for Sex

adjusted to conform to the preferred totals, except in cases in which data were missing for one or more disaggregation categories – for instance, if data were available on the number of victims by firearms, but not for other mechanisms.

Adjustments were only calculated when data was selected for all categories of a disaggregation (e.g. when all age groups had a selected value). For instance, an adjustment was calculated for the victims by age group only for countries and years with selected data for all age groups. When primary data was available for some age groups, but not for all, no adjustment was generated.

Adjustments of total homicide time series

As outlined above, data on the *total* number of victims of intentional homicide by country included in the UNODC Homicide Statistics (2019) dataset correspond to the original value provided by the preferred source. In a limited number of countries, a time-series adjustment was applied to ensure consistency of longer time series:

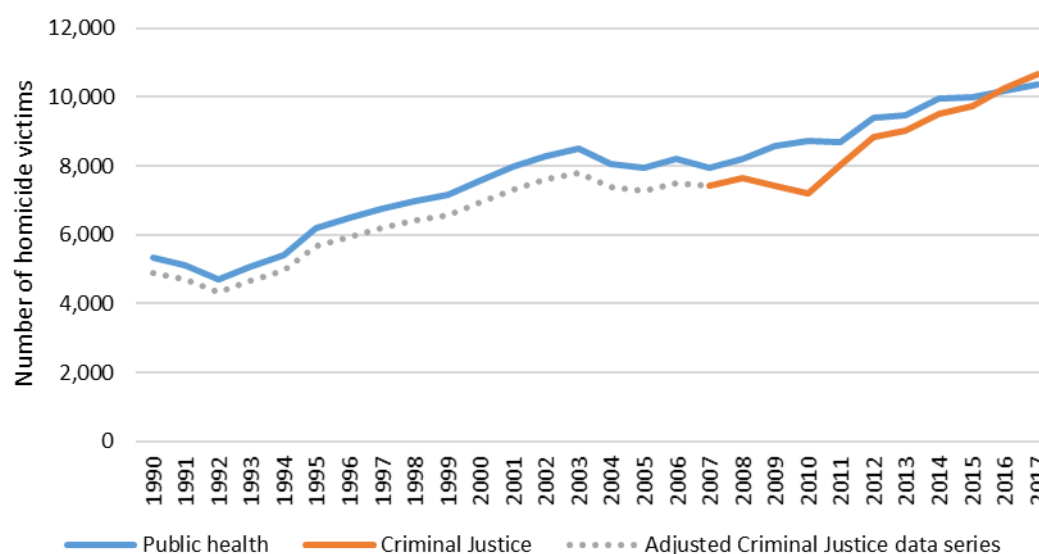
In order to compile consistent time series of total homicides back to 1990, in several cases data from multiple sources were combined to expand the number of available years within a country's time series. Such combinations were only conducted when the sources were considered compatible. In a few countries, adjustments were applied in order to ensure the consistency of older (pre-2000) time series going back to 1990 with more recent data.²³ In such cases the data source is clearly labelled as "adjusted value".

Time series adjustments were performed when a country had two sources covering different year-ranges, which had very similar trends in an overlapping time period, but where these trends were at different levels. Figure A.1 illustrates the case of a simulated country, where public health and criminal justice data had quite similar trends, but where homicide counts from the public health source are, on average, 9% greater than the criminal justice data series.

Adjusted Male Victims+Adjusted Female Victims=Total Homicide Victims

²³ Adjustments were applied mostly to pre-2000 data to ensure consistency of time trends between different sources.

Figure A.1. Homicide Count by Year, simulated country, 1990 to 2017



Based on the standard criteria for data validation, it had been determined that the detailed criminal justice data were the preferred source. To use this time series and extend it consistently back to previous years, public health data prior to 2006 were adjusted by a fixed proportion corresponding to the average relative distance between the preferred series and the public health series, for the overlapping years across both sources. Adjusted series were only produced for the total count of homicides for 12 countries.²⁴

Data used to calculate homicide counts and rates at the sub-national level

Data for calculating homicide rates for recent years at the sub-national level are available for most countries in the Americas and several countries in Africa and Asia. Sub-national homicide data (which are not collected in the UN Crime Trends Survey) were mostly collected from national sources and predominantly reflect criminal justice data from official sources (Police, Ministry of Interior, National Statistical Office or similar institution). Where available, collected data were included in the pre-publication data file sent to national authorities for validation and all data corrections were addressed in the final publication. Separately, population data on sub-national entities were collected mostly from official sources (e.g. Census data from National Statistical Offices).

To calculate sub-national homicide rates, sub-national homicide counts were first adjusted (if necessary) using the same procedure as for other homicide disaggregations (see above), so that the sum of total homicides in all sub-regions equals the (validated) sum of total homicides in that country. Adjusted counts were

²⁴ The countries for which adjusted series for total homicide counts prior to the year 2000 have been produced were the following: Belgium, Brazil, China, Ecuador, Germany, Netherlands, New Zealand, Portugal, Republic of Korea, Spain, Thailand, and UK.

then used to calculate sub-national rates of homicide shown in separate maps in colour codes (see Booklet 2) for two points in time (2012 and 2017).²⁵

Data used to calculate city homicide rates

Data on homicide victims in the three most populous cities of each country have been collected through the United Nations Crime Trends Survey since 2005. In addition, these data were complemented using data from external sources with comparable data on homicide victims. Data on cities' population were also collected in the UN-CTS, but if no such data were provided, official data from national sources (e.g. censuses) or from the United Nations Population Division were used to calculate the city homicide rate.

Data used to calculate homicide by situational context

Data on organized crime/gang-related homicides, intimate partner/family-related homicides and homicides linked to other types of crime were sourced mainly from the UN Crime Trends Survey (as well as a few additional sources where available). Data have been selected using the same criteria adopted for the selection of the other data disaggregations. However, criminal justice authorities of individual countries often classify the situational context of homicide according to national practices and definitions, which are generally linked to national legislations and operational requirements, and which may not fully conform to the categories and definitions of the International Classification of Crime for Statistical Purposes (ICCS). Only data conforming to the ICCS were included in the UNODC Homicide Statistics (2019). For that reason, data on the situational context of homicides are available for a smaller sample of countries and years than other disaggregations.

Review of Homicide Dataset by national authorities

As a final step of data validation, all preferred data values (on homicide totals as well as all available data disaggregations) destined for publication and use were sent to official counterparts in United Nations Member States for their review. All comments and data revisions received from Member States within the deadline were taken into account. Any new data provided by countries or any corrections to existing data were subject to the same evaluation process, using the same criteria as previously selected data.

²⁵ In a few cases, changes in administrative borders (for example, merging or splitting of regions) were addressed by displaying the current administrative region in the maps for both points in time and applying an estimated rate for the earlier time period.

Estimation of homicide time series at global, regional and sub-regional level

Besides the selection and publication of homicide data at country level of the highest quality possible, this edition of the Global Study of Homicide has focused on the production of consistent and comprehensive time series on homicide at various geographical levels. Monitoring trends of homicidal violence is needed to assess whether countries are being made safer and this requires a shift in the methodological approach: focus has been put on delivering accurate and consistent time series, as opposed to delivering one-point estimates. This also reflects the requirements of the 2030 Agenda for Sustainable Development, which gives high priority to trends monitoring.

The production of consistent and comprehensive time series at various geographical levels is still undermined by the lack of quality data in some regions and for certain periods. The methodology used in this GSH for estimates at global, regional and sub-regional level aims to make the best possible use of available data, sets minimal thresholds for the production of estimates at aggregated level, and conveys information on degrees of uncertainty by crafting confidence ranges around estimated values.

For each regional aggregate, homicide rates should correspond to the sum of all homicides in the region, divided by the resident population of that region, in each year. However, many countries did not provide data for some of the years between 1990 and 2017. As a result, the sample of countries with available data is different for each year. If left unaddressed, this issue would result in inconsistencies, as rates would be drawn from a different set of countries each year.

Estimation of time series (trends) of homicides at national level

The first step involved the production of time series on homicide rates at country level for the period 1990-2017. For each country, estimates of homicide data have been produced for those years where data were missing.²⁶ Specifically, for each country the years without data were complemented by using a moving average of the years with available data for that same country. Specifically, for each country, the rates of homicides of years without data were replaced by a moving average of the homicide rates of all other years in that same country's time series.

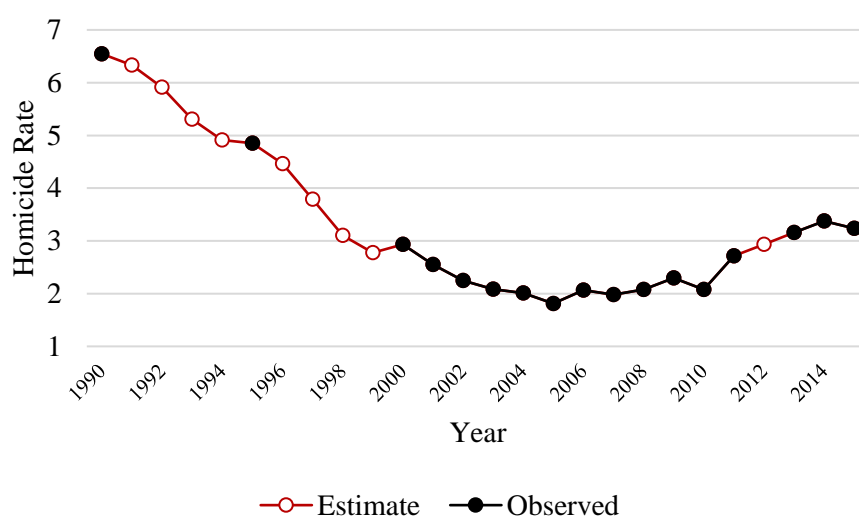
In the few cases where only one value in a country's time-series was available, it was automatically imputed for all other years, i.e., taken as a value for the whole time-series. Where at least two actual values were present in a country's time-series, missing years were estimated using an Exponentially Weighted Moving Average (EWMA). Following this approach, for each individual country-year, missing values in the homicide rate were replaced by the average homicide rate of other years in that

²⁶ As stated previously, data published for the national level are only those derived from national sources: national time series derived through the estimation method described here were built only for the purpose of producing estimates at higher geographical level, while they have not been published as such.

country's series (see Figure A.2), using weighting factors that decrease exponentially.²⁷

A moving average effectively reflects the fact that the homicide rate of most countries is generally quite stable over time and takes advantage of that property for the calculation of trend estimates. In addition, by using a moving average, all estimated homicide rates were limited by the range of all other available homicide rates of that same country, thus avoiding the generation of outliers that were either too high, or too low. Finally, this methodology was purposefully developed to be simple. A single estimation formula is applied to all data without exception, thus generating estimates that are objective, easy to communicate and to replicate.

Figure A.2 – Simulated Country; Moving Average Estimate for Homicide Rates over Time



Estimation of time series (trends) of homicides at global, regional and sub-regional level

Countries and territories were accounted for in the calculation of regional aggregates if they had at least one year with actual observed data.²⁸ Entities without actual data for any year were not used for the calculation of aggregated rates.

²⁷ Exponentially weighted moving average (EWMA) imputes missing values proceeding from the impact of the central value of the time series on all other years, which decreases exponentially for more distant time periods. As such, observations located next to a central value i have a weight of 0.5^1 , all observations that are two periods away ($i+2$, $i-2$) have a weight of 0.5^2 , those three periods away ($i+3$, $i-3$) obtain the weight of 0.5^3 , etc. For producing a moving average, all years with actual values are taken into account, but the further an actual value is located from the actual central value, the lower the weight it is accorded in a country's time series. This method has a number of advantages: it differs from a simple moving average that would impute the same values for each missing year and result in a flat trend without changes between consequently imputed years; EWMA, on the contrary, produces a value for each missing year depending on the weights of the actual observations, which in turn depend on their distance from the central value; this method also has a major advantage in comparison to linear-based approaches which base their imputation proceeding from the value of a direct neighbor, which could happen to be an outlier, thus reducing the impact of single outlying observations on the overall trend. For details, see Moritz, S. & Bartz-Beielstein, T. (2017). imputeTS: Time Series Missing Value Imputation in R. The R Journal. 9 (1).

²⁸ Only South Sudan and the Cook Islands had a single year of actual observed data, and these years represent the rates for their entire series. In addition, the estimate of total homicide rates in Nigeria are

The main purpose of this estimation strategy was to maintain the consistency in the sample of countries representing each region over time, while utilizing all available data for the calculation of regional trends. As estimates are calculated for all countries with at least one year of data, this strategy enabled the inclusion of a much greater number of countries in the calculation of global, regional, and sub-regional trends. For total homicide trends, data for 202 entities are reflected in the calculation of global trends. Together, these countries hosted 96 per cent of the world's population in 2017.

Aggregate homicide rates per 100,000 population for all regional aggregates in each of four major world regions (Americas, Asia, Europe and Oceania) have been computed by using the complete estimated time series data of all countries with available data in each region, divided by the sum of the population of the same countries with data on homicide, and multiplied by 100,000. Aggregate regional homicide counts were then obtained by applying the regional homicide rate to the sum of the total population in that region (including the countries with no available data) and dividing by 100,000.

As explained below, a modified procedure was followed to obtain regional homicide counts and rates for Africa.

Aggregate global homicide counts were obtained by summing up the regional homicide counts of all regions and the global homicide rate was obtained by dividing the resulting global homicide count by the total global population and dividing by 100,000.

Homicide rates for each subregion were obtained by summing up the total homicide counts of all countries with available data in each subregion, divided by the sum of the population of the same countries with data on homicide, and multiplied by 100,000.

To ensure that data published at the various geographical levels rely on a sufficiently large and diverse set of actual data, a minimal threshold was set for the publication of regional or sub-regional estimates: for any region/sub-region and year, estimates are produced only when actual observed data cover at least 30 per cent of the countries that together constitute at least 30 per cent of the population of that region/sub-region (30/30 rule). The application of this rule implied that no trend data were produced for Africa as a whole for the period before 2004; for Oceania as a whole prior to 2001; and for any sub-regions of Africa for the whole period 1990-2017.

Calculation of Regional Estimates for Africa

Due to the low coverage of actual data in Africa and in order to better reflect the diversity of homicide levels across African countries a different approach was used to calculate regional homicide estimates. While in other world regions, aggregate homicide counts were obtained by applying the average homicide rate from countries with available data to the total population in the same geographical aggregate (including countries with no available data), the approach to calculate a regional

based on a simple three-year average of homicide counts in 2013-2016 (see box on homicides in Nigeria in Booklet 2). All other entities had between 2 and 28 years of actual observed data between 1990 and 2017: Out of all countries/territories with at least one data point available, 45 per cent of countries had data available for more than 20 years, 33 per cent of countries had data available for 11-20 years and, finally, 22 per cent of countries had up to 10 years of data available.

homicide estimate for Africa rests on the classification of countries into three groups according to levels of insecurity. This approach was taken due to the low coverage of actual data in African sub-regions and in order to better reflect the diversity of homicide levels among African countries. To classify African countries into one of the three groups, five sets of external data reflecting different aspects of insecurity were used: data from the Afrobarometer (victimization prevalence based on four crime and violence-related survey items), the Economist Intelligence Unit (Crime and Insecurity Index from 1-5), the UN Department of Safety and Security (country security classifications from 1-5), the Global Terrorism Database (casualties from terror attacks per 100,000 population), and the Uppsala Conflict Data Program (number of conflict deaths per 100,000 population).

All indicators of insecurity were indexed and, for each indicator, countries were grouped into one of three ordinal categories by calculating 3-quantiles:

1. Lower insecurity
2. Moderate insecurity
3. Higher insecurity

The final grouping was calculated by averaging the values from each of the five indicators.²⁹ Average homicide rates for each of the three groups were then calculated by aggregating the homicide counts of all countries with available homicide data within each group, divided by the population that was covered by countries with available data within each group, multiplied by 100,000. The resulting 'group rate' was then applied to the aggregated population of all countries within each group to obtain group-specific estimates of homicide counts for all years. Adding up these group-specific counts provided the count estimate for the entire African region. The homicide rate for the entire African region was then calculated by dividing the count estimate by the aggregated population of all African countries, multiplied by 100,000.

Estimating confidence ranges around time series

As in any measurement exercise, the precision of homicide estimates provided in the Global Study on Homicide 2019 is affected by measurement errors and estimation variability. In order to quantify and communicate this uncertainty, estimated confidence ranges were calculated and presented (see Booklet 2).³⁰

Two components were considered in calculating the estimated confidence ranges for homicide counts and rates:

Measurement error: inaccurate recording of events or lack of compliance with international definitions can produce errors in national data (both actual data and estimated values). This error affects data from all countries and a general approximation is provided here by using the observed difference between independent sources available for the same year (to all homicide counts, observed or

²⁹ The grouping is based on data for the latest available year for any of the five indicators and subsequently remains the same for all years.

³⁰ The approach applied here does not intend to provide a standard confidence interval, but instead attempts to illustrate and communicate uncertainty about the precision of the trends shown.

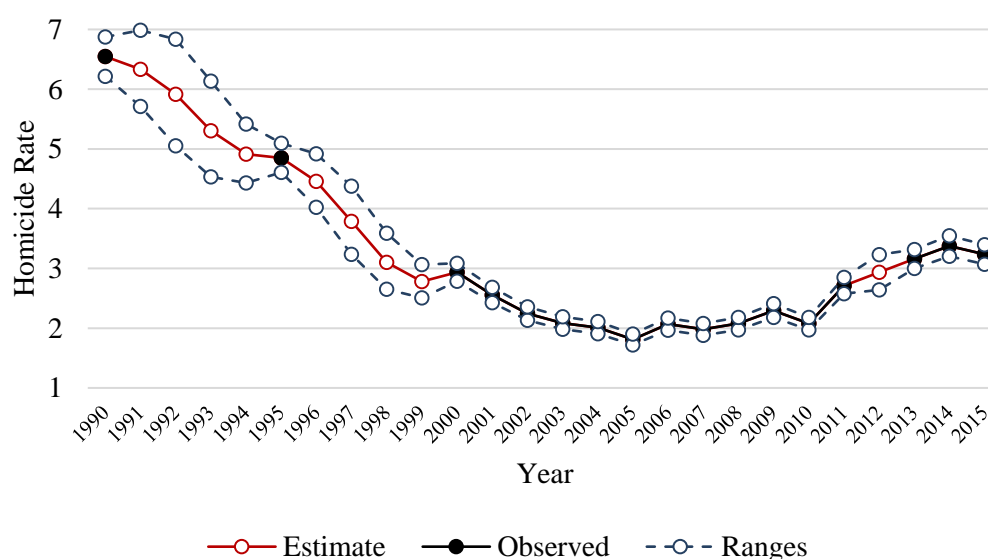
estimated, a range of plus and minus 5% was added³¹ to convey this measurement error.

Estimation error: For countries with at least one year of data on homicides, an additional penalty of plus and minus 5% was added³² to the value of each estimate for each year of distance between the estimate and the closest observed homicide count.

Ranges around global and regional trends were obtained by adding up – for each year – the compounded ranges of of all countries that were a part of each regional aggregate. For countries which had no actual data on homicides for any year, and thus also did not have any estimates obtained by the EWMA method, ranges were calculated by applying the maximum and the minimum rate of homicides of the countries’ sub-region to the country’s population.

As a consequence of the described approach to calculate estimated confidence ranges, countries with fewer years of actual data have wider ranges around the national trend (see Figure A.3) and contribute more to the error around the trends of their regions and sub-regions. In addition, regions and sub-regions with a greater number of countries without any data have even wider ranges.

Figure A.3 – Simulated Country; Estimated Ranges around Homicide Rates



Estimation of time series (trends) of homicide disaggregations

In addition to the trends of total homicide victims, regional trends were also calculated for some disaggregations of homicide victims, namely for the number of victims by sex, by age group, by mechanism, and for victims of homicides by family members or intimate partners. For consistency, the calculation of those trends followed a similar methodology as used for the total homicide rate, but with one important difference: estimates for missing years were not based on the homicide rate of each disaggregation (e.g on the homicide rates of males and females separately),

³¹ The 5% figure is calculated as the average proportional distance between the public health and criminal justice values, excluding the outlier years.

³² The 5% figure is calculated as the average yearly change in homicides around the world, which is relatively consistent across regions and sub-regions.

but on the proportion of victims of each disaggregation relative to the total number of homicides.

For example, if 40 per cent of the homicide victims of a particular country were females in year x and 50 per cent were females in year x+10, a moving average of that percentage was used to estimate that proportion for years without actual data in that same country (see Figure A.4).

Subsequently, estimated percentages were applied to the total homicide count to obtain an estimated count of homicides per disaggregation (e.g. for male and female victims, see Figure A.5).

By focusing on percentages, it was possible to ensure consistency between the sum of victims of relevant disaggregations and total homicide counts that resulted from the prior data validation. This approach is supported by the fact that the proportions of each disaggregation tend to remain relatively stable over time.

Figure A.4 – Simulated Country; Moving Average Estimate for Sex Ratio over Time

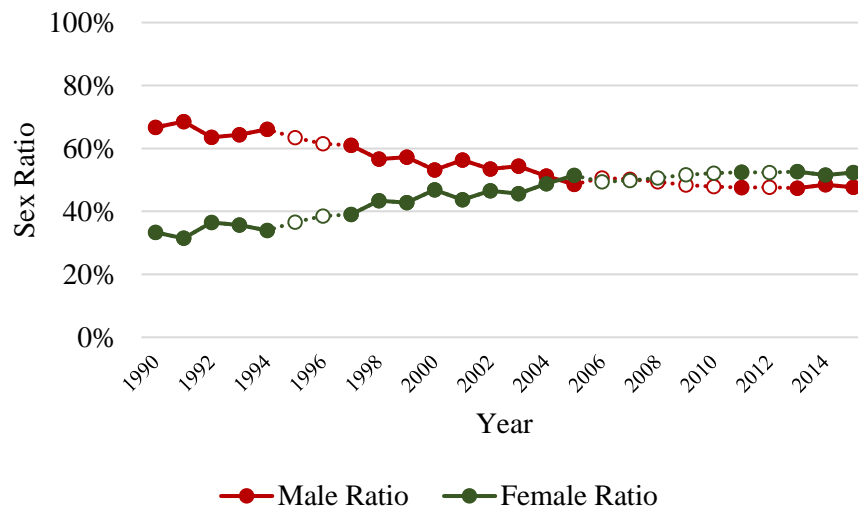


Figure A.5 – Simulated Country; Moving Average Estimate for Sex Rate over Time

