Casualty Estimates in the Rwandan Genocide

David A. Armstrong II, Christian Davenport & Allan Stam

Routledge
Taylor & Francis Group

FORUM: CALCULATING MORTALITY IN THE RWANDAN GENOCIDE

Casualty Estimates in the Rwandan Genocide

David A. Armstrong II[a], Christian Davenport[b] and Allan Stam [c]

[a]Social Sciences Centre, University of Western Ontario, London, Canada; [b]Political Science, University of Michigan, Ann Arbor, MI, USA; [c]Frank Batten School, University of Virginia, Charlottesville, VA, USA

Introduction

The estimation of casualties in any situation of political conflict is challenging. The state-of-the-art statistical tools[1] require named, overlapping lists of victims, location, time and information about event type. This is not a situation in which researchers in the Rwandan case found themselves since late 1994. Instead, researchers had incomplete surveys of (often) unidentified victims which have different spatio-temporal scopes and behavioural focus. It is through this lens that we detail our best efforts to estimate the total casualty figure from the violence undertaken in Rwanda 1994 along with appropriate uncertainty boundaries. To be clear: the driving question behind our work has been – Is it possible, based solely on the data, to derive precise, defensible estimates of the casualty figures? Below, we discuss why we feel we have to answer this question in the negative and our focus on transparency with regard to source material, methodological procedure and potential errors in estimation.

Our approach is consistent with a growing body of social science research (building on the work of earlier pioneers)[2] that seeks to disaggregate conflict processes within large-scale territorial units (for diverse cases see references[3]; for Rwanda see references[4]). These efforts attempt to identify the different actions and actors engaged in violent behaviour across locations and times. This approach is useful for understanding who did what to

[1] Patrick Ball and Megan Price, "Using Statistics to Assess Lethal Violence in Civil and Inter-State War," *Annual Review of Statistics and Its Application* 6, no. 1 (2019): 63–84.

[2] Charles Tilly, *Popular Contention in Great Britain, 1758–1834* (New York and London: Routledge, 1995).

[3] Helen Fein, *Accounting for Genocide: National Responses and Jewish Victimization During the Holocaust* (Chicago: University of Chicago Press, 1994); Stewart Tolnay and E. M. Beck, "Racial Violence and Black-Migration in the American South, 1910 to 1930," *American Sociological Review* 57 (1992): 103–16; Patrick Ball, *Who Did What to Whom? Planning and Implementing a Large-Scale Human Rights Data Project* (Washington, DC: American Association for the Advancement of Science, 1996); Patrick Ball, Paul Kobrak, and Herbert Spirer. *State Violence in Guatemala, 1960–1996: A Quantitative Reflection* (Washington, DC: American Association for the Advancement of Science, 1999); Nils Weidmann and Michael D. Ward, "Predicting Conflict in Space and Time," *Journal of Conflict Resolution* 54, no. 6 (2010): 883–901; Ralph Sundberg and Erik Melander, "Introducing the UCDP Georeferenced Event Dataset," *Journal of Peace Research* 50, no. 4 (2013): 523–32; Arturas Rozenas, Sebastian Schutte, and Yuri Zhukov, "The Political Legacy of Violence: The Long-Term Impact of Stalin's repression in Ukraine," *Journal of Politics* 79, no. 4 (2017): 1147–61.

[4] Scott Straus. *The Order of Genocide: Race, Power, and War in Rwanda* (Ithaca, NY: Cornell University Press, 2006); Philip Verwimp, "Death and Survival During the 1994 Genocide in Rwanda," *Population Studies* 58, no. 2 (2004): 233–45; Marijke Verpoorten, "The Death Toll of the Rwandan Genocide: A Detailed Analysis for Gikongoro Province," *Population* 60, no. 4 (2005): 401–39; Marijke Verpoorten, "The Intensity of the Rwandan Genocide: Measures from the Gacaca Records," *Peace Economics, Peace Science and Public Policy* 18, no. 1 (2011): 873–83; Marijke Verpoorten, "Detecting Hidden Violence: The Spatial Distribution of Excess Mortality in Rwanda," *Political Geography* 31, no. 1 (2012): 44–56; David Yanagizawa-Drott, "Propaganda and Conflict: Evidence from the Rwandan genocide," *Quarterly Journal of Economics* 129 (2014): 1947–94.

whom within situations where overt conflagrations have taken place. However, there are important limitations to this approach in general and specifically in this case where the editors of this journal asked us to: "present your view of the death toll in the Rwandan genocide." From the beginning, we have maintained that the type of information necessary to make the determination of genocide was near impossible to acquire (i.e. the intent of all perpetrators and the actual or perceived identification of all of those who died). Consequentially, we tried to generate reasonable estimates about the overall death toll produced by *all* violence in Rwanda during 1994. While our efforts to parse violence ethnically received the most attention, the bulk of our research has been dedicated to investigating the death toll generated by all forms of violence. We thus focus on this effort here.

This broader contextualization is inconsistent with the international discussion surrounding Rwanda, but it was consistent with the narratives of human rights groups and students within Rwanda when our fieldwork was active (2000–2004): e.g. earlier state repression (i.e. prior to 1989), interstate war (1990–1993), the RPF occupation of the Northern part of Rwanda (1993), conflict during the period democratization (1994), continued intrastate/civil war (1994), the period of genocide (1994), the RPF victory (1994), the end of the intrastate/civil war and genocide (1994), post-war/genocide domestic pacification (1994-present), the invasion of Congo (1996–1997), the occupation of Congo (1997), the re-invasion of Congo (1998–2003), targeted assassination of RPF opponents abroad (1998-present), the systematic return of political opponents to Rwanda (1998-present) and Rwandan government persecution of civil society (1999-present). For this essay, we will focus our discussion on the violence of 1994.

Data

To produce estimates of casualty counts, we used data from six sources which were interested with counting the dead. Five of the six sources could be used to produce daily counts of deaths within each prefecture, the last source had no temporal disaggregation. We also compiled other sources of information: e.g. a representative household survey of Butare residents, roughly a dozen focus groups, interviews with prisoners in both domestic and international proceedings and various human rights documents from different organizations within Rwanda (e.g. Liprodhor). Despite this, we relied upon sources that appeared to rigorously collect information over at least a single prefecture (or equivalent to a national state).

Our first data source was *Africa Rights*, a regional organization developed to bring truth and justice to the victims of the genocide. In "Rwanda: Death, Despair and Defiance"[5] they compiled all available eyewitness accounts of the genocide into one book, the second edition of which includes additional data largely from the previously inaccessible prefectures of Kibuye, Cyangugu, and Gikongoro. Nominally, their efforts attempted to cover the entire country. Between April and June 1994, one individual conducted interviews during the civil war as well as genocide. The total number of deaths accounted for by Africa Rights was approximately 132,072.

Human Rights Watch, an international NGO dedicated to monitor human rights violations all over the world, served as the second source of data. "Leave None to Tell the

---

5 Africa Rights, *Rwanda: Death, Despair and Defiance*, 2nd ed. (London: Africa Rights, 1995).

Tale"[6] was intended to educate people and bolster public support for the prosecution of the perpetrators of the genocide. Undertaken in 1995–1996, this study was based on the oral testimonies of thousands of survivors, killers, people who saved, and bystanders of genocide as well as written documentation from diplomats, UN staff members, and the local Rwandan administration. Again, while nominally aimed at the entire country, Human Rights Watch paid particular attention to Southern Rwanda, which was most affected by the genocide and believed to be a compelling narrative. The total number of deaths accounted for by Human Rights Watch was approximately 40,530.

IBUKA, a Tutsi organization (i.e. the group of Tutsi that stayed in Rwanda after being chased out in the 1950s), provided our third source of data. Undertaken from 1996 to 1999, the purpose of the "Kibuye Dictionary Project"[7] was to provide justice for the victims and their families by thoroughly identifying all the victims in this prefecture and documenting the number and names of victims along with the circumstances and date of their deaths. We employed a corrected version of the data provided by Philip Verwimp.[8] The total number of deaths accounted for by Verwimp's adjustment to the Ibuka data was approximately 25,703.

The *Ministry of Higher Education, Scientific Research and Culture*, a cabinet ministry of the Rwandan government, was our fourth source of data.[9] Between 25 November 1995 and 10 January 1996, this organization engaged in a project called "The Commission for the Memorial of the Genocide and Massacre in Rwanda" in collaboration with other ministries including Labour and Social Affairs, Rehabilitation and Social Integration, Home Affairs and Communal Development, Family Affairs and Women's Development and Defense. The Project was funded by HCDH, UNICEF, GTZ and UNESCO/PEER. The project's geographical scope was the entire country. The total number of deaths accounted for by this work was approximately 755,504.

We obtained data from the *Ministry of Youth, Culture and Sport* which undertook a mass-grave identification project with assistance from the Ministries of Social Affairs, Rehabilitation of Social Integration, Communal Development, Family and the Promotion of Women, and the Ministry of Defense.[10] Using contacts throughout the country to identify all sites of mass killing, these ministries used forensic evidence to ascertain the number of victims that existed in each locale. This country-wide project was initiated and completed in 1995. The total number of deaths accounted for by the Ministry of Youth, Culture and Sport was approximately 823,402.

Our final source of data was the *Ministry of Local Administration and Department of Information and Social Affairs* who developed a report called "The Counting of Genocide Victims."[11] Here, 1,825 enumerators were recruited to carry out the survey in an effort

---

6 Human Rights Watch, *Leave None to Tell the Story: Genocide in Rwanda* (New York: Human Rights Watch, 2002). https://www.hrw.org/reports/1999/rwanda/.
7 IBUKA, *Kibuye Dictionary Project* (Kigali, Rwanda: IBUKA, 1999).
8 Verwimp, "Death and Survival".
9 *Ministry of Higher Education, Scientific Research and Culture*, "Preliminary Report on Identification of Sites of the Genocide and Massacres That Took Place in Rwanda From April to July 1994" (Kigali, Rwanda: The Commission for the Memorial of the Genocide and Massacre in Rwanda, 1996), https://genodynamics.weebly.com/uploads/1/8/3/5/18359923/ministry_of_higher_education_scientific_research_and_culture_report.pdf .
10 *Ministry of Youth, Culture and Sport*, "The Mass Grave Identification Project" (Kigali, Rwanda: Republic of Rwanda, 1996).
11 *Ministry of Local Administration and Department of Information and Social Affairs (MINALOC)*. "The Counting of Genocide Victims" (Kigali, Rwanda: Republic of Rwanda, 2002), https://genodynamics.weebly.com/uploads/1/8/3/5/18359923/minaloc_translated_document.doc.

to name the victims of the genocide, identify the numbers of victims, and to locate areas most affected by the genocide as a guide for aid allocation. Beginning in 2000, in cooperation with the National University of Rwanda and the National Office of Population, a countrywide survey was implemented and analysed. Although the number of respondents not known, they were either survivors or neighbours of those who died. The total number of victims accounted for was 939, 218 (i.e. "whom neighbors, survivors or other locales have reported to have lived in a particular household and have been victims of genocide and for whom they can provide all information asked in the survey").[12] Unlike the other data considered here there is no temporal information so we cannot use this dataset to measure casualties per day as with the others.

Method

We approached this topic as a measurement problem. In this paradigm, a latent construct (i.e. the actual casualty figure) produces observed, error-laden indicators (our data sources). We then use the similarities in the relationships among the indicators to derive estimates of the latent construct with methods like those discussed in Armstrong.[13] We consider the degree to which different sources report similar events or patterns in events (i.e. whether or not something took place how many people died in a specific space/time). Such a model basically looks like:

$$\text{Indicator}_{i,j} = \beta_{0,j} + \beta_{1,j}\text{Latent}_i + \varepsilon_{i,j}$$

Here, the Latent_i are the estimates of the casualty figure, the $\beta_{1,j}$ terms represent the relationship between the estimated true counts and the actual observed counts; and, the $\beta_{0,j}$ term indicates the expected indicator value when the estimated latent death count is zero. Each indicator is one of the five sources of data mentioned above. The $\varepsilon_{i,j}$ term is the residual – what is left over in the indicator that cannot be explained by the latent estimate (i.e. "measurement error"). One problem with this modelling strategy is that the latent variable estimate is independent of the scale of the indicator variables. So, even though the indicators are measured in lives, the latent variable is not. By considering the systematic part of the measurement equation (everything after the equal sign, excluding the $\varepsilon_{i,j}$ term), we could then reconstruct how each source would calculate casualty figures net of measurement error. This will give us a way to estimate total casualty figures based on any source or set of sources.

We use Markov Chain Monte Carlo simulation with essentially uninformative priors (i.e. where no source is privileged relative to others) to estimate the model. This allows us to provide appropriate uncertainty bounds on the figures that we do generate.[14] In the model we use, rather than trying to predict the raw indicator, we predict the standardized inverse hyperbolic sine-transformed indicators to deal with the quite different scales across sources. We exclude the IBUKA data from the model because the patterns at the

---

[12] *MINALOC*, "The Counting," 19.
[13] David A. Armstrong, "Stability and Change in Political Rights and Civil Liberties," *Journal of Peace Research* 48, no. 5 (2011): 653–62.
[14] Why not just use the source with the largest number? Using the largest value would mean that the only source of measurement error is undercounting. It precludes the possibility of overcounts. As a less important feature of the problem, using the maximum would also preclude us from calculating uncertainty bounds, we would simply have to take that value as given. If we did this, identified total would be 1,396,782.

commune aggregate level are negatively related to those produced by other indicators.[15] Leaving us with five sources. Constrained geographic coverage and a relatively small sample make this finding unsurprising.

There are, of course, alternative approaches that one could take. For example, rather than focusing on similarities, it would be possible to choose the maximum value across all sources. This would assume that the only source of error would be under-counting.

Results

Unsurprisingly, each source generates quite different estimates. Figure 1 shows the estimates for the five data sources we use. The estimates are a function of the raw counts from all of the sources and they represent the best guess for each source accounting for incomplete geographic coverage and all of the relationships that exist across the five sources. Considering the estimates and their attending uncertainty bounds, the total casualty estimates range from around 42,000 on the low end (an obvious underestimate) to around 1.5 million on the high end,[16] something that is very likely an over-estimate. Averaging across all of the different sources, we get a total figure of just over 580,000 with an 80 per cent credible interval ranging from just over 500,000 to roughly 687,000. A more rigorous averaging that weights by the amount of available information in each source provides a slightly different estimate, still – 730,000 (650,000, 845,000; 80 per cent credible interval).

Comparison

How well do our measures compare against others? There has been a small amount of quantitative work that has emerged undertaken by a relatively small number of scholars.[17] Numerous topics have been explored here: e.g. when does violence start in a particular place,[18] how many were killed after violence was initiated[19] and who was victimized as well as who were the perpetrators by ethnicity, economic background/occupation and geographic locale.[20]

The data created and employed by the research above is quite varied. Within this work, one can find field interviews,[21] focus groups,[22] surveys,[23] censuses,[24] forensic evaluation[25] and content analysis of media reports.[26] Of course, each source comes with their own

---

[15] We've run many models in the past, but we think that the estimates we created most recently were based on a single model as well as with different assumptions about what sources of information are useful.

[16] The actual values might be a bit different from our earlier work, but they are of the same magnitude.

[17] Davenport and Stam, "What Really Happened"; Straus, "The Order of Genocide"; Verwimp, "Death and Survival"; Verpoorten, "The Death TWoll of the Rwandan Genocide"; "The Intensity of the Rwandan Genocide"; "Detecting Hidden Violence"; Yanagizawa-Drott. "Propaganda and Conflict"; Brehm, "Subnational Determinants."

[18] Straus, "The Order of Genocide".

[19] Verwimp, "Death and Survival"; Brehm, "Subnational Determinants".

[20] Verwimp, "Death and Survival".

[21] Davenport and Stam, "What Really Happened"; Straus "The Order of Genocide"; Fujii "Killing Neighbors."

[22] Davenport and Stam, "What Really Happened."

[23] Davenport and Stam, "What Really Happened"; Straus, "The Order of Genocide."

[24] IBUKA, *Kibuye Dictionary Project*; MINALOC, "The Counting".

[25] *Ministry of Higher Education, Scientific Research and Culture* "Preliminary Report on Identification of Sites"; *Ministry of Youth, Culture and Sport* "The Mass Grave Identification."

[26] Davenport and Stam, "What Really Happened"; Yanagizawa-Drott, "Propaganda and Conflict."
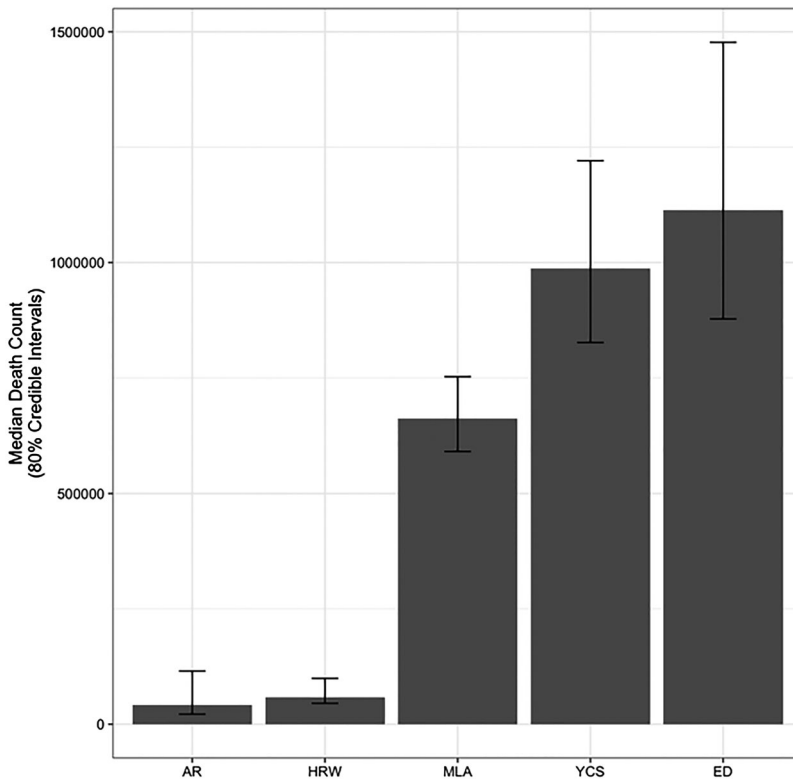
Figure 1. Casualty estimates by source.

strengths and weaknesses. For example, census and content analysis can involve all subjects within a population and thus they can be said to be representative – capturing all individuals within Rwanda, whereas other approaches are directed toward subsets/samples of the population. The latter must appropriately make the case that it is somehow representative (i.e. by being randomly drawn) or there must be a clear acknowledgment of exactly how general the claims from the study could be extended (i.e. to what population). Interviews and focus groups provide researchers with detailed information about what people experienced, perceived and thought/reflected upon but there are problems concerning the potentially traumatized and/or deceptive individual recalling as well as being willing to retell what happened.[27] While estimations tend to vary, we wish to highlight methodological differences. For example, either researchers take information from a single source and avoid comparison against/inclusion with another or they just put several sources together in some manner. Perhaps the best work here is Verpoorten[28] who employs a specific demographic approach to the topic. Unfortunately, this work is less interested in temporal differences and thus her approach relies upon slightly different source material as well as modelling. As a consequence, our work is quite different in how it addresses the issues involved.

---

27 Fujii, "Killing Neighbors."
28 Verpoorten, "The Death Toll of the Rwandan Genocide"; "The Intensity of the Rwandan Genocide"; "Detecting Hidden Violence."

Discussion

We think that the exercise above highlights some fundamental truths about trying to derive casualty estimates from secondary sources – the most common way that this is done.

First, there are many arbitrary decisions required to generate casualty estimates. For example, we had to choose a model. The model has parameters that require identification. We also had to choose which sources go into the model. In our case, retaining rather than deleting the *IBUKA* data, increases the averaged predicted counts by around 100,000 and also increases the uncertainty in the estimates. We feel that we are on solid statistical ground in removing that source, but that remains a choice nonetheless.

Second, the results still require the researcher to either imply or express belief about the veracity of different sources. By either choosing to use a single source or aggregate multiple sources, researchers are making a statement about their belief in the utility of each measure. Not making an explicit choice (i.e. just using a single source or averaging across all sources with equal weight) is itself a statement of faith – specifically, that all sources are equally reliable. In any event, this exercise has failed to remove us from the situation where our conclusions about what happened are based on our prior beliefs about the reliability of the data.

Three, our discussion here relates to overall estimates by commune. However, often we might be interested in how the conflict unfolded – the daily or weekly casualty totals by commune. While we haven't discussed those explicitly here, our work identifies that all of these complications and more (specifically sparse data) can cause real problems in trying to arrive at reasonable estimates. If this is the goal, the researcher needs an enormous amount of data.

Given all of the caveats and choices that are required (some of which cannot be justified statistically), we have always felt that the most defensible position is that no clear casualty figure emerges. This is why we have consistently provided estimates of the error within all of our discussion of the topic – deviating from the majority of practices within all of the media and most of the scholarship reported over time.

Four, and related to the last point, within our research we have consistently strived to be transparent – a practice not often followed and/or respected by others in the field. At any point in time within our project, researchers could access the raw material that we collected, the code used to generate estimates and make decisions about what they wanted to trust or not trust. What would have been a reasonable critique to make of our project was that the underlying source material was fundamentally flawed and for someone to come up with a publicly available alternative source. This never happened. While some have commented on the fact that *Human Rights Watch* might not have uniformly well covered the entire country and that *African Rights* might have been biased against a few locations, nothing approached the damning criticism expressed by Alex De Waal[29] about the latter source until the last few years. A few commented that the Kibuye database compiled by IBUKA might have suffered from a few limitations but nothing at all that impugned the whole effort. Indeed, the organization has received nothing but praise.

---

[29] Alex De Waal, "Writing Human Rights and Getting it Wrong," *Boston Review*, 6 June 2016: http://bostonreview.net/world/alex-de-waal-writing-human-rights.

Finally, no one has said that the various Ministry reports issued by the Rwandan government were flawed. Again, each of the efforts had received a significant amount of praise. This is why we chose to use them as well as make them available to other scholars.

ORCID

Allan Stam ⓘ http://orcid.org/0000-0002-2533-9495

Disclosure Statement

No potential conflict of interest was reported by the authors.

Notes on contributors

David A. Armstrong II is the Canada Research Chair in Political Methodology, Director of the Centre for Computational and Quantitative Social Science and Associate Professor of Political Science at Western force in London, Ontario. His work has been published in the *American Political Science Review*, the *American Sociological Review* and the *American Journal of Political Science* among other places. His latest work focuses on finding comparable measures of government and challenger conflictual behaviour.

Christian Davenport is a Professor of Political Science and Faculty Associate at the Institute for Social Research at the University of Michigan, Research Professor at the Peace Research Institute Oslo and Elected Fellow at the American Association for the Arts and Sciences. Primary research interests include political conflict, measurement, racism and popular culture. He is the author of seven books (e.g. *The Peace Continuum* [2018], *How Social Movements Die* [2015] and *Media Bias, Perspective and State Repression* [2010]), approximately 50 articles and the winner of numerous awards.

Allan C. Stam is Professor of Leadership and Public Policy at the Frank Batten School at the University of Virginia. His work on war outcomes, durations, and mediation appears in numerous political science journals. Several grants have supported his work, including four from the National Science Foundation. His books include *Win Lose or Draw* (1996), *Democracies at War* (2002), and *The Behavioral Origins of War* (2004). He is the recipient of the 2004 Karl Deutsch award, given annually by the International Studies Association to the scholar under the age of 40 who has made the greatest contribution to the study of international politics.