

## Mathematics and Statistics for Human Rights

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“Every human has the right to life and their life should be protected.” Oxford Dictionary on Human Rights

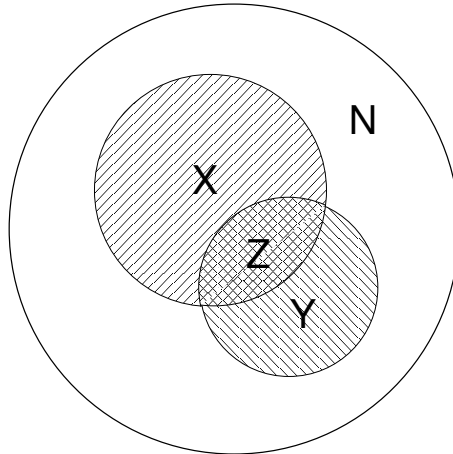
Mathematical and statistical methods are well known to underpin our highly technological society but it is perhaps less well known that mathematics and statistics are also being used as tools in the defence of human rights. One of the organizations involved in this work is the Human Rights Data Analysis Group (HRDAG) which was established by the American Association for the Advancement of Science. This article describes some of the methods and cases with which the HRDAG has been involved.

One of the most fundamental ways in which statistical analysis helps in human rights cases is in recording and analysing human rights abuse data. The raw data, collected from different sources, is usually an incomplete record. Typical sources include individual testimonies, administrative records from morgues and cemeteries, eyewitness interviews and official customs and immigration records. Statistical methods are required to evaluate and analyze this data so that it can be used in evidence in criminal prosecutions. An example of this use occurred in a court case against the Yugoslav government in February 2007. In their defence, the Yugoslav government claimed that the killings and migrations under investigation were a result of actions by the North Atlantic Treaty Organisation (NATO) and the Kosovo Liberation Army (KLA). In this case, Dr Patrick Ball, Director of Benetech Human Rights program, extrapolated from the raw data (exhumation records, interviews with victims, and records provided by Albanian border guards) to provide testimony that between 9,000 and 12,000 ethnic Albanians were killed in Kosovo and 875,000 were forced to flee the country between March and June 1999. Dr Ball also used the statistical analysis of the data to demonstrate that the patterns of killing and migration were significantly different to the patterns and activities of the North Atlantic Treaty Organisation (NATO) and the Kosovo Liberation Army (KLA), thus discrediting the Yugoslav government's defence.

One of the key statistical tools used in extrapolating data from incomplete and different sources is the method of multiple systems estimations. This can be an effective tool when data is collected from distinct sources but with partially overlapping data. Such a scenario is illustrated schematically in the figure below. Suppose that  $N$  represents the total number of deaths in a human rights abuse case and  $X$  and  $Y$  represent

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the numbers of deaths as recorded by two different sources. It is also supposed that some of the deaths that have been recorded are recorded by both sources so there is an overlapping population  $Z$ . The numbers  $X$ ,  $Y$ , and  $Z$  are known from the records but  $N$  is unknown and has to be inferred from the known records. If all deaths have the same probability of being captured in each sample, then

$$\frac{X}{N} = \frac{Z}{Y} \quad \text{and} \quad \frac{Y}{N} = \frac{Z}{X},$$

so that

$$N = \frac{XY}{Z}$$

provides an estimate of the total number of deaths.

HRDAG recently began to analyze data relating to deaths during the thirty-six year civil war in the Republic of Guatemala. This war ended through a UN Peace Accord in 1996. Three separate data bases with lists of people killed in the conflict were analyzed. The names on the lists had been obtained from interviews with victims and witnesses. The data was recorded during the hostilities and after the war, however statisticians did not begin to perform statistical analysis until after the Peace Accord in 1996. At this time there was a vast amount of data, that required collating and sorting. HRDAG reported that Guatemala's National Police had 80 million documents in their historic archive. Mathematicians working for HRDAG in 2007 reported that "the records were stored in a series of dark rooms overrun by rats, bats and cockroaches. Many of the papers were soaked by rainwater from leaks and broken windows." These documents contained photos and police identification of victims. Guatemalan civil rights workers sorted and organised the documents at a cost of over 2 million dollars (donated by Sweden and Germany). The statistical analysis of the data did not begin until March 2007, after the documentation had been completely recovered. The analysis of this data is ongoing and will continue until 2009. Many people in Guatemala lost family and friends as a result of human rights violations during the conflict and in analyzing the data HRDAG hopes to help to be able to identify what happened to missing persons

and to help to prepare cases against those responsible. Information extracted from the data has already been used as evidence in serving warrants for the arrest of members of the Guatemalan National Police. It was alleged that the Guatemalan National Police were allegedly responsible for burning 39 protestors alive at the Spanish embassy in 1980. "In July of 2006, the Spanish National Court issued an international arrest warrant for torture, murder and illegal detention against the former director of the National Police, General German Chupina Barahona, and seven other former Guatemalan security officials."(HRDAG) There is still much that may come out of further statistical analysis of this data bank.

One of the persons who has contributed substantially to statistical research into the human rights crimes is Romesh Silva. Romesh has a Bachelor of Science (Hons) from the University of New South Wales with a major in statistics. He has since completed a Master of Arts in International Affairs from Columbia University, New York and a Master of Arts in Demography from the University of California, Berkeley. Romesh led HRDAG projects in Sri Lanka, Timor-Leste, Chad and Bangladesh and also contributed to HRDAG projects in Colombia, Sierra Leone, Guatemala and Liberia.

More about the use of statistics in analyzing human rights abuses can be found from the HRDAG web site <http://www.hrdag.org>