MAPPING GLOBAL VIOLENCE AND HEALTH INFORMATION

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RESUMEN

Este articulo describe la producción de un atlas mundial sobre violencia y salud. El Atlas ha sido publicado por el Centro para el Desarrollo de la Salud de la Organización Mundial de la Salud (OMS), en Kobe (Japón). Los Sistemas de Información Geográfica (SIG) han jusgado un significativo papel en la recogida, integración, gestión, análisis y presentación de la información. El formato y estilo del Atlas es a la vez audaz e innovador. En el artículo se describen el proceso seguido y la producción del mismo.

Palabras Clave:

Mundial, violencia, SIG, salud pública, cartografía, OMS

ABSTRACT

This paper describes the production of an atlas on global violence and health. The World Health Organization, Centre for Health Development (WHO Kobe Centre), Kobe, Japan has published the Atlas. GIS has played a significant role in the collection, collation, management, analysis and presentation of the information. The form and style of the Atlas is both bold and innovative. The paper describes the process and production.

KEYWORDS

Global, violence, GIS, public health, cartography, WHO

1. INTRODUCTION

It has been recognised that the two chief causes of an early death are infectious diseases and violence. The World Health Organization (WHO) recognises the importance of this issue among its international community and has, along with its related global organizations, decided on a plan of action. This paper outlines the development of a Global Atlas on Violence and Health for the World Health Organization [WKC, 1999], Centre for Health Development (WHO Kobe Centre), Kobe, Japan. This Atlas is part of the action plan of the WHO [McDonald, 2000, p2].

This publication is a graphical presentation of available global violence and epidemiological information. The data are presented at the country level (as compared to the regional or local level) and are mapped against several socio-economic data sets. The aim of the Atlas is primarily to present these complex data in a graphical form that most easily facilitates interpretation by the reader. Alternative forms of textual data presentation were discounted.

The mapping of global violence and health information with spatially referenced data present significant problems. The major problems are: the (in)completeness of the various tables, the form of the textual and graphical representations and the spatial analyses.

While international agencies such as WHO, FAO, OECD and the World Bank inter alia, spend considerable resources and dedica-

tion on collecting and collating global data sets, very few of these data sets are complete. The issues are directly compounded by the numerously different national collection methods, the differing national reporting procedures and the equally non-uniform definitions of health variables within and across jurisdictions. What is a reportable offence in one country may not even be reported in another. Furthermore - nations rarely all report and submit information at the same time, for the same period or for the same year. All these statistics, numbers and information are possibly the tip of the iceberg - most of the violence in the world possibly goes on at home - behind closed doors and way from any formal (or for that matter informal) reporting.

It is most common for international epidemiological publications to be compiled in a textual and/or tabular form. The creation of an atlas is a non-trivial task - which projection to use and how should continuous data be classified for thematic mapping? These cartographical and spatial problems must be resolved so as to minimise any potential systematic biases towards or against a country or particular data set.

The Global Atlas on Violence and Health (GAVH) was undertaken by the author under contract to WKC. The entire project was completed in five months from May 1999. All data were collected from existing global information sources and the publication was achieved by a research team of three people under the overseeing guidance of an international Editorial Board and, of course WKC executive staff.

2. OBJECTIVES

The World Health Report was first issued in 2002 and measured the amount of disease, disability and death in the world. [SEARO 2002]. This report noted that violence kills more than 1.6 million people every year. On an average day, 1424 people are killed in acts of homicide, roughly one death every minute. One person commits suicide every forty seconds. About thirty-five people are killed every hour as a direct result of armed conflict. World health authorities had earlier responded to this dire situation - the WHO Kobe Centre had taken direct action and commissioned the publication of the Atlas.

The GAVH was a major undertaking of data integration and the spatial referencing and analyses of these data against several socio-economic variables. No new data were collected nor were new surveys undertaken. Violence may be classified into any number of categories according to an even more varied list of criteria [WKC, 1999]. In the end, the purpose of any such taxonomy must be to manage and explain. In the Atlas a simple classification was used, violence was broken down into the following classes and subclasses:

- Interpersonal violence
  - Total homicide
  - Male homicide
  - Female homicide
  - Assault

- Self inflicted violence
  - Suicide
  - Male suicide
  - Female suicide
  - Youth suicide

- Assault
  - Police records
  - Victim-based surveys

- Violence against women
  - Rape from police records
  - Victim-based surveys
  - Genital mutilation
  - Domestic violence

- Other - includes
  - Elder abuse, child abuse, domestic violence, armed conflicts, child pornography, youth crime and justice, feminisation of poverty, sexual harassment and cultural/traditional violence.

These violence data sets were presented in map form and were graphically compared with five socio-economic indicators: unemployment, urbanisation and urban agglomeration, expenditure ratio of (defence)/(health and education), ratio of food (exports)/(imports), and income distribution.

Most importantly, the underlying objective of the Atlas was to inform people, policy makers and politicians of the facts about violence. The facts as best they could be determined. To this end, a risk was taken and manifests itself in a pictorial coffee-table atlas on violence and health. The risk was that such a glossy book of maps would trivialise the enormity and gross repugnance of violence. The author and Editorial Board considered the risk worth taking. The innovative way the material was presented was partially influenced by the farsighted and laterally thinking cartogra-

pher Russell Kirkpatrick. Some may even see his work as a parallel to the organic architectural movement commenced by Louis Sullivan and mostly by Frank Lloyd Wright of the early 20th century. A brave, but reasonable comparison. It was - without doubt - Kirkpatrick's recent work on the Contemporary Atlas New Zealand - The Shapes of Our Nation, [Kirkpatrick, 1999 and McKinnon, 1997] that led the way and showed how it might be done.

3. METHOD

All the data were managed in a Microsoft Access database and ArcView. Adobe Illustrator, Photoshop, and Microsoft Excel were used to produce the graphics; and Macromedia Freehand used to layout the atlas.

A projection had to chosen - the choice was critical. No projection can accurately map the oblate spheroidal globe into two dimensions without distortions. It was important to select a projection that minimised the distortions. Projections that increasingly distort with increasing latitude were discounted. These types of projections grossly over state the areas of polar countries and for thematic maps this would have introduced unacceptable (apparent) biases. On the other hand, other projections look too much like a segmented and peeled orange and were considered to be pictorially and aesthetically unacceptable. A compromise was arrived at and the Robinson's Projection (see http://www.geography.wisc.edu/maplib/rob_proj.html) was chosen. This projection, a pseudo cylindrical projection, is orthophanic (right appearing) in that it compromises between the preservation of shape, distance and area. In this way it was believed that visual comparisons between countries would be reliable. The maps in the Atlas have a central meridian of 160° East and scales vary from 1:300,000,000 to 1:100,000,000. Scale is true along latitude 38° North and South. The United Nations Group of Experts of Geographic Names (UNGEGN) has developed a convention for naming countries - The Donor Principle. The principle - adopted for the Atlas - is based on the countries naming themselves and converting non-Roman alphabets and ideographic writing systems into Roman scripts. This was adopted by the United Nations in 1975 and attempts to preserve native spelling and pronunciation within the limits of the Roman script [UNGEGN, no date].

Many of the maps represent continuous data and derived classes were generally defined at quartiles. This divides the continuum into four classes of equal numbers of countries. A simple colour scheme of two contrasting colours was selected to highlight two classes above and two classes below the median of each data variables distribution. Visually, a reader could easily compare countries from one part of a map to the other. White was used to indicate where data were unavailable.

A set of socio-economic variables was chosen against which the violence and health data could be mapped. With advice from WKC and the New Zealand Ministry of Health the following variables were adopted;
  • Unemployment
  • Urbanisation and urban agglomeration

• Expenditure ratio of (defence)/(health and education)
• Ratio of food (imports)/(exports)
• Income distribution

Unemployment data were primarily derived from the World Bank, World Development Indicators for 1997. Latest data, for this and other variables are now available [World Bank, 2004]. Unemployment is defined as the share (percentage) of the labour-force that is without work, but is available for work, and looking for work. Labour-force is all those persons able and available for work and aged fifteen years and over. These data were compiled from the International Labour Office's Year Book of Labour statistics. The coverage is incomplete; of 258 countries (the number of countries recognised by the UN at the time of publishing the Atlas) data were compiled for 104 [WKC, 1999, p25].

Urbanisation data were compiled from two sources; the 1997 World Bank, World Development Indicators and the 1995 United Nations Statistics Division, Indicators on Human Settlements. Urbanisation definitions follow national census surveys and may include criteria based on any of the following; size of population in a locality, population density, distance between built-up areas, legal and administrative boundaries or urban characteristics. They differ from country to country so international comparisons should be performed with some caution [WKC, 1999, p29].

Urban agglomeration and its rapid increase may be reflected by the number of large urban centres. Urban agglomeration is primarily determined by urban centres with a population equal to or greater than one million people. It is expressed as the percen-

tage of the total population that lives in these urban centres. Data were available for 145 countries [WKC, 1999, p31]. The United Nations estimates that by 2015 there will be 225 urban centres with populations more than two million and twenty-six of these will have populations greater than ten million!

Ratio of expenditure is the ratio of spending on (defence)/(health and education). All expenditures are expressed as a percentage of the gross domestic product (GDP) and were compiled from the World Bank, World Development Indicators 1997. The ratio could only be determined for 81 countries. Not all nations had all three parameters available but were included if defence and one of, health or education, could be determined [WKC, 1999, p33].

Food imports/exports ratios were compiled from information obtained from the World Bank, World Development Indicators, 1997. Imports and exports relate to the percentage of merchandise (standardised against the 1987 US$). Data was compiled for 107 countries. The Standard International Trade Classification (SITC) series M, no. 34 revision 2 was used to define merchandise imports and exports [WKC, 1999, p37].

Income distributions were computed as Gini Coefficients. A Gini Coefficient is a measure of the income inequality within a population. On an income distribution graph (accumulated population verses accumulated income) a diagonal line with a gradient of one represents perfect equality (for example, 10% of the population receives 10% of the income and so on to 100%). However, if income is concentrated among a portion of the popu-

Country	Population 1997	Unemplmt % lab-force, 1997	Urbanisation % pop, 1995	Expenditure ratios 1990 - 1995	Ratio food imports/ exports 1990 - 1993	Income distribution Gini Coefficient*
Austria	8,132,505	4.2	64	0.06	1.54	n/a
Belgium	10,165,059	12.7	97	0.15	n/a	27.01
Denmark	5,305,048	8.1	82	0.14	n/a	32.09
Finland	5,137,269	14.7	63	0.12	2.16	29.93
France	58,609,285	12.6	75	0.17	0.70	43.11
Germany	82,071,765	11.1	87	0.51	1.91	31.22
Greece	10,616,055	10.4	59	0.43	0.25	34.53
Ireland	3,606,952	10.8	58	0.10	0.46	36.31
Italy	56,830,508	12.1	67	n/a	1.94	34.93
Luxembourg	420,415	6.4	89	n/a	n/a	27.13
Nederlands	15,649,729	6.2	89	0.15	0.68	28.59
Portugal	9,931,045	7.1	36	n/a	2.01	37.44
Spain	39,107,912	22.1	76	0.12	0.84	27.9
Sweden	8,865,051	8.1	83	0.19	3.80	31.63
U. Kingdom	58,820,519	6.1	89	0.29	1.40	25.98

n/a = not available. * = dates vary considerably, refer to [Deininger, K. and Squire, L., 1996] for exact dates and explanations.

Table 1.- Typical Socio-economic Information for 15 European Union Countries.

lation the distribution deviates from the diagonal in the form of a Lorenz curve. The Gini Coefficient qualitatively describes the area between the diagonal and the Lorenz curve. It has a range of values between 0 (perfect equality) and 100 (total inequality). The data for this indicator were obtained from Deininger and Squire (1996). Data were computed for 106 countries and as this was a low figure an additional variable, Income Gap, was also derived [Deininger and Squire, 1996]. Income Gap expresses as a ratio (the top quintile's share of income)/(the bottom quintile's share of income). This was available for 101 countries, but with a high level of overlap with the countries for which a Gini Coefficient was determined [WKC, 1999, p38].

As baseline data, population figures were obtained from the US Bureau of Census for 227 countries.

Typical data for the 1995 fifteen European Union nations is shown in Table 1.

4. RESULTS

All the data and analyses were arranged in three parts; part one, an introduction; part two, cartographic illustrations of global violence and health; and part three, tabulated violence statistics. There were 89 pages of maps, charts and explanatory diagrams. The graphics have three primary purposes, to:

1. Graphically present the underlying basic violence and health data and socio-eco-

nomic indicators (see examples, Figures 1 and 2)

2. Graphically present the spatially integrated violence health data mapped against the socio-economic indicators (see examples, Figures 3 and 4)

3. Explain in several pictorial formats (graphs, scatter plots and graphic tables), the level of possible correlation between the violence and health data and the socio-economic data or to clarify a particular facit of the indicators (see examples, Figures 5 and 6)

In the atlas considerable effort was expended to simplify any (possible) correlations between variables. Intuitively, the following arguments (inter alia) may be posited. Countries with:

• Low education and health expenditures may be prone to higher levels of violence

• High defence budgets may be inherently aggressive and violent

• High food imports and low food exports (a potential for food shortages) may be prone to higher levels of violence

• High levels of urbanisation and agglomeration may be prone to higher levels of violence

• High Gini Coefficients (indicating income inequality) may be prone to higher levels of violence.

The author, the Atlas and WKC made and continue make no attempt to imply that such causal relationships exist between the indicators employed and the types of violence examined. Readers of the Atlas were and still are encouraged to draw their own conclusions from the factual data presented, in written and graphical form [WKC, 1999, p7]. It is believed that the innovative form of the Atlas has made this an easier and more reliable task.

5. CONCLUSION

The Global Atlas on Violence and Health is a novel way of portraying complex information to a wide and varied international audience. Its bold and innovative graphics are used to emphasis - even reverently popularise - the plight of those subjected to violence. Violence is one of the two largest causes of premature motility and as such is recognised as a global issue. Spatial analyses and professional cartography have been employed to bring these facts to readers.

Nowadays it would be just as difficult to obtain all the information for the countries. Data is unfortunately available in non-uniform styles and at either different dates or over different periods. On the other hand spatial data is more readily available and generally in standard formats. For this type of public health and epidemiological data The Centers for Disease Control and Prevention (CDC) in Atlanta Georgia, America is a most useful repository of information. CDC (refer to http://www.cdc.gov/) now has Resources for Creating Public Health Maps (within the Division of Public Health Surveillance and

Informatics) where spatial data may be downloaded - mostly for free. A lot of the data is idiosyncratic to America but there are useful Internet links and some international files (see http://www.cdc.gov/epiinfo/maps.htm).

6. ACKNOWLEDGEMENTS

REFERENCES

Deininger, K. and Squire, L., (1996). *A New Data Set Measuring Income Inequality*, The World Bank Economic Review, Vol. 10, No. 3, pp.565-91. (also see http://www.worldbank.org/research/growth/dddei squ.htm, last visited 1st September, 2004).

Kirkpatrick, R., (1999). *Contemporary Atlas New Zealand* - The Shape of Our Nation, David Bateman Publishers, Auckland, 160 pages.

McDonald, D., (2000). *Violence as a Public Health Issue*, Trends and Issues in Crime and Criminal Justice, Newsletter, Australian Institute of Criminology, Canberra, ISBN 0 642 24169 4, 6 pages.

McKinnon, M. (ed.), (1997). *New Zealand Historical Atlas Ko Papatuanuku e Takoto Nei*, David Bateman Publishers, Auckland, 290 pages.

UNGEGN, - United Nations Group of Experts on Geographical Names, http://unstats.un.org/unsd/geoinfo/about_us.htm, last visited 1st September, 2004.

SEARO, (2002). *Regional Health Forum News*, WHO South-East Asia Region, Vol. 6, No. 2, pp1

WKC, (1999). *Global Atlas on Violence and Health*, World Health Organization, Centre for Health development (WHO Kobe centre), Kobe Japan, Publication WHO/WKC/TECH.SER./99.1, 152 pages.

World Bank, (2004). The World Bank, Data and Statistics, World Development Indicators, http://www.worldbank.org/data/, last visited 1st September 2004.
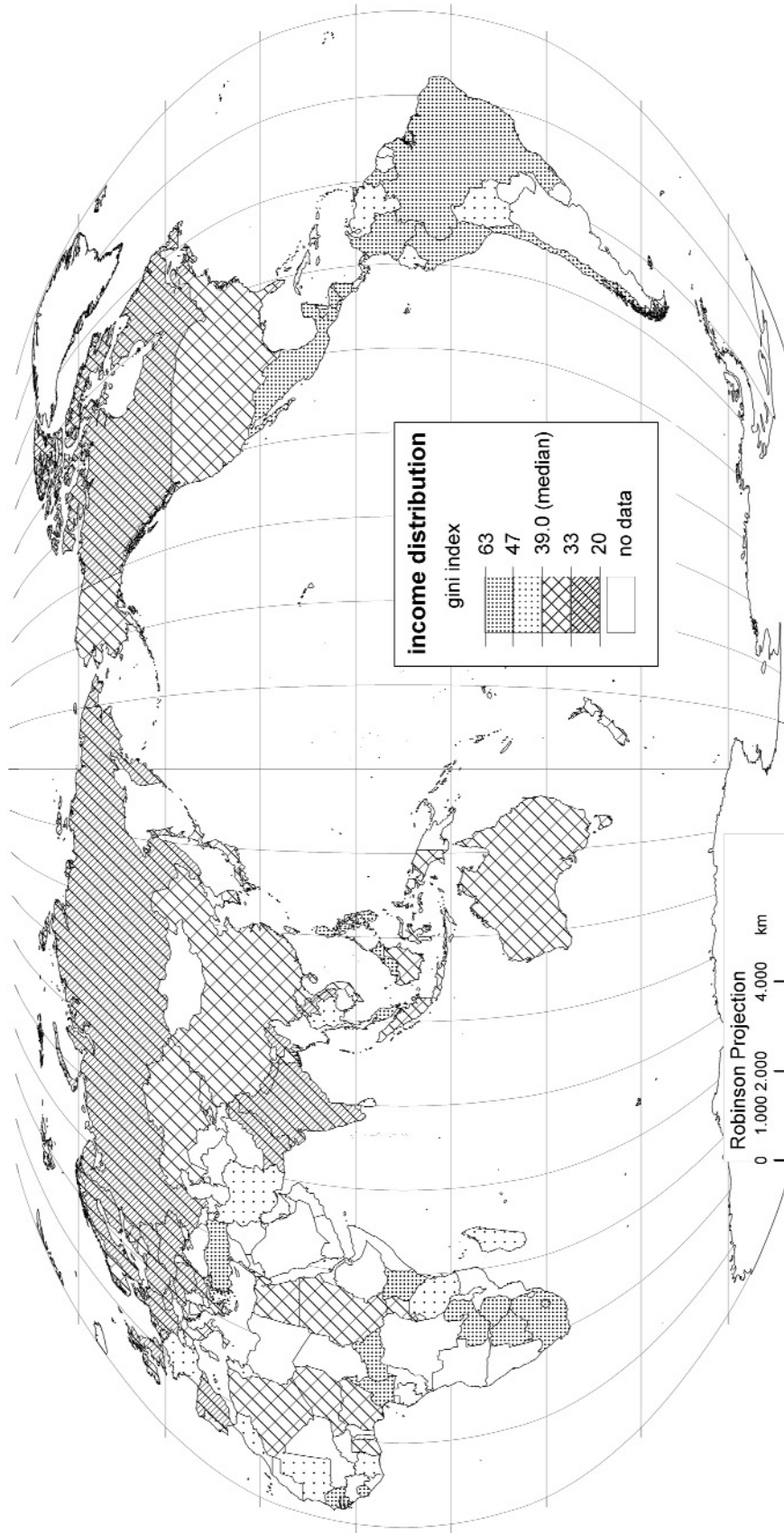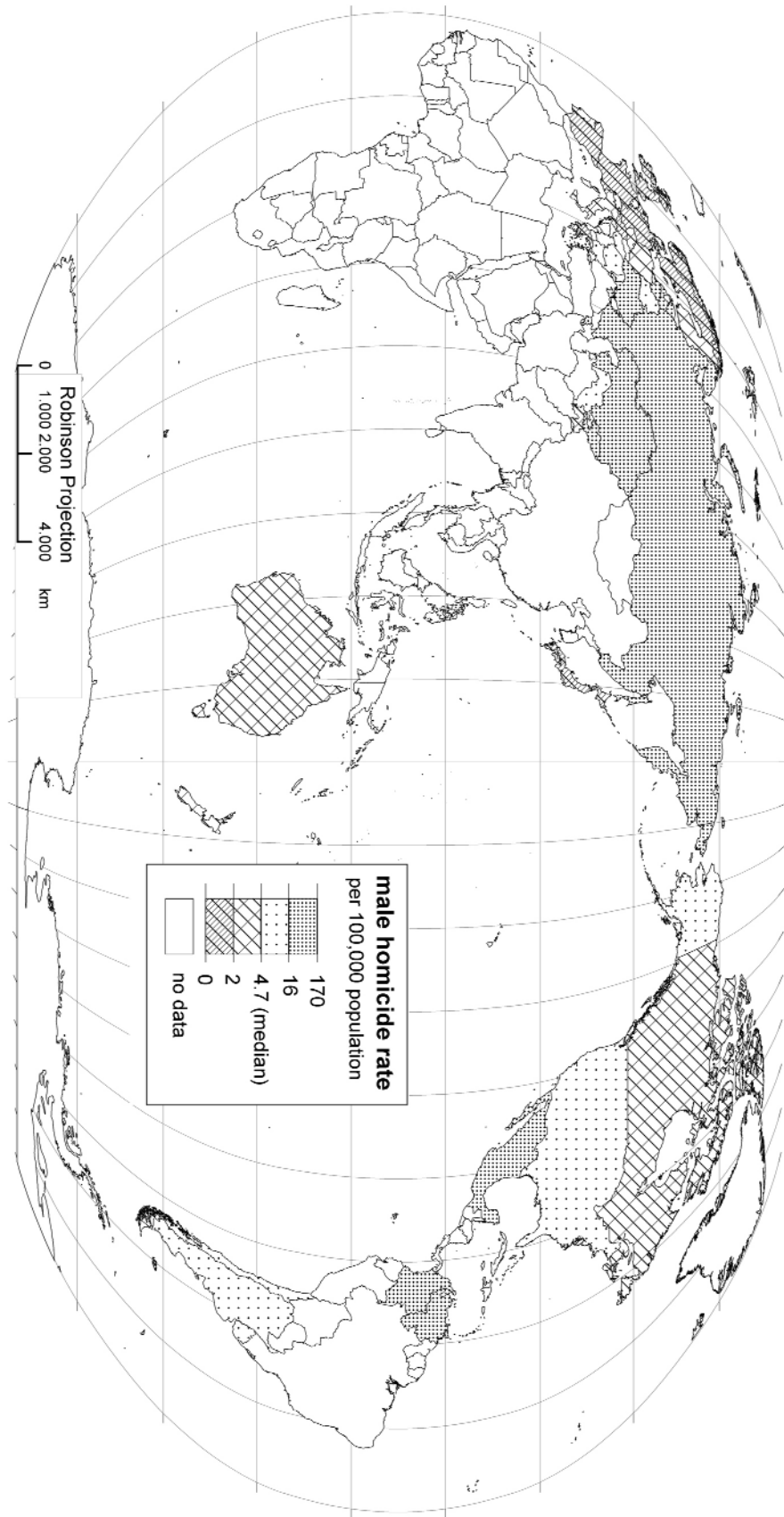
Figure 1.- Income Distribution (Gini Coefficients) adapted from [WKC, 1999, p38] as a black and white version

Figure 2.- Male Homicide Rate (per 100,000 population) adapted from [WKC, 1999, p46] - black and white version
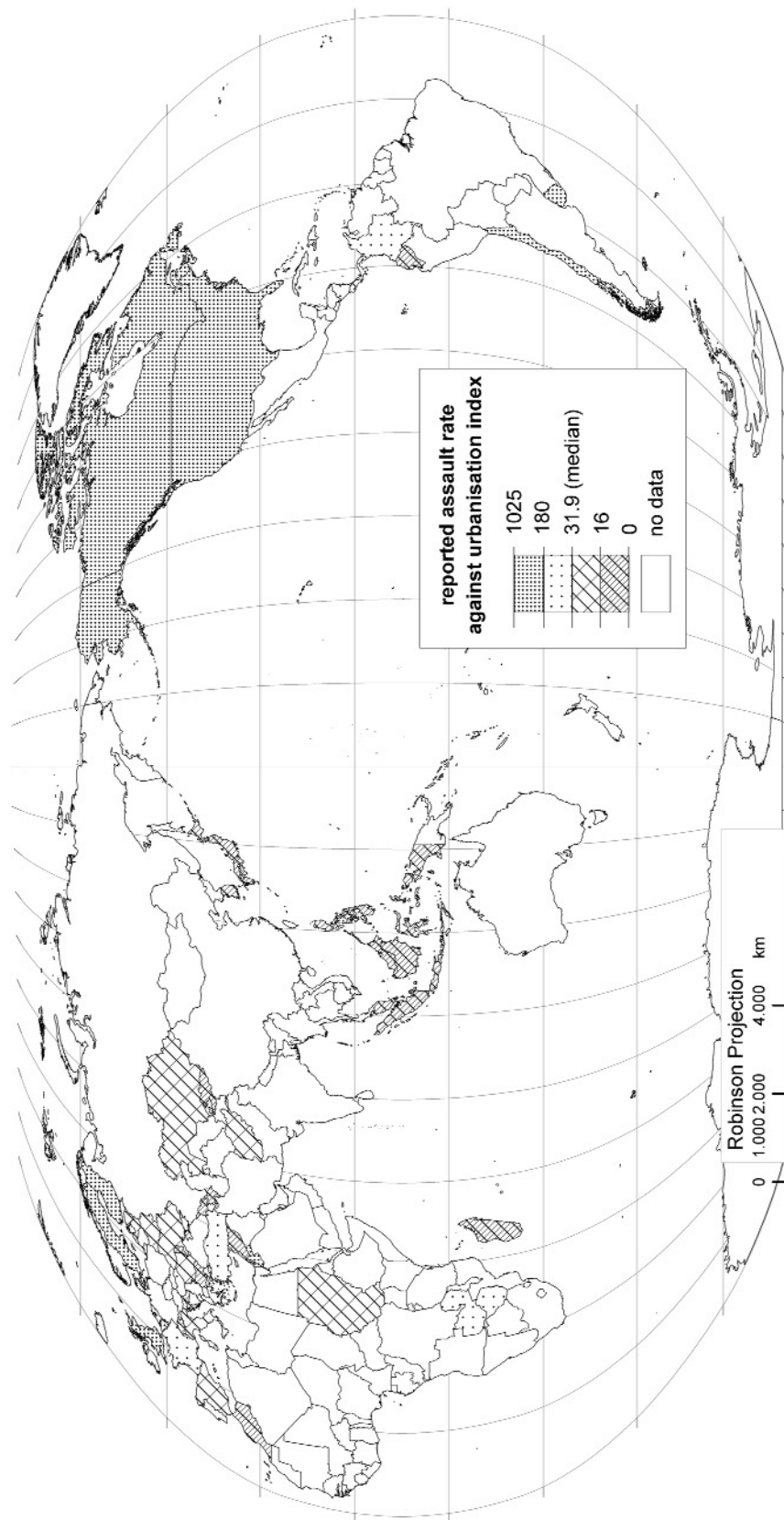
Figure 3.- Assault and Urbanisation (recorded assault rate against urbanisation index) adapted from [WKC, 1999, p62] as a black and white version
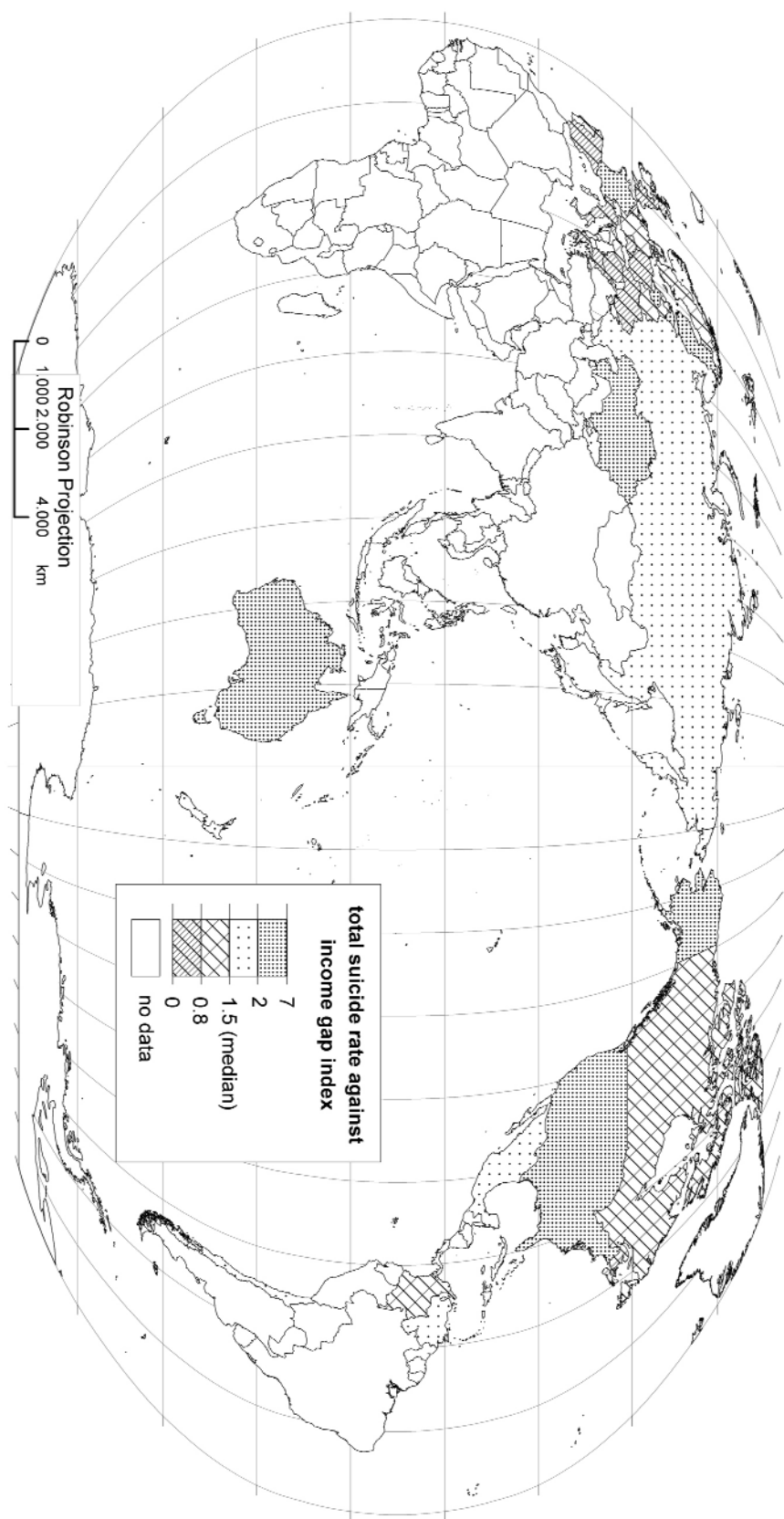
Figure 4.- Suicide and Income Gap (total suicide rate against income gap index) adapted from [WKC, 1999, p89] as a black and white version

total suicide rate against income gap index

- 7
- 2
- 1.5 (median)
- 0.8
- 0
- no data

Robinson Projection

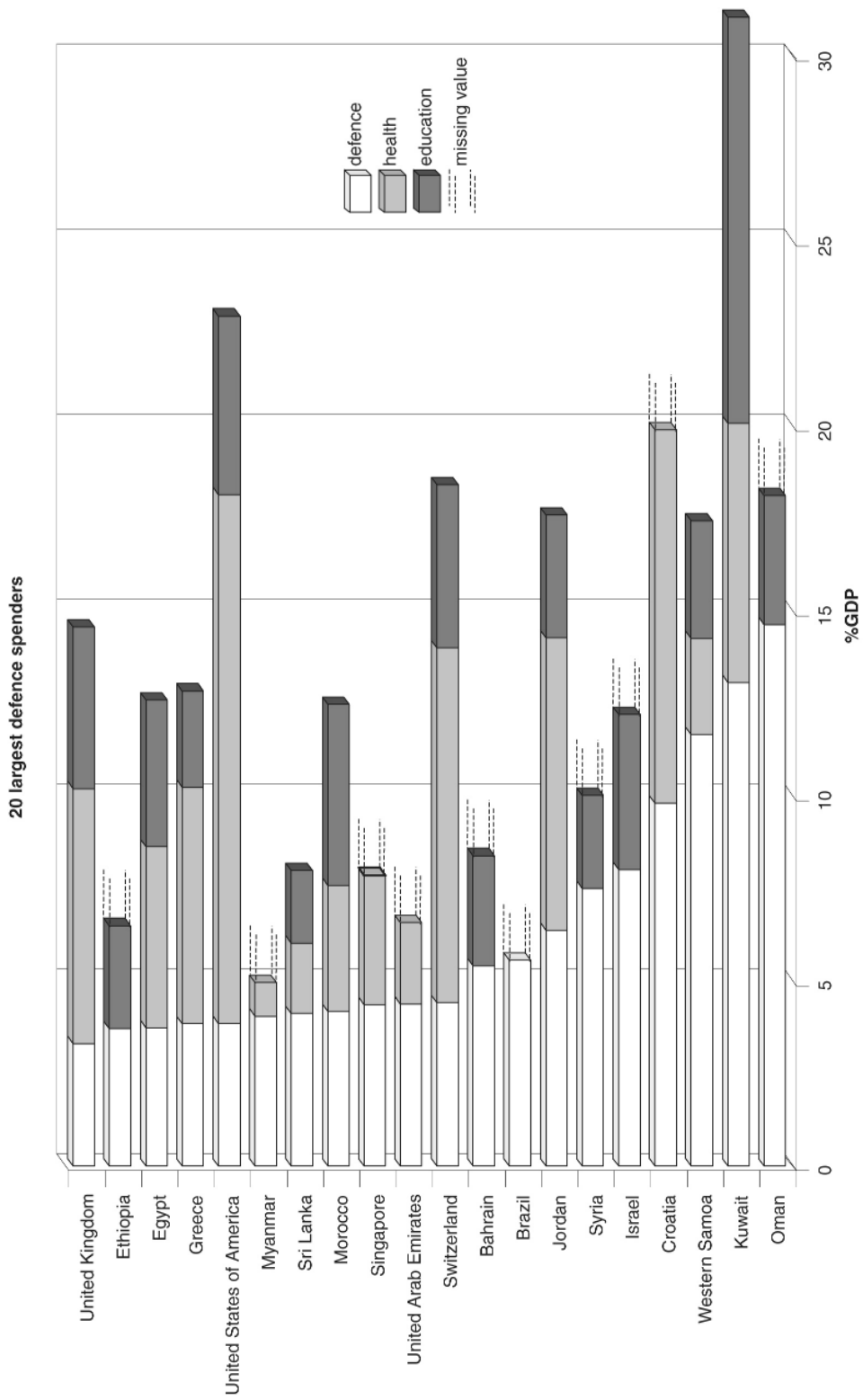0 1.000 2.000 4.000 Km

20 largest defence spenders

Figure 5.- The 20 Largest Defence Spenders (% GDP) adapted from [WKC, 1999, p35] as a black and white version
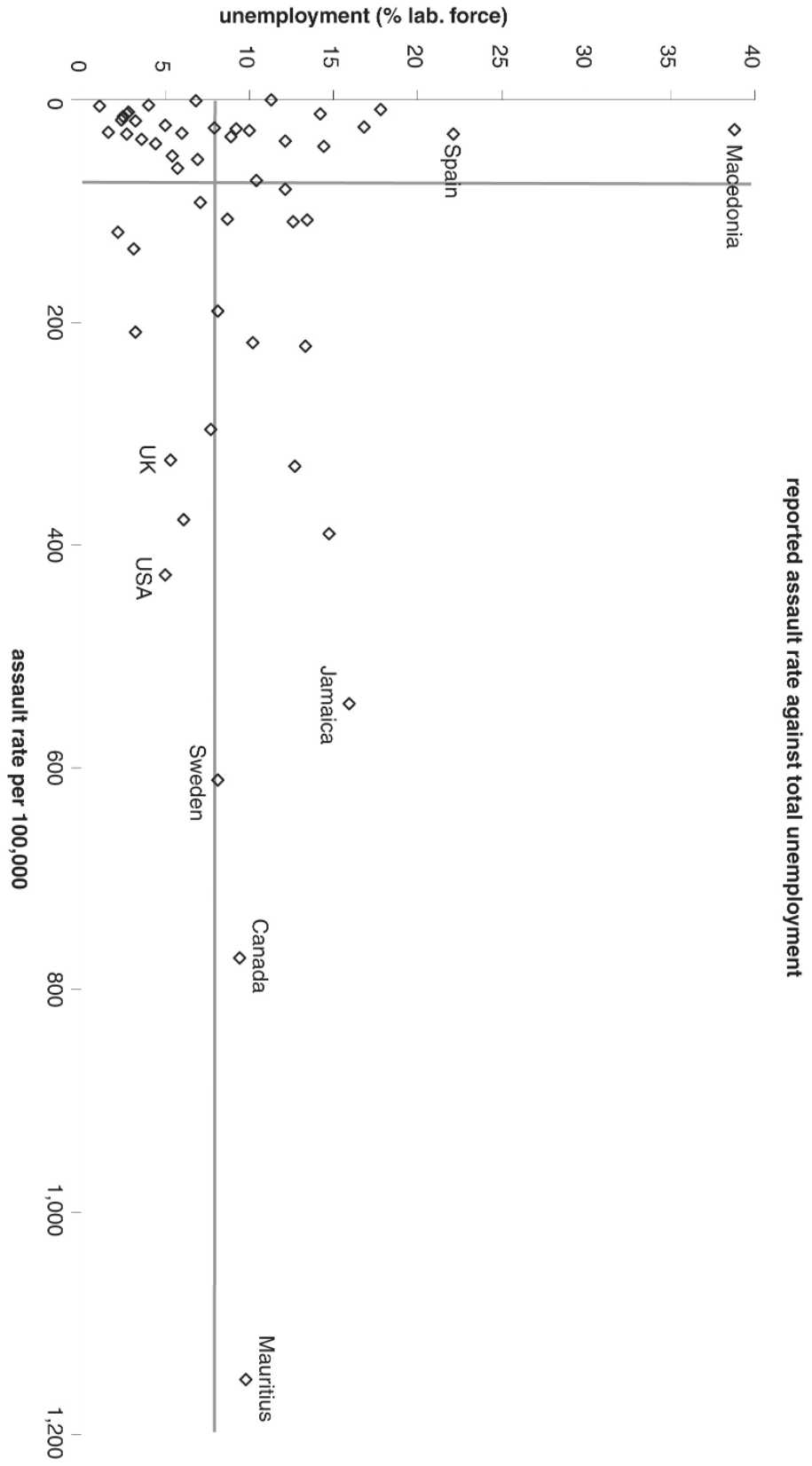
Figure 6.- Recorded Assault Rate Against Total Unemployment (unemployment (% labour-force) verses assault rate per 100,000) adapted from [WKC, 1999, p60] as a black and white version