Death by Survey

Estimating Adult Mortality without Selection Bias

Emmanuela Gakidou Gary King

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  (death certificates, mostly in developed countries)
- Demographic surveillance systems
  (a few isolated projects)
- Wild guesses
  (typically reported in the media, usually citing other wild guesses as authorities)

Who Uses Mortality Data?

- Medical researchers

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- Public health researchers

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- Political scientists:
  - IR studies: the elite decision to go to war
  - Should also study: more ultimate outcomes, like human misery or mortality
  - The Big Problems: uncertainty and selection bias

Uncertainty in Death Estimates from Major Sources

The 1990s' Ten Most Deadly Conflicts

		People Killed (in 1000s)		
Country	Year	Low	High	Range
Rwanda	1994	500	1,000	500
Angola	1992–4	100	500	400
Somalia	1991–9	48	300	252
Bosnia	1992–5	35	250	215
Liberia	1991–6	25	200	175
Burundi	1993	30	200	170
Chechnya	1994–6	30	90	60
Tajikistan	1992–9	20	120	100
Algeria	1992–9	30	100	70
Gulf war	1990–1	4.3	100	95.7

Selection bias in Mortality from War Data

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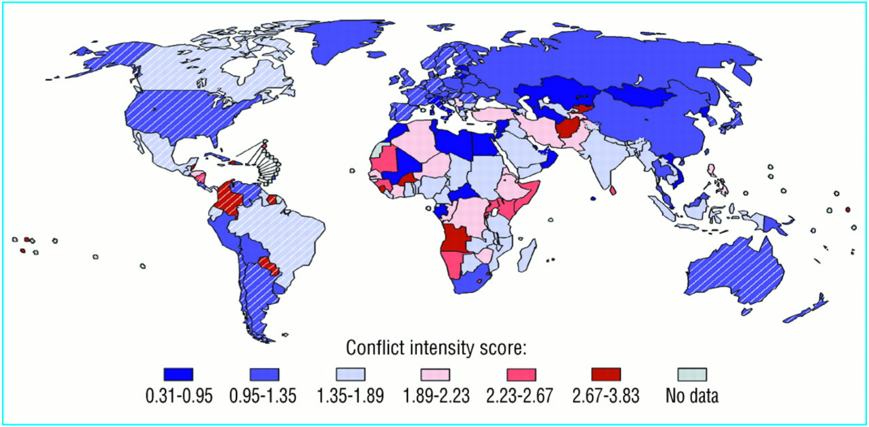

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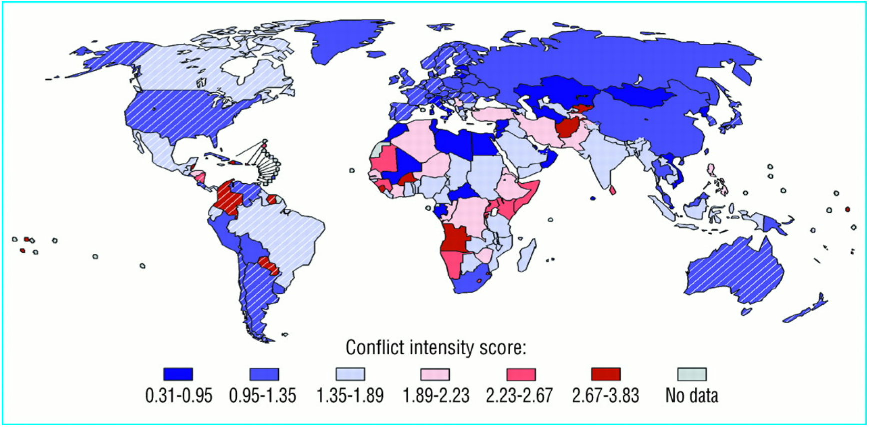

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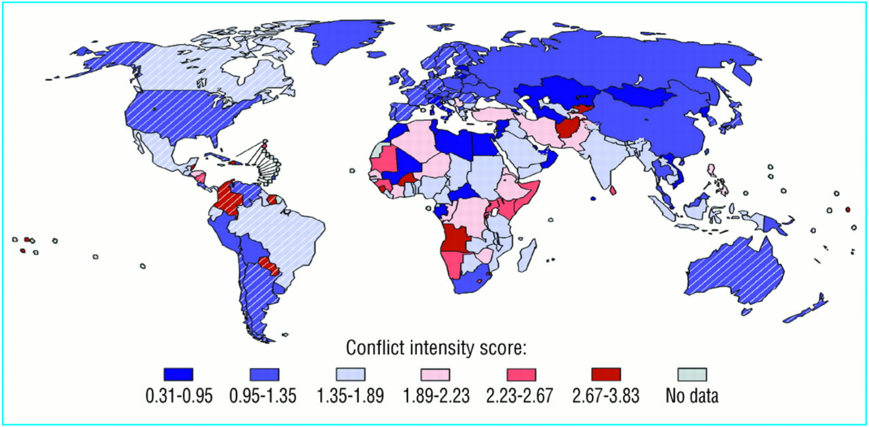

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No registration areas: much higher conflict

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- Spouses (Malaker 1986; Stanton, Noureddine and Hill 2000; Singh 2000; Timaeus 1991)
- Household residents and others (Feeney 2001; Graham, Brass, and Snow, 1989)

Extensive Efforts to Develop and Apply These Methods

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- Demographic and Health Surveys (70 countries)

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- Directing public health dollars (9% of the world's economy)

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The Opportunity

- Joining Demography and Statistics (through political science)
- Directing public health dollars (9% of the world's economy)
- Understanding the consequences of war and the causes of war

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q =

d_j	Sibship
0	1
1	1
0	1
1	2
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- Applied as estimators to (time 1) samples: unbiased

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$\Longrightarrow$

Data available to sample at time 2

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- Each respondent reports on entire sibship
- High mortality sibships: underrepresented
- No sibships with 0 survivors
- Some families counted more than once

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- Sample includes n "survivors" by design

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Trussell and Rodriguez (1990) prove: if mortality is independent of sibship size, all biases cancel: $\check{q}$ is unbiased.

Is mortality independent of sibship size?

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Peru	2000
Indonesia	1997
Burkina Faso	1998
Benin	1996
Peru	1996
Nigeria	1999
Philippines	1998
Chad	1997
Brazil	1996
Indonesia	1994
Senegal	1999
Philippines	1993
Mali	1996
Tanzania	1996

Guinea	1999
Zimbabwe	1994
Nepal	1996
Cameroon	1998
Cote D'Ivoire	1994
Togo	1998
Eritrea	1995
Ethiopia	2000
Zimbabwe	1999
Colombia	1995
Zambia	1996
Uganda	1995
Madagascar	1997

Is mortality independent of sibship size? No!

		Correlation			Correlation
Peru	2000	0.97	Guinea	1999	0.80
Indonesia	1997	0.96	Zimbabwe	1994	0.76
Burkina Faso	1998	0.95	Nepal	1996	0.75
Benin	1996	0.95	Cameroon	1998	0.75
Peru	1996	0.95	Cote D'Ivoire	1994	0.75
Nigeria	1999	0.93	Togo	1998	0.74
Philippines	1998	0.93	Eritrea	1995	0.70
Chad	1997	0.93	Ethiopia	2000	0.71
Brazil	1996	0.92	Zimbabwe	1999	0.69
Indonesia	1994	0.91	Colombia	1995	0.52
Senegal	1999	0.90	Zambia	1996	0.47
Philippines	1993	0.88	Uganda	1995	-0.06
Mali	1996	0.86	Madagascar	1997	-0.19
Tanzania	1996	0.82			

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An Alternative Estimator

- No assumption about sibship size and mortality.
- Two problems addressed separately:
  1. Underrepresentation of high mortality families
  2. Nonrepresentation of families with zero survivors

Underrepresentation of high mortality families

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(Temporarily assuming no families with 0 survivors)

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- Sampling sibships at time 1: proportional to “Births” (B_i)

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- Sampling sibships at time 1: proportional to “Births” (B_i)
- Sampling sibships at time 2: proportional to Survivors (S_i)

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- Sibship mortality: $M_i = \frac{\text{“Births”} - \text{Survivors}}{\text{“Births”}} = \frac{B_i - S_i}{B_i}$
- Sampling sibships at time 1: proportional to “Births” (B_i)
- Sampling sibships at time 2: proportional to Survivors (S_i)
- Estimation at time 1: simple average is unbiased

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- Weights are common; quantities of interest that serve as their own weights are not.

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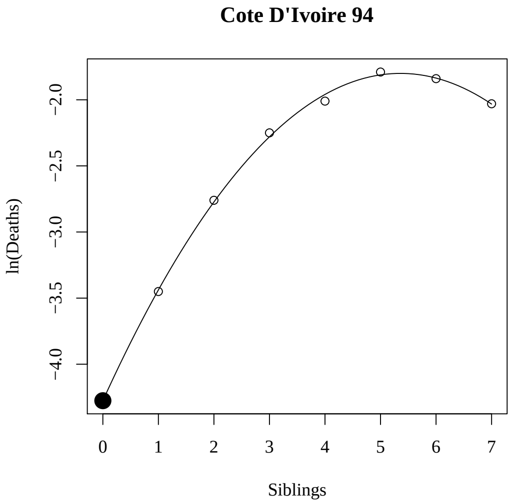
- Approach: we extrapolate from families with survivors
- Thus, this part of the answer is more uncertain

Extrapolation to Deaths in Families with 0 Survivors



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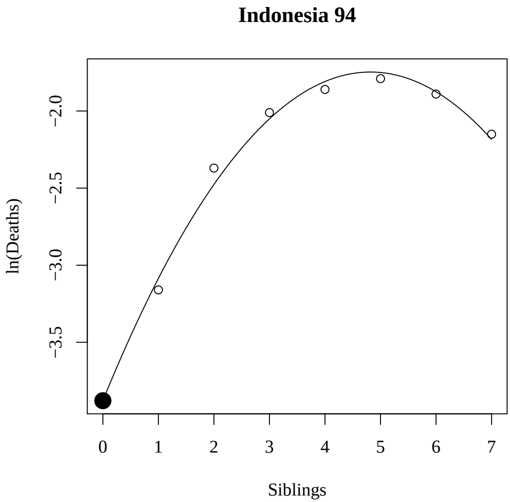

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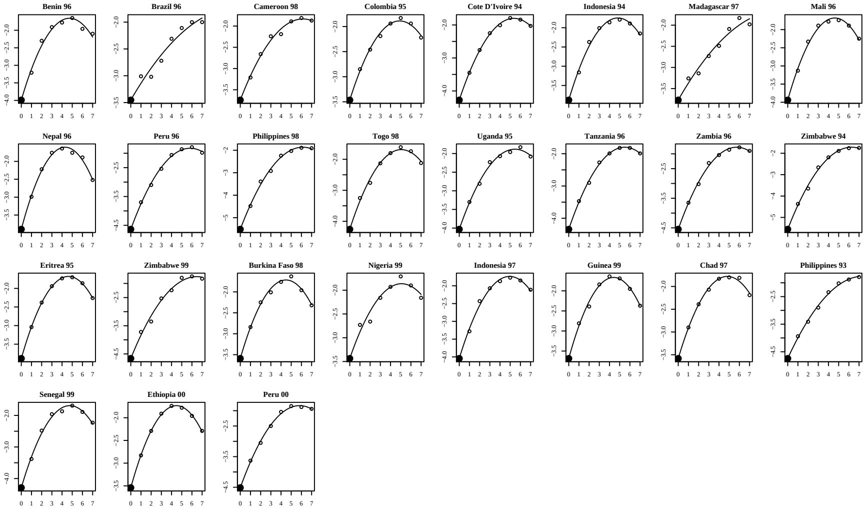

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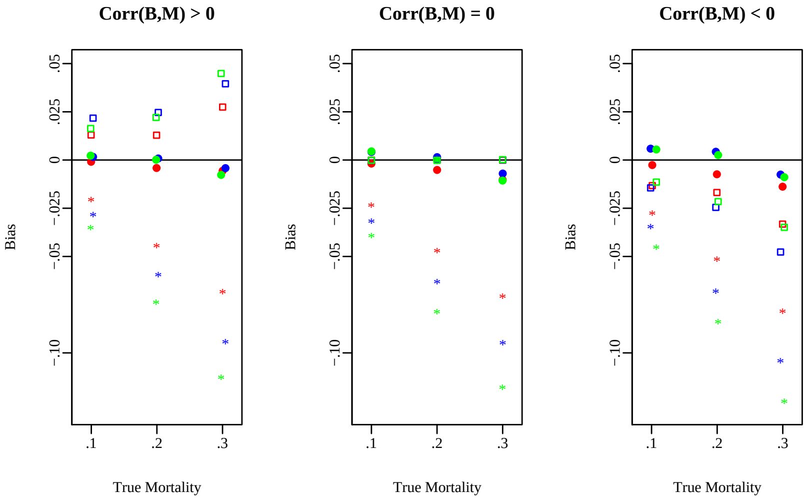
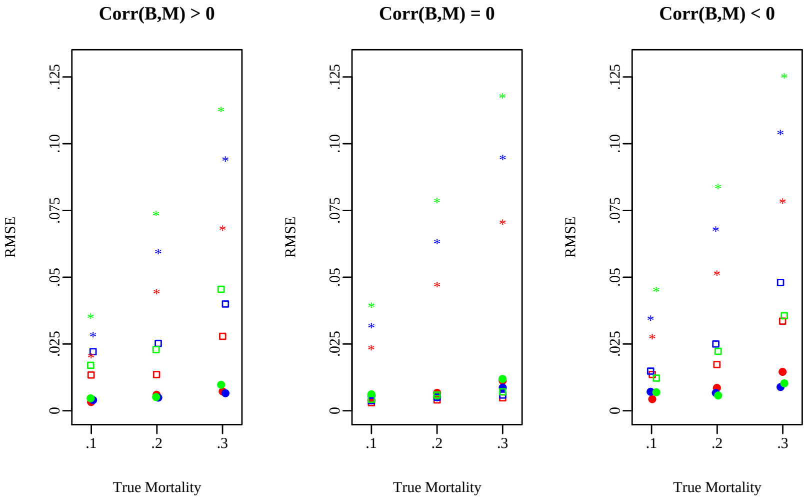
For each, create 1,000 data sets, each with $n = 1,000$ randomly drawn time 2 survey respondents

Bias



Corr(B,M) > 0
Corr(B,M) = 0
Corr(B,M) < 0
Bias
.05
.025
0
−.025
−.05
−.10
.1
.2
.3
True Mortality

Root Mean Square Error



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- Weighting plus extrapolation for families with 0 survivors: 92% corrected

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- Thus, an equivalent expression for $\hat{q}$:

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- May also estimate maternal mortality, the mortality of parents from data on (adult) children, sisters, etc.

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- All the methods we discussed generalize to person-years

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5. Ideally, a new subfield within IR predicting mortality and human misery with war and the predictors of war.

This paper and other information

http://GKing.Harvard.edu