

# EXCESS FEMALE MORTALITY IN AFRICA

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## Missing Women

Amartya Sen (1990, 1992) defined “missing women”

- Sex ratio (males/females) in developed countries  $< 1$
  - Ratio in India and China suspiciously high ( $>1$ )
  - Sen suggests way to quantify “missing women”
  - Calculate number of extra women who would have been alive (in China or India) if these countries had the same ratio of women to men as in developed countries
  - Developed countries embody counterfactual: sex ratios reflect situation in which men and women “receive similar care”
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## Missing Women

Resulting estimates -- more than 200 million women are demographically “missing” worldwide

Presumably from inequality and neglect leading to excess female mortality

To explain the global “missing women” phenomenon - research mainly focused exclusively on excess female mortality in Asia

- Sex selective abortion and female infanticide
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## Missing Women in Africa

Anderson and Ray (2010)

- Move away from use of overall sex ratios
- How are missing women allocated by age and disease?
- Majority of women are missing at adult age ( $>15$ )
- Africa has comparable number of missing women (relative to female population numbers)
- At least 30% of missing women are to be found in Africa
- Excess female mortality in Africa vastly overlooked issue

This paper uses same methodology as Anderson and Ray (2010) to determine how missing women are distributed across Africa by age and disease

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## Sen – Missing Women

Calculate the number of extra women who would have been in China or India if these countries had the same ratio of women to men as obtain in areas where women and men receive similar care (developed countries)

$$Missing = \left[ \frac{SR}{\widehat{SR}} - 1 \right] Pop^w$$

- 100 million missing women
- Revised estimates: 200 million

## Anderson and Ray (2010)

Move away from use of overall sex ratios

- How are missing women allocated by age?
- Are most of them found at birth?

Any computation of missing women presupposes a counterfactual

- Sen -- overall sex ratio in developed countries -- where women suffer least discrimination
- We use the same counterfactual

## Anderson and Ray (2010)

Use mortality rates by age and gender

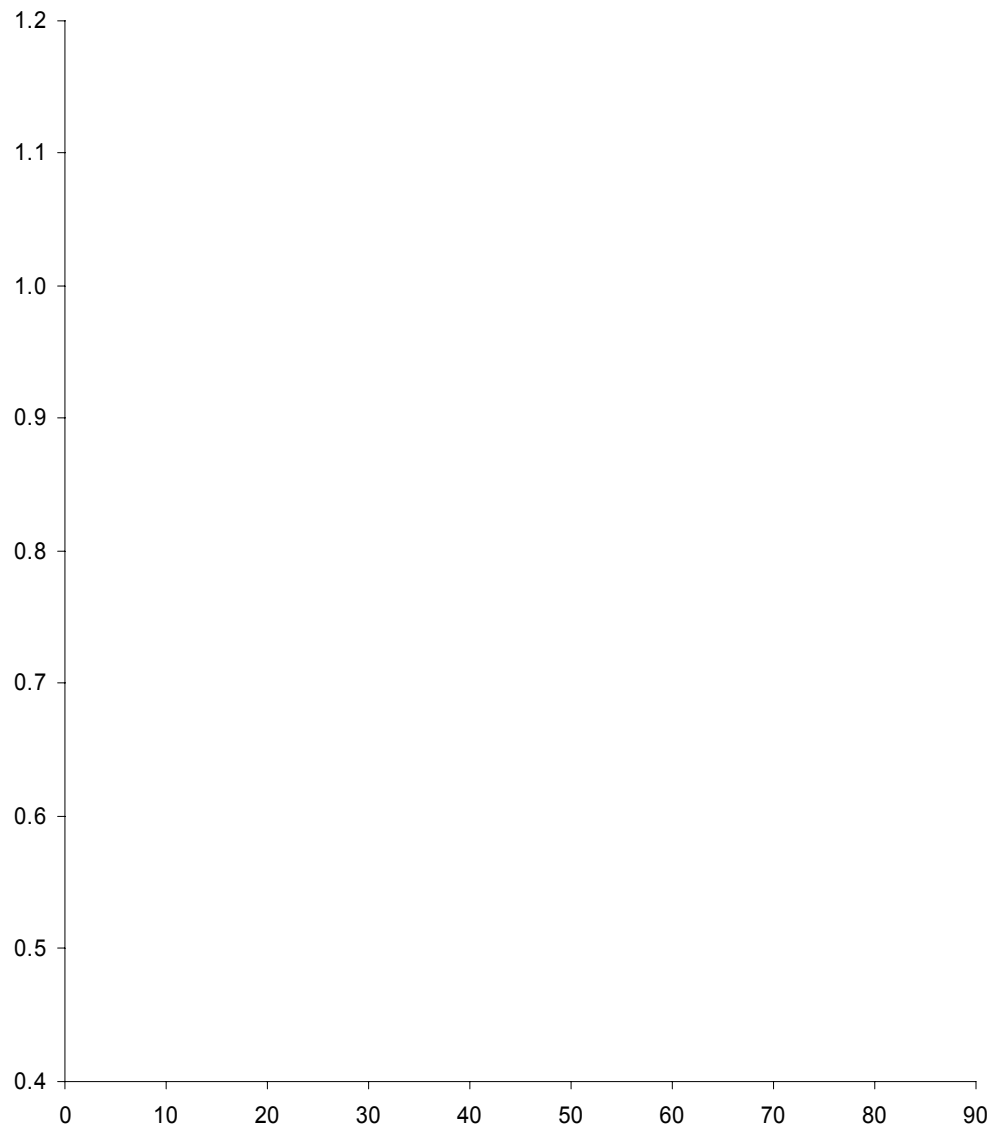
We suppose (for each age category) that the relative death rates of females to males are “free of bias” in developed countries

We compare these rates with the actual relative rates in the developing country of interest, and obtain missing women under that age category

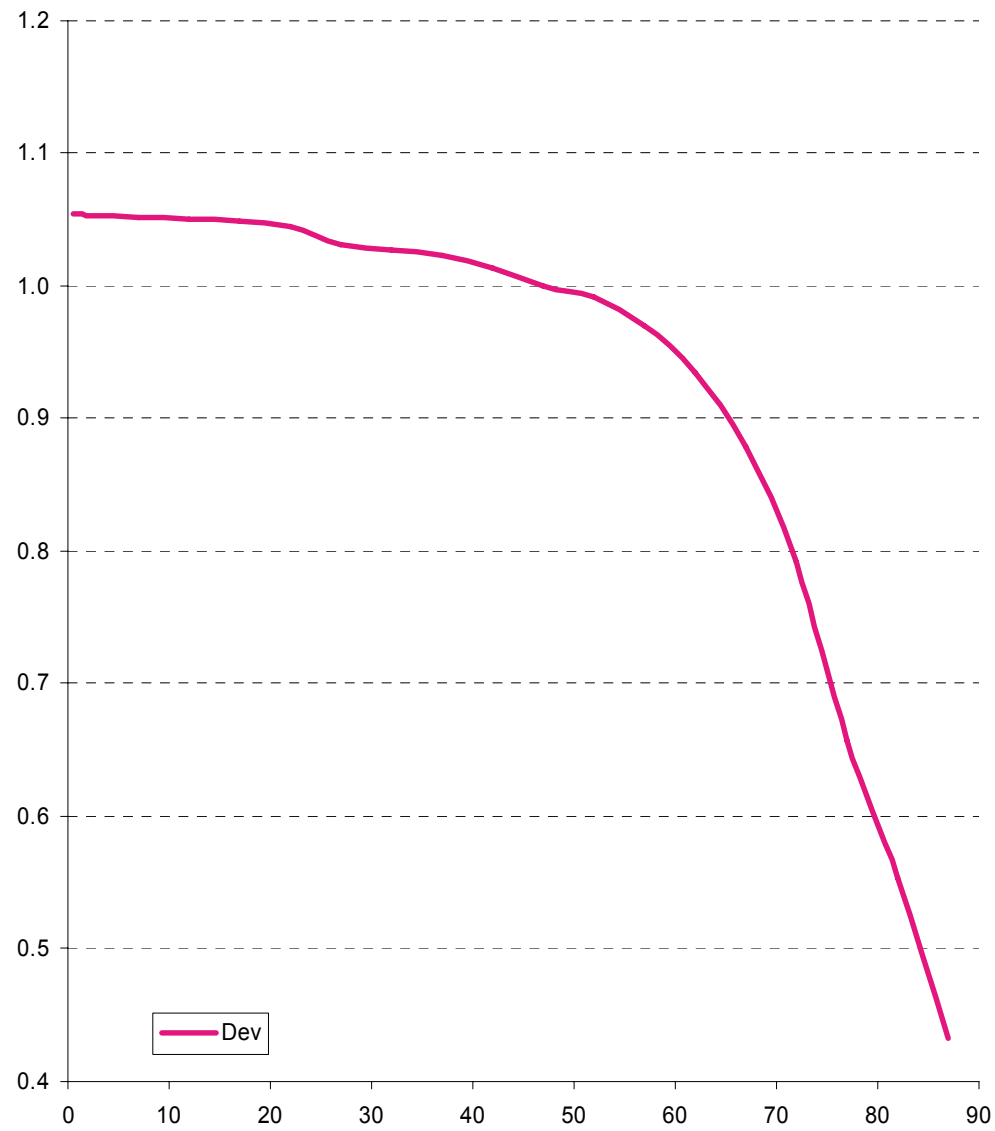
# Preliminaries: Sex Ratios By Age



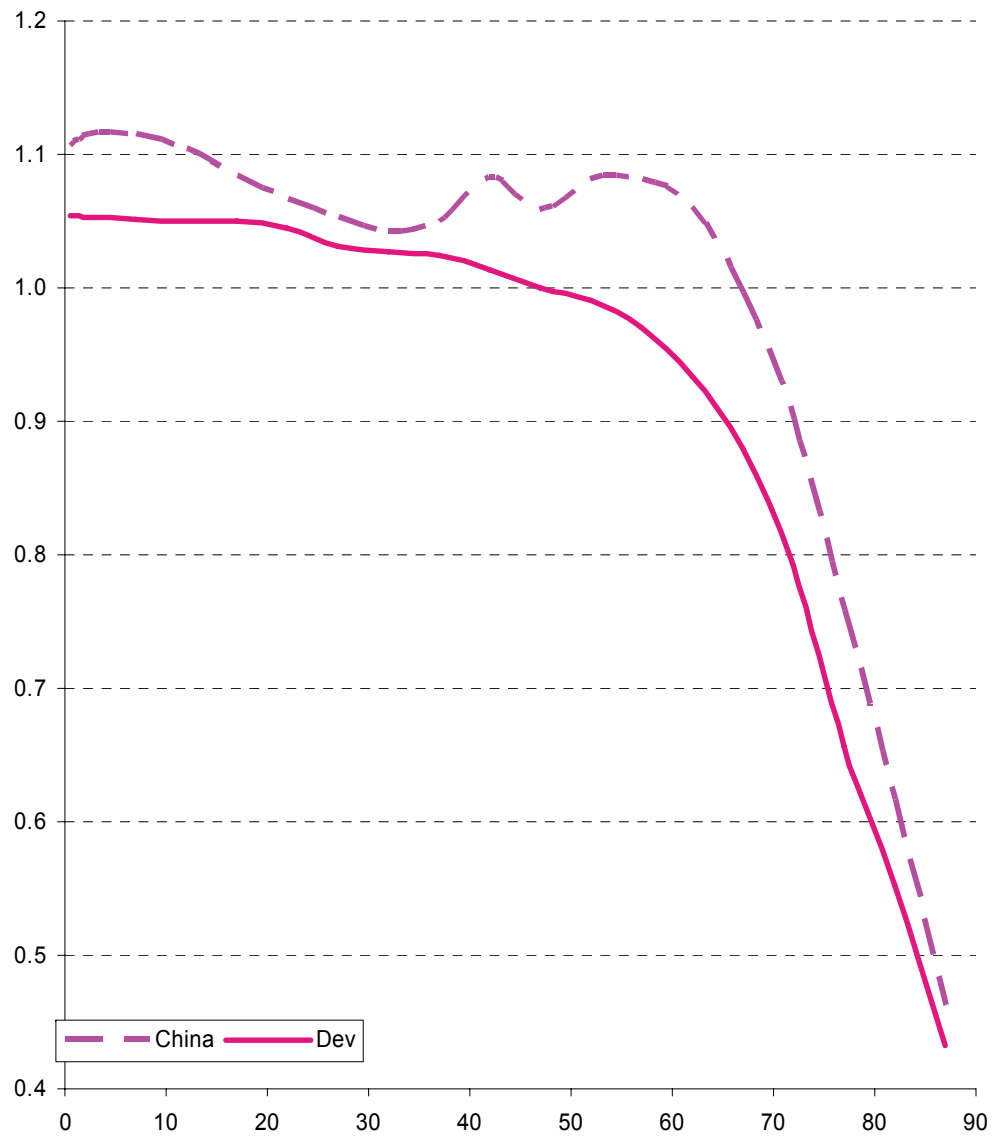
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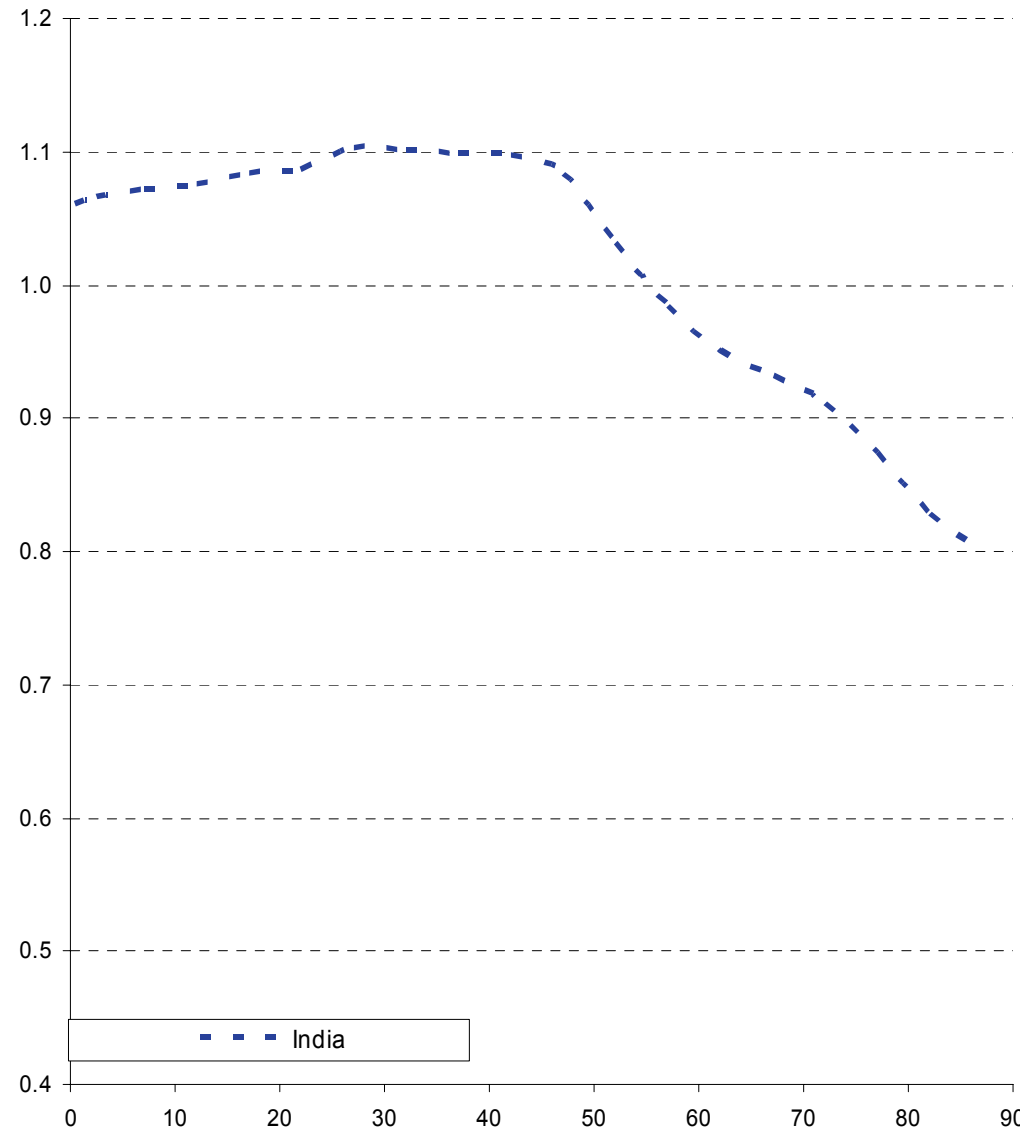
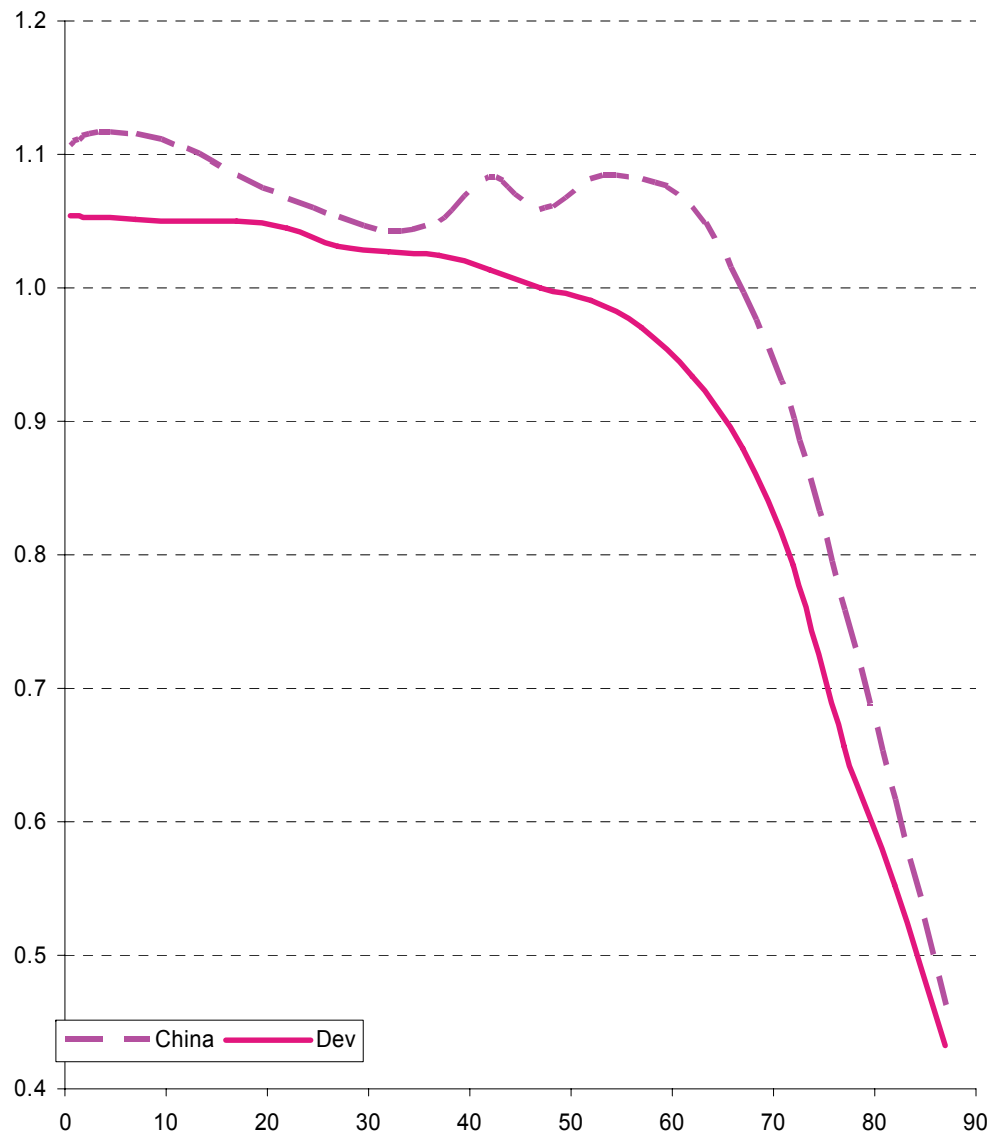
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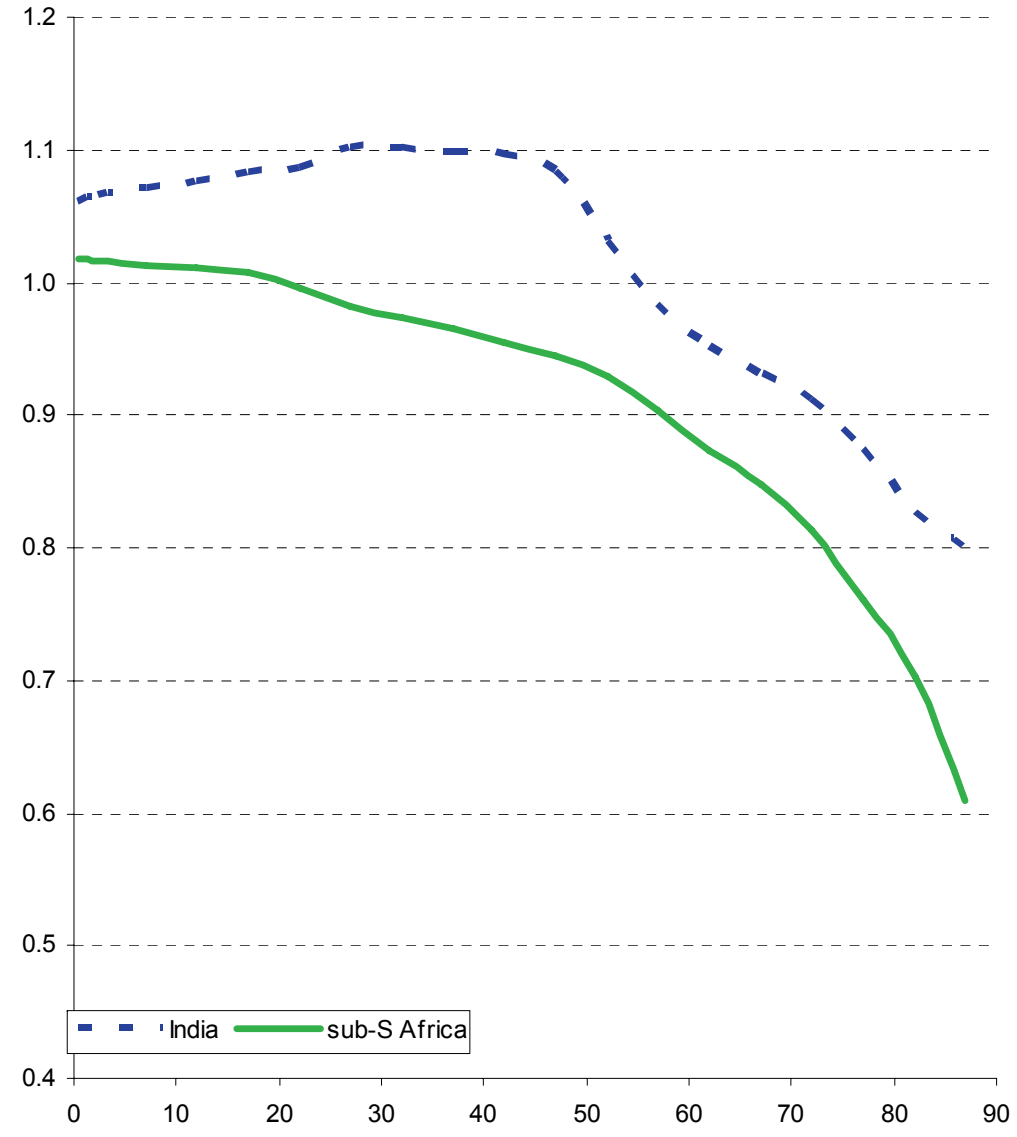
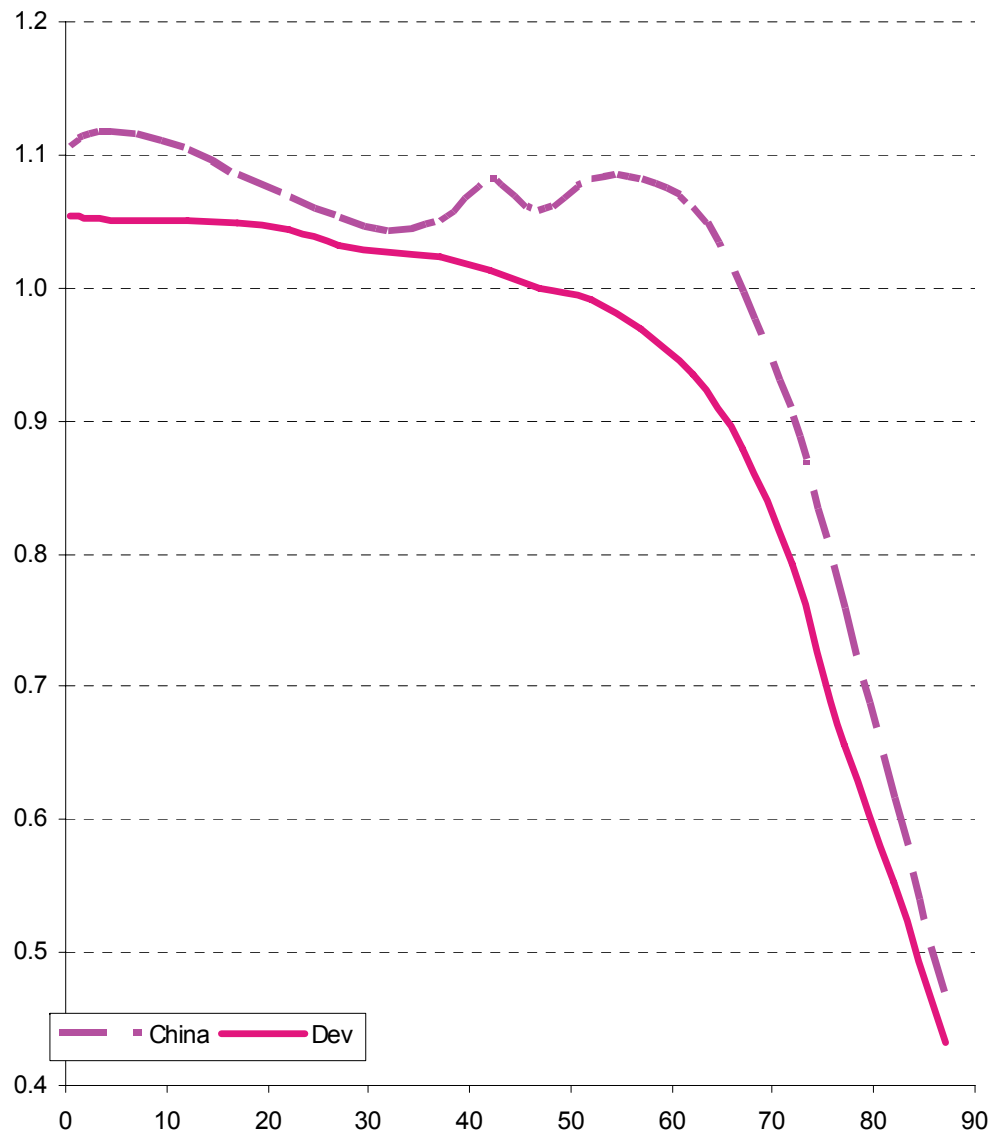
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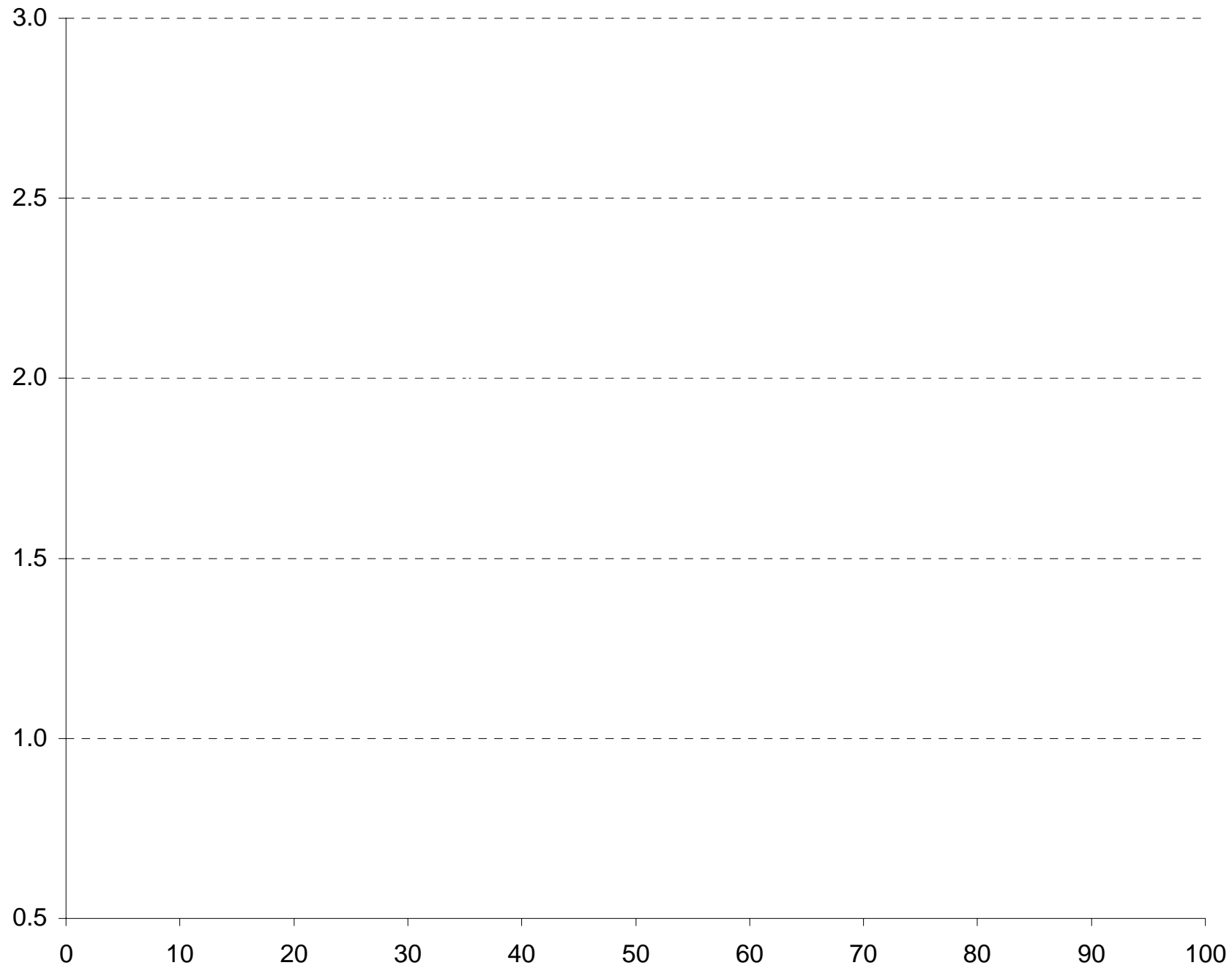


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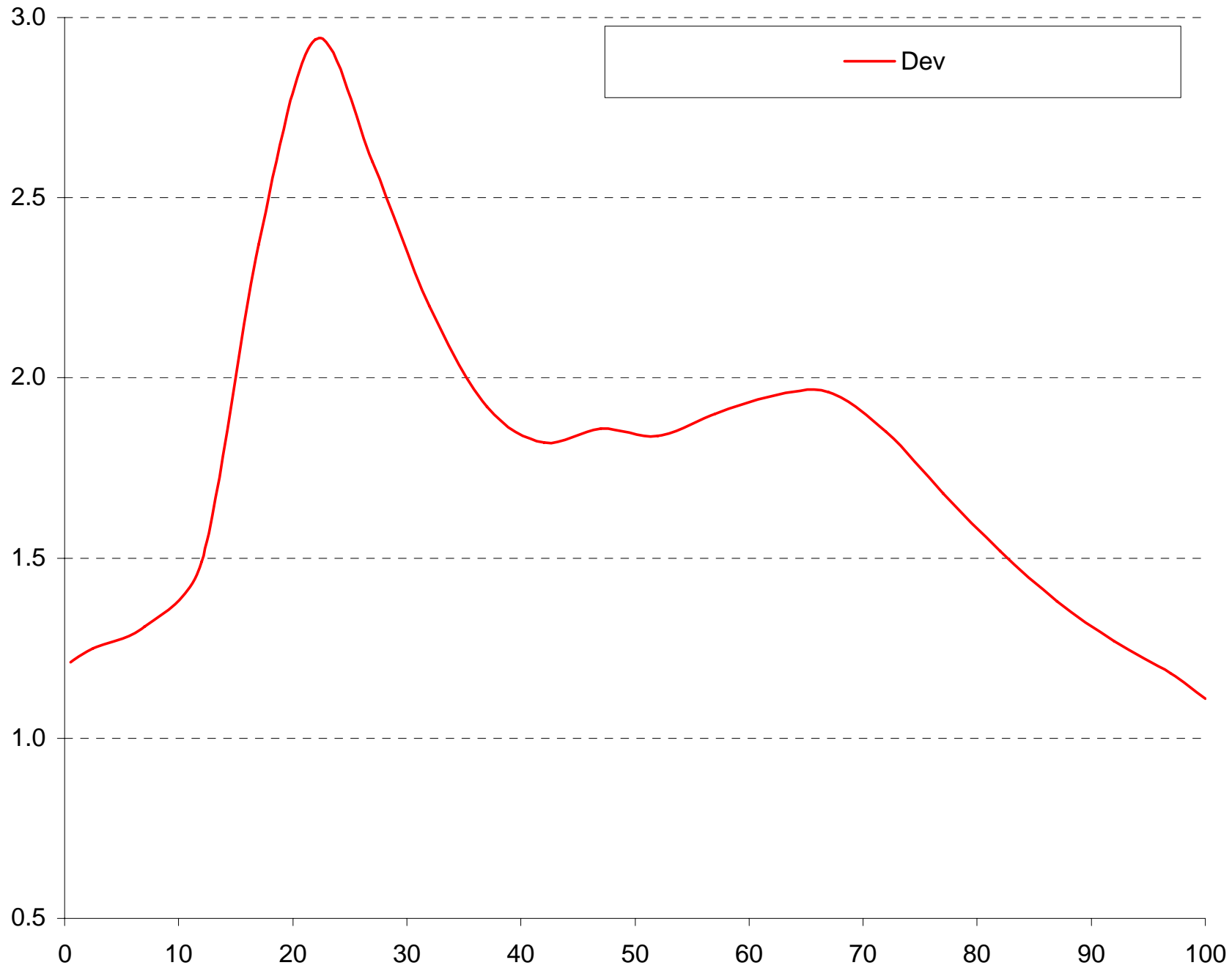


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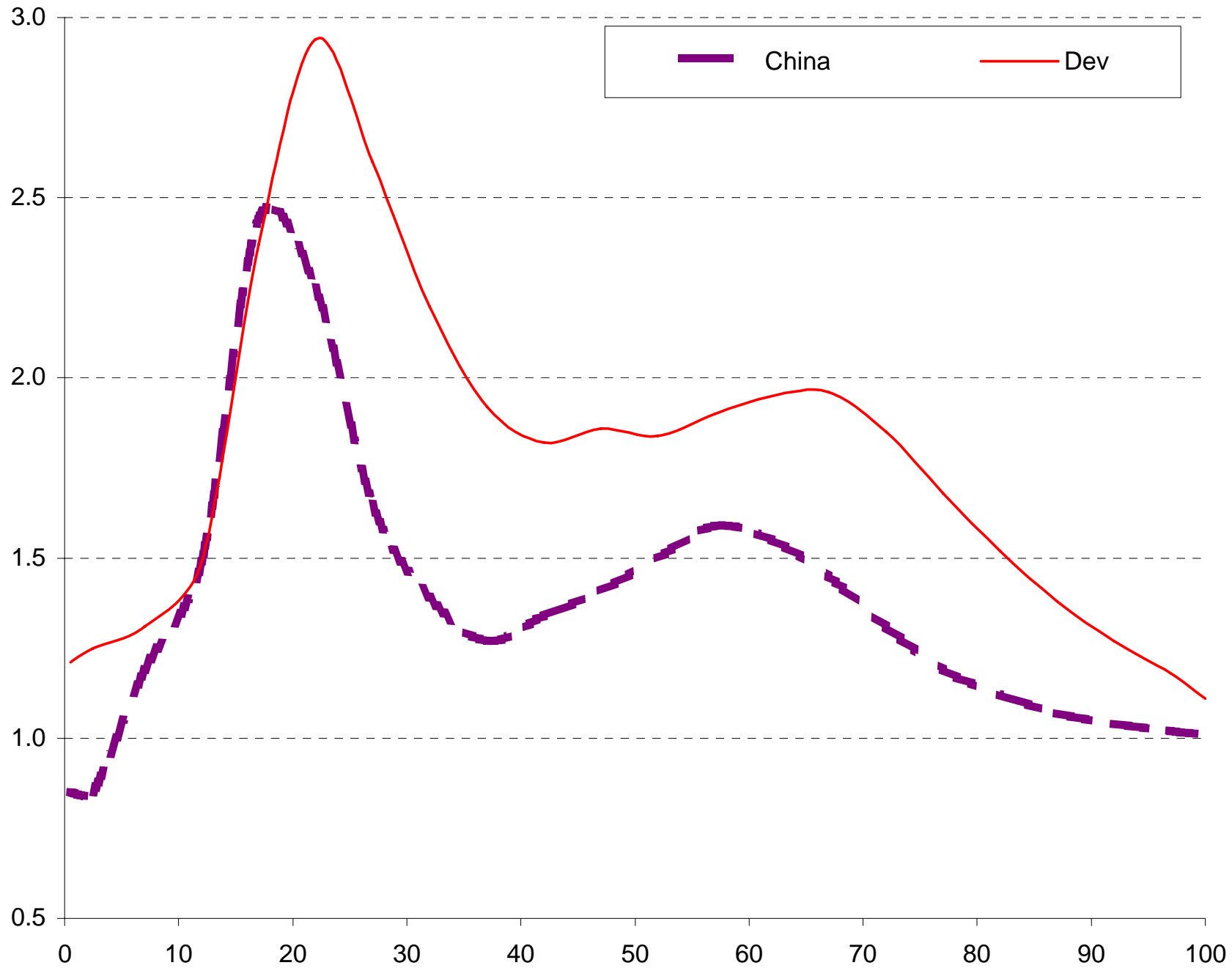


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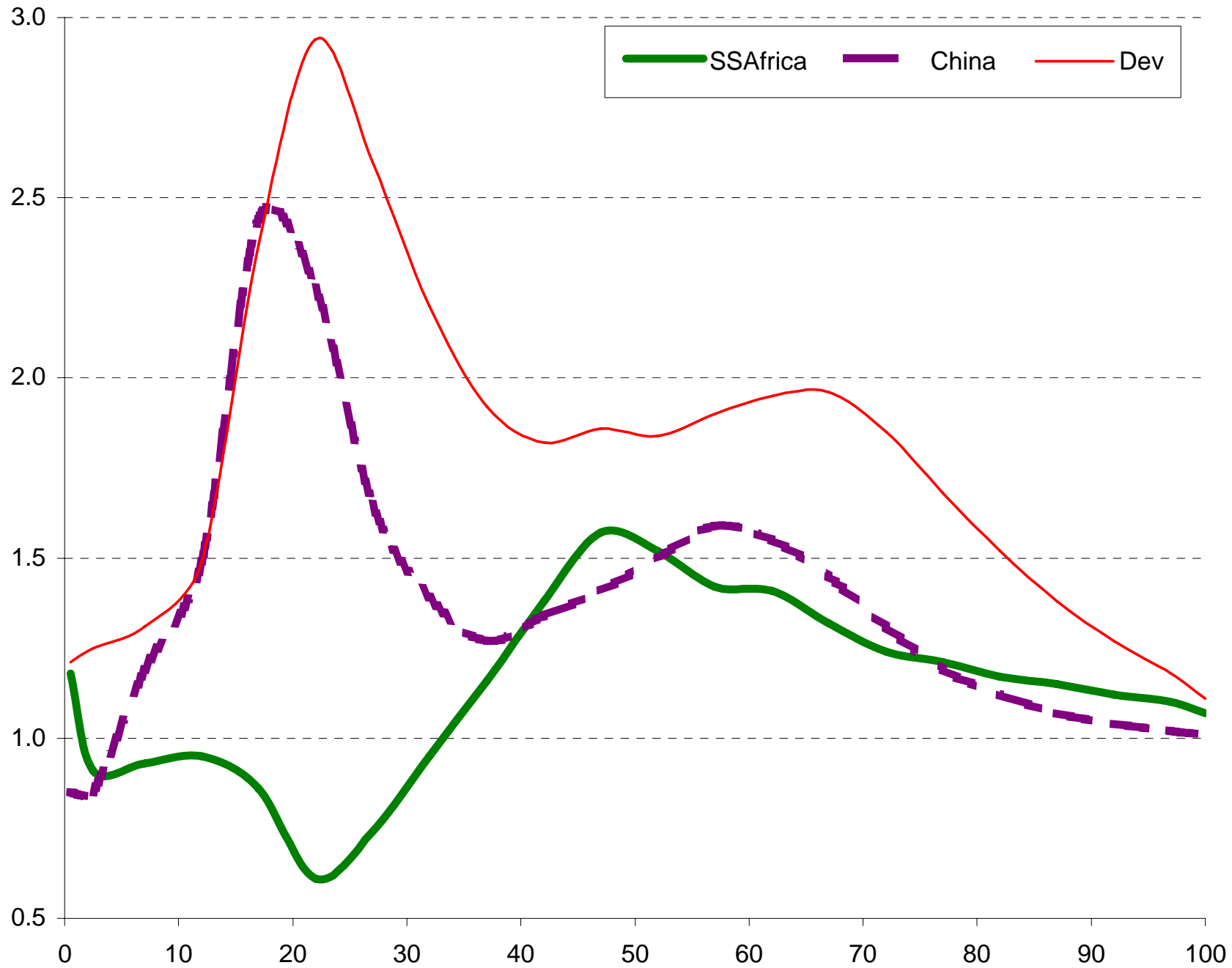




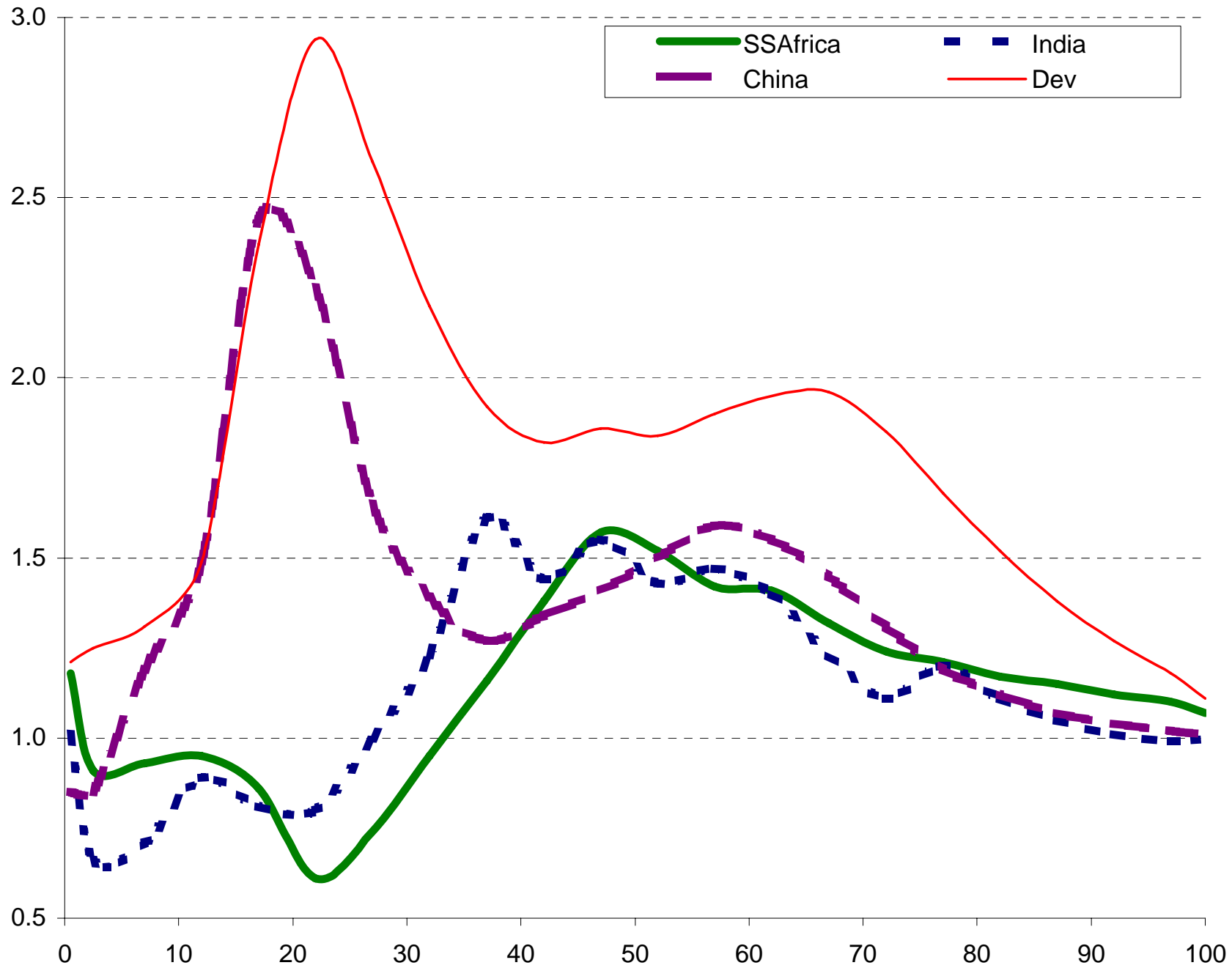
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# Missing Women: By Age

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- *Unbiased death rate* for women of age  $a$  in country of interest:

$$u^w(a) = \frac{d^m(a)}{\hat{d}^m(a) / \hat{d}^w(a)}.$$



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- *Unbiased death rate* for women of age  $a$  in country of interest:

$$u^w(a) = \frac{d^m(a)}{\hat{d}^m(a) / \hat{d}^w(a)}.$$

- Missing women at age  $a$  then given by

$$\boxed{\text{mw}(a) = [d^w(a) - u^w(a)] \pi^w(a)}.$$

where  $\pi^w(a)$  is the starting population of women of age  $a$ .

■ Missing women

$$mw_A = \sum_{a=0}^n mw(a).$$

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| <b>Excess Female Deaths, 000s</b> | <b>India</b> | <b>China</b> | <b>ssAfrica</b> |
|-----------------------------------|--------------|--------------|-----------------|
| At Birth                          | 184          | 644          | 0               |
| 0–4                               | 310          | 132          | 192             |
| 5–14                              | 93           | 2            | 70              |
| 15–29                             | 258          | 24           | 578             |
| 30–44                             | 94           | 73           | 345             |
| 45–59                             | 121          | 89           | 84              |
| 60–69                             | 241          | 154          | 101             |
| 70–79                             | 300          | 336          | 112             |
| 80+                               | 114          | 272          | 44              |
| <b>Total (<math>mw_A</math>)</b>  | <b>1712</b>  | <b>1727</b>  | <b>1526</b>     |
| % Female Population               | 0.34         | 0.31         | 0.44            |

Sources: WHO, UN Population Division, SRB

## Data

Global Burden of Disease (GBD) study (WHO, World Bank, Harvard School of Public Health)

GBD study used numerous data sources and epidemiological models to estimate first comprehensive worldwide cause-of-death patterns by age–sex groups for over 130 important diseases

Estimates reflect all information currently available to the WHO

Rely on most recent data for Africa - year 2011

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## Data - Reliability

Vital statistics not systematically collected in developing countries

- Health and Demographic Surveillance Sites

WHO makes use of more than two thousand model life tables  
(using developed and developing countries)

World Development Report (2012) replicated our 2010 estimates  
using alternative data from UN and WHO – similar estimates

Our estimates of excess female mortality robust to varying expert  
methods for computing mortality in developing countries

Still require caution – highest quality available for our purposes

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| <b>Region</b>   | <b>Age Group</b> | <b>Excess Female Deaths</b> | <b>% Female Pop.</b> |
|-----------------|------------------|-----------------------------|----------------------|
| East Africa     | 0-14             | 94                          | 0.14                 |
| West Africa     | 0-14             | 196                         | 0.32                 |
| North Africa    | 0-14             | 38                          | 0.12                 |
| Southern Africa | 0-14             | 0                           | 0                    |
| Central Africa  | 0-14             | 98                          | 0.35                 |
| East Africa     | 15-59            | 397                         | 0.49                 |
| West Africa     | 15-59            | 452                         | 0.59                 |
| North Africa    | 15-59            | 71                          | 0.11                 |
| Southern Africa | 15-59            | 207                         | 1.18                 |
| Central Africa  | 15-59            | 191                         | 0.61                 |
| <b>Total</b>    |                  | <b>1742</b>                 |                      |

Table 1. Excess Female Mortality by U.N. sub-Region and Age Group: 000s

## Excess Female Deaths by Disease

WHO divides causes of death into three categories:

- (1) communicable, maternal, perinatal, and nutritional diseases;
- (2) non-communicable diseases;
- (3) injuries

Infectious disease, nutritional, reproductive ailments—the Group 1 diseases—predominate in higher mortality populations

Replaced by chronic and degenerative diseases (Group 2) in low-mortality populations (cardiovascular, cancer)

--- Epidemiological Transition

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| Disease                     | East | West | North | Southern | Central |
|-----------------------------|------|------|-------|----------|---------|
| All Causes                  | 11.2 | 13.8 | 4.2   | 5.5      | 18.7    |
| <i>(1) Communicable</i>     | 10.1 | 12.8 | 3.2   | 4.8      | 17.2    |
| (A) Infectious/Parasitic    | 5.40 | 7.45 | 1.25  | 2.96     | 9.82    |
| HIV                         | 0.91 | 0.51 | 0.03  | 1.98     | 0.43    |
| Diarrhoeal                  | 1.94 | 2.07 | 0.55  | 0.57     | 3.23    |
| Childhood Cluster           | 0.34 | 0.56 | 0.08  | 0.03     | 0.54    |
| Menigitis                   | 0.32 | 0.34 | 0.08  | 0.07     | 0.47    |
| Malaria                     | 1.09 | 3.11 | 0.13  | 0.02     | 3.58    |
| (B) Respiratory             | 1.82 | 2.24 | 0.75  | 0.59     | 3.52    |
| (C) Perinatal               | 2.48 | 2.82 | 1.09  | 1.13     | 3.30    |
| (D) Malnutrition            | 0.36 | 0.27 | 0.13  | 0.15     | 0.54    |
| <i>(2) Non-Communicable</i> | 0.6  | 0.6  | 0.6   | 0.5      | 0.8     |
| <i>(3) Injuries</i>         | 0.5  | 0.4  | 0.4   | 0.2      | 0.6     |

Table 2. Overall death rates per 1000 individuals (Aged 0-14) by U.N. sub-Region and Disease



| <b>Disease</b>              | <b>East</b> | <b>West</b> | <b>North</b> | <b>Southern</b> | <b>Central</b> |
|-----------------------------|-------------|-------------|--------------|-----------------|----------------|
| All Causes                  | 8.9         | 7.5         | 3.0          | 13.3            | 8.2            |
| <i>(1) Communicable</i>     | 5.0         | 4.3         | 0.5          | 10.5            | 4.4            |
| (A) Infectious/Parasitic    | 4.1         | 3.3         | 0.3          | 9.3             | 3.3            |
| Tuberculosis                | 0.6         | 0.9         | 0.1          | 0.4             | 0.8            |
| HIV/AIDS                    | 2.7         | 1.6         | 0.1          | 7.3             | 1.4            |
| Malaria                     | 0.06        | 0.04        | 0.01         | 0.01            | 0.07           |
| (B) Respiratory             | 0.4         | 0.4         | 0.1          | 0.9             | 0.5            |
| (C) Maternal                | 0.4         | 0.5         | 0.1          | 0.1             | 0.6            |
| <i>(2) Non-Communicable</i> | 2.5         | 2.4         | 1.9          | 1.9             | 2.5            |
| <i>(3) Injuries</i>         | 1.4         | 0.8         | 0.6          | 0.8             | 1.3            |

Table 3. Overall death rates per 1000 individuals (Aged 15-59) by U.N. sub-Region and Disease

| <b>Disease</b>              | <b>East</b> | <b>West</b> | <b>North</b> | <b>Southern</b> | <b>Central</b> |
|-----------------------------|-------------|-------------|--------------|-----------------|----------------|
| <i>(1) Communicable</i>     | 113         | 205         | 38           | 4               | 104            |
| (A) Infectious/Parasitic    | 76          | 123         | 18           | 4               | 65             |
| HIV                         | 22          | 11          | 0            | 4               | 4              |
| Diarrhoeal                  | 18          | 32          | 8            | 0               | 19             |
| Childhood Cluster           | 1           | 3           | 1            | 0               | 2              |
| Meningitis                  | 9           | 13          | 1            | 0               | 8              |
| Malaria                     | 23          | 55          | 3            | 0               | 28             |
| (B) Respiratory             | 22          | 39          | 10           | 0               | 23             |
| (C) Perinatal               | 5           | 30          | 7            | 0               | 7              |
| (D) Malnutrition            | 5           | 7           | 2            | 0               | 5              |
| <i>(2) Non-Communicable</i> | 0           | 0           | 0            | 0               | 0              |
| <i>(3) Injuries</i>         | 3           | 4           | 1            | 0               | 2              |

Table 4. Excess Female Deaths (Aged 0-14) by U.N. sub-Region and Disease: 000s

| <b>Disease</b>              | <b>East</b> | <b>West</b> | <b>North</b> | <b>Southern</b> | <b>Central</b> |
|-----------------------------|-------------|-------------|--------------|-----------------|----------------|
| <i>(1) Communicable</i>     | 424         | 341         | 28           | 206             | 141            |
| Tuberculosis                | 18          | 22          | 3            | 0               | 13             |
| HIV/AIDS                    | 328         | 194         | 5            | 199             | 67             |
| Malaria                     | 7           | 3           | 1            | 0               | 3              |
| Respiratory                 | 10          | 11          | 0            | 6               | 2              |
| Maternal                    | 132         | 161         | 25           | 8               | 70             |
| <i>(2) Non-Communicable</i> | 70          | 127         | 31           | 9               | 68             |
| Malignant                   | 32          | 44          | 11           | 1               | 11             |
| Diabetes                    | 10          | 12          | 4            | 2               | 6              |
| Cardio                      | 61          | 73          | 28           | 8               | 38             |
| Digestive                   | 6           | 12          | 4            | 1               | 8              |
| <i>(3) Injuries</i>         | 0           | 0           | 0            | 0               | 0              |

Table 5. Excess Female Deaths (Aged 15-59) by U.N. sub-Region and Disease: 000s

| Country    | Age 0 - 14 | % Fem Pop | Age 15 - 59 | % Fem Pop |
|------------|------------|-----------|-------------|-----------|
| Burundi    | 2.5        | 0.08      | 21.1        | 0.46      |
| Comoros    | 0.04       | 0.02      | 0.5         | 0.14      |
| Djibouti   | 0          | 0         | 1.0         | 0.21      |
| Eritrea    | 0          | 0         | 2.1         | 0.09      |
| Ethiopia   | 19.0       | 0.05      | 124.5       | 0.30      |
| Kenya      | 1.9        | 0.01      | 44.0        | 0.21      |
| Madagascar | 4.2        | 0.05      | 8.1         | 0.08      |
| Malawi     | 5.4        | 0.08      | 19.0        | 0.26      |
| Mauritius  | 0          | 0         | 0           | 0         |
| Mozambique | 19.6       | 0.20      | 40.6        | 0.36      |
| Rwanda     | 0.8        | 0.02      | 11.2        | 0.21      |
| Somalia    | 16.0       | 0.40      | 13.2        | 0.29      |
| Tanzania   | 33.2       | 0.17      | 32.1        | 0.08      |
| Uganda     | 0          | 0         | 11.7        | 0.15      |
| Zambia     | 0          | 0         | 21.4        | 0.35      |
| Zimbabwe   | 3.3        | 0.06      | 46.0        | 0.68      |

Table 6. Excess Female Deaths - East Africa: 000s

| Country       | Age 0 - 14 | % Fem Pop | Age 15 - 59 | % Fem Pop |
|---------------|------------|-----------|-------------|-----------|
| Benin         | 5          | 0.13      | 2.5         | 0.06      |
| Burkina Faso  | 0.4        | 0.25      | 2.6         | 0.03      |
| Cape Verde    | 0          | 0         | 0           | 0         |
| Cote d'Ivoire | 10         | 0.12      | 43.0        | 0.39      |
| Gambia        | 0.3        | 0.04      | 1.6         | 0.18      |
| Ghana         | 0          | 0         | 9.0         | 0.07      |
| Guinea        | 2          | 0.05      | 8.1         | 0.16      |
| Guinea Bissau | 0          | 0         | 2.8         | 0.34      |
| Liberia       | 2          | 0.11      | 5.8         | 0.29      |
| Mali          | 9.4        | 0.17      | 3.7         | 0.06      |
| Mauritania    | 1.1        | 0.09      | 3.4         | 0.19      |
| Niger         | 19.3       | 0.26      | 13.9        | 0.20      |
| Nigeria       | 127.0      | 0.20      | 328.2       | 0.41      |
| Senegal       | 1.9        | 0.03      | 9.0         | 0.14      |
| Sierra Leone  | 3.6        | 0.15      | 10.4        | 0.35      |
| Togo          | 0          | 0         | 7.9         | 0.22      |

Table 7. Excess Female Deaths - West Africa: 000s

| Country | Age 0 - 14 | % Fem Pop | Age 15 - 59 | % Fem Pop |
|---------|------------|-----------|-------------|-----------|
| Algeria | 0          | 0         | 11.2        | 0.05      |
| Egypt   | 0          | 0         | 2.5         | 0.005     |
| Libya   | 0.5        | 0.02      | 0           | 0         |
| Morocco | 0          | 0         | 4.3         | 0.02      |
| Sudan   | 46         | 0.28      | 54.1        | 0.24      |
| Tunisia | 0          | 0         | 0           | 0         |

Table 8. Excess Female Deaths - Northern Africa: 000s

| <b>Country</b> | <b>Age 0 - 14</b> | <b>% Fem Pop</b> | <b>Age 15 - 59</b> | <b>% Fem Pop</b> |
|----------------|-------------------|------------------|--------------------|------------------|
| Botswana       | 0.4               | 0.06             | 4.6                | 0.39             |
| Lesotho        | 0.3               | 0.04             | 7.5                | 0.68             |
| Namibia        | 0                 | 0                | 2.0                | 0.16             |
| South Africa   | 0                 | 0                | 190.7              | 0.62             |
| Swaziland      | 0.4               | 0.08             | 3.9                | 0.62             |

Table 9. Excess Female Deaths - Southern Africa: 000s

| Country        | Age 0 - 14 | % Fem Pop | Age 15 - 59 | % Fem Pop |
|----------------|------------|-----------|-------------|-----------|
| Angola         | 9          | 0.12      | 34.2        | 0.37      |
| Cameroon       | 12         | 0.15      | 48.7        | 0.48      |
| CAR            | 5.7        | 0.32      | 14.9        | 0.64      |
| Chad           | 15         | 0.31      | 23.4        | 0.43      |
| Congo          | 1          | 0.10      | 4.3         | 0.22      |
| DRC            | 54         | 0.18      | 62.7        | 0.20      |
| Eq. Guinea     | 0.4        | 0.16      | 1.4         | 0.38      |
| Gabon          | 0          | 0         | 1.7         | 0.20      |
| Sao Toma et P. | 0          | 0.05      | 0           | 0.02      |

Table 10. Excess Female Deaths - Central Africa: 000s



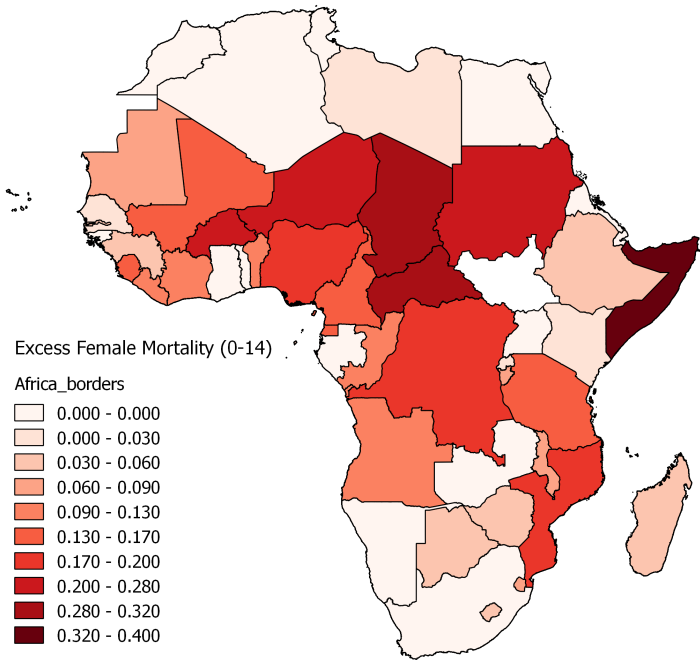


Figure 1 – Excess Female Mortality (0-14)

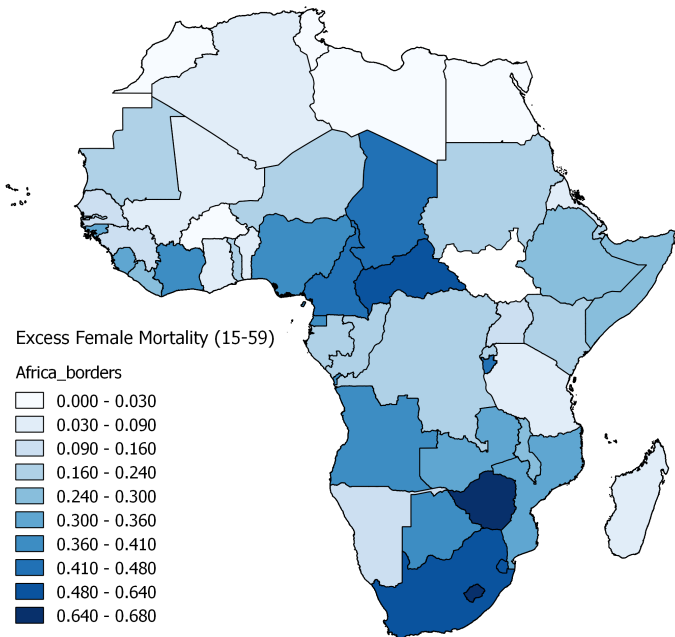


Figure 2 – Excess Female Mortality (15-59)

## **Southern Africa as a Benchmark**

Possible - use of developed countries as reference group may be “inappropriate” for poor countries in Africa

Elsewhere (Anderson and Ray 2010) robustness checks – Latin America/ Caribbean, African-American – similar estimates

For younger age group (0-14) - can redo our computations using countries in Southern Africa as a benchmark

- Region in Africa with lowest excess young female mortality
-

| <b>Disease</b>          | <b>East</b> | <b>West</b> | <b>North</b> | <b>Southern</b> | <b>Central</b> |
|-------------------------|-------------|-------------|--------------|-----------------|----------------|
| All Causes              | 137         | 243         | 45           | 0               | 126            |
| <i>(1) Communicable</i> | 134         | 228         | 41           | 0               | 119            |
| HIV                     | 7           | 4           | 0            | 0               | 1              |
| Diarrhoeal              | 43          | 55          | 11           | 0               | 35             |
| Childhood Cluster       | 11          | 18          | 2            | 0               | 9              |
| Meningitis              | 0           | 0           | 0            | 0               | 1              |
| Malaria                 | 26          | 62          | 3            | 0               | 32             |
| Respiratory             | 34          | 52          | 12           | 0               | 32             |
| Perinatal               | 72          | 97          | 21           | 0               | 42             |
| Malnutrition            | 9           | 9           | 3            | 0               | 7              |

Table 11. Excess Female Deaths (Aged 0-14) by U.N. sub-Region and Disease: 000s

[Southern Africa as a Benchmark]

## Southern Africa as a Benchmark

Estimates of excess mortality for young female increase

- Relative to developed country reference group - relative death rate of young males is higher in countries of Southern Africa

Overall estimates of excess female mortality --- increase by 25%

- Excess female deaths from perinatal conditions increase more than three-fold
- Estimates of excess deaths from diarrhoeal diseases increase by about 50%

If anything -- earlier estimates are lower bound on excess young female mortality in Africa

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## Mechanisms

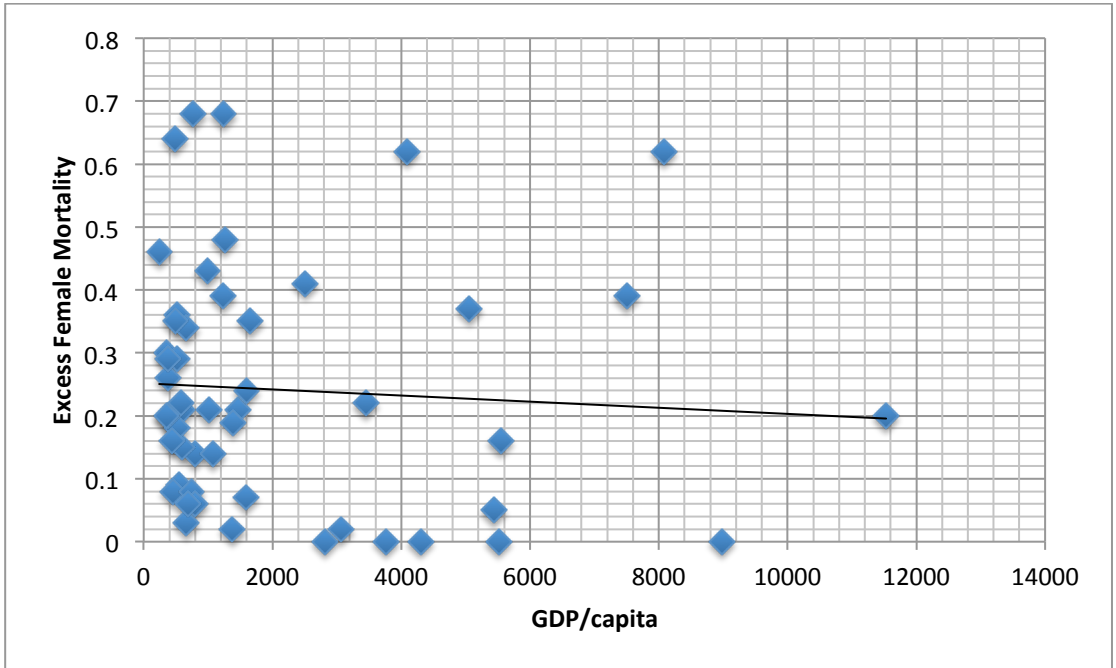


Figure 3 – GDP/capita and Adult Excess Female Mortality

## Mechanisms

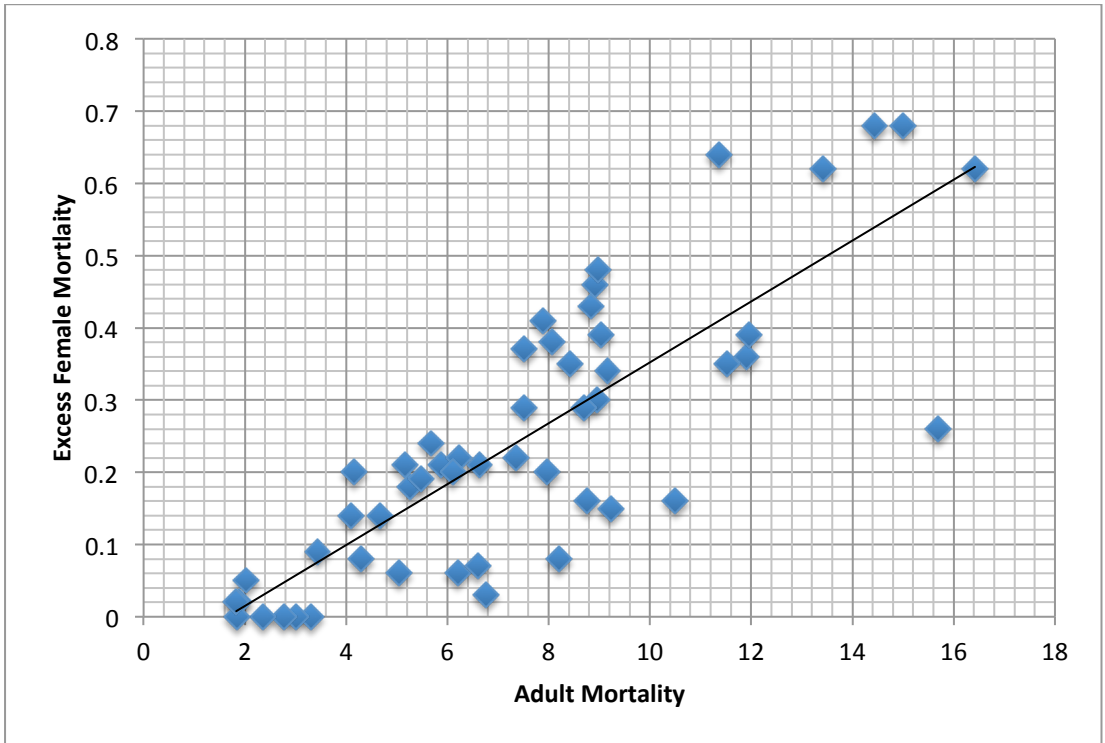


Figure 4 – Overall Adult Mortality and Adult Excess Female Mortality

## Mechanisms – Importance of Disease

Significant positive correlation between excess female mortality and overall mortality rates

- Certain diseases play stronger role

Excess mortality among girls (ages 0 and 14)

- Highest in Central and West Africa
  - Regions plagued by high comparable overall death rates from diarrhoeal diseases, malaria, respiratory infections and perinatal conditions
  - Malaria – 25% premature deaths; Respiratory – 19%
-



## Mechanisms – Importance of Disease

Given disease can have more impact in particular regions

Overall mortality rates from diarrhoeal diseases significantly higher in Central compared to Eastern Africa

- Number of excess young female deaths from this disease is comparable across the two regions

Older age group:

- Tuberculosis more impact in Central Africa but respiratory diseases has lower impact compared to elsewhere
-

## **Mechanisms – Host of Factors**

Necessary to further explore why certain diseases lead to higher rates of excess female deaths than do other diseases

Why certain diseases have larger impact on excess female mortality in certain regions compared to others

Likely host of factors —biological, social, environmental, behavioural, or economic—which explain this variation in excess female mortality across Africa

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## Mechanisms – Biological Gender Bias

Among younger women - malaria plays important role

Malaria control threatened by rapid development and spread of antimalarial drug resistance

--- Gender bias component to this resistance?

Acute respiratory infections:

- Developed countries more severe in males than in females
- Higher for young females in parts of Africa?

--- Lower relative protective immunity in Africa for females?

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## Mechanisms – Biological Gender Bias

Extreme excess female mortality from HIV/AIDS epidemic in all regions except North Africa – 800,000/year

Overall female death rate from the virus is 1.2 times that for males

Elsewhere in world -- death rate from virus higher for males  
(4:1 in high-income countries)

Biological differences by gender in susceptibility to HIV infection cannot explain these large differences

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## Mechanisms – Treatment Gender Bias

Malaria -- insecticide-treated mosquito nets and indoor residual spraying commonly prevent this disease

- Resource-constrained households might provide young boys with mosquito nets before girls?

Diarrhoeal disease – treated with solution of clean water, sugar and salt, and with zinc tablets

- Differential treatment by gender?
-

## Mechanisms – Female Decision Making Power

Women with limited bargaining power excluded from household decision making power

- Female autonomy enhances child health outcomes

Role of breastfeeding?

- Breast milk best form of nutrition for infants
  - Significantly reduces risk of disease
  - East and Southern Africa - 40 % babies exclusively breastfed
  - Inadequate support from partner? Labour burdens?
  - More likely to breastfeed sons compared to daughters?
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## Mechanisms – Cultural Factors

### Role of early marriage?

- Pregnancy among adolescent girls could be relevant - Malaria infection during pregnancy carries substantial risks
- 12% of girls in Sub-Saharan Africa are married before the age of 15

Rates of child marriage exceptionally high (28-29%) in Niger, Central African Republic, and Chad

- Also amongst countries with highest rates of excess female mortality from malaria for girls aged 0-14
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## Mechanisms – Cultural Factors

Traditional religions within Africa

- Archetypal institution is the patrilineage
- At least one surviving son is highly desired

Islam has strong grip in several parts of Africa

- Evidence in other non-African Islamic countries child female mortality exceeds males
  - In some Islamic settings in Africa - boys and men traditionally eat first - girls and women eat the leftovers
  - When food is short -- females have very little to eat
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## Conclusion

Beyond scope to identify specific mechanisms for excess female mortality in Africa

Significant variation across continent -- difficult to pin point single explanation

Alarming numbers of excess female deaths across the continent

- Further research focusing on this issue is crucial
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