Why Did HIV Decline in Zimbabwe?

Mapping & modelling epidemics & behaviour using multiple methods

Simon Gregson
Introduction

- For many years, Uganda was the only country in sub-Saharan Africa for which there was convincing evidence of a national decline in HIV prevalence.

- In the early-2000s, data from national ANC surveillance & from the Manicaland Study suggested that HIV prevalence had started to decline in Zimbabwe & that this might be linked to behaviour change.\(^\dagger\)

\(^\dagger\) Gregson, Garnett, Nyamukapa et al. Science 2006
Introduction

- In 2004, UNAIDS commissioned a comprehensive epidemiological review to assess the evidence for HIV decline in Zimbabwe.

- The results of the review provided convincing evidence that HIV prevalence had declined from c1997 due to a combination of sustained high AIDS mortality & reductions in HIV incidence†.

- The review also found evidence that substantial reductions in risk behaviour had occurred.

Introduction

- Following the review, further work using multiple research methods was commissioned to investigate the underlying causes of the HIV decline in Zimbabwe:
  1. Fitting a mathematical model to trends in ANC surveillance data
  2. Analysis of epidemiological & behaviour trends in population sub-groups
  3. Historical mapping of HIV prevention programme activities
  4. Qualitative investigations of the causes of behaviour change
  5. Cross-country comparison of underlying contextual factors
  6. Triangulation of the findings & review of the evidence at a national stakeholders meeting
Outline

Summary of epidemiological & behaviour data

Alternative explanations for HIV decline

Using prospective survey data to measure programme impact
HIV prevalence

2009: 14.3% (13.4%-15.3%)

Epidemiological & Behaviour Trends

HIV prevalence trends in selected countries in SSA
Epidemiological & Behaviour Trends

Mortality

DHS surveys - sibling survival method

Source: Zimbabwe Demographic & Health Survey (ZDHS), 1994, 1999, 2005/06
Epidemiological & Behaviour Trends

HIV incidence

Harare: Post-natal women (■) & male factory workers (■)
Manicaland: Male & female adults (■)

Model fits to HIV surveillance data

--- without behaviour change --- with behaviour change

Epidemiological & Behaviour Trends

Model estimates of trends in HIV prevalence, incidence & mortality

Epidemiological & Behaviour Trends

Survey data on behaviour change

Alternative Explanations for HIV Decline

Competing explanations

Natural epidemic dynamics
High mortality - ‘Funeral effect’
Economic collapse
Biomedical interventions
Behavioural interventions
Alternative Explanations for HIV Decline

Criteria considered

Plausible causal pathway via proximate determinants
(multiple partnerships, consistent condom use, transmission probability)

Population-level effectiveness
(C-RCTs, individual-level evidence + modelling)

Coverage / exposure
(target groups)

Consistency in timing of change with period of rapid reduction in HIV risk
Alternative Explanations for HIV Decline

Cumulative effects of reductions in risk behaviour on HIV transmission

Source: Geoff Garnett
Alternative Explanations for HIV Decline

1. Natural dynamics of the epidemic

Counter-factual models suggest insufficient to account for size/timing of decline

Empirical evidence for HIV incidence continuing to decline

Empirical evidence for substantial behaviour change during period
model fits indicate acceleration in risk reduction

Source: Zvitambo
Alternative Explanations for HIV Decline

2. High mortality - ‘Funeral Effect’

Timing consistent - *reached high levels by late 1990s*

Important motivating factor - *focus groups etc.*

Insufficient without correct knowledge & means to avoid infection
Alternative Explanations for HIV Decline

3. International migration

Model scenarios suggest would need to be highly selective as well as substantial

Limited evidence available suggests HIV prevalence lower in migrants

Model scenarios of the effect of migration on HIV prevalence

HIV prevalence in Zimbabwe-born ANC attendees in the UK

--- Baseline; --- 0-10% pa migration 1997-2000, 10% pa 2000 →; HIV+ 20 times > likely to migrate

Source: Gregson, Gonese, Hallett et al. IJE 2010
Alternative Explanations for HIV Decline

4. Economic collapse - increased poverty

**Argument:** fewer men can afford to pay for transactional sex vs. more women may be driven into offering transactional sex

**Evidence that transactional sex has declined**

![Graph showing declining sex work and odds of infection]

**Economic collapse too late?**

![Graph showing average real earnings and GDP per capita over time]

**Source:** Manicaland Study

**Source:** Halperin, Mugurungi, Hallett et al.

*PLoS Medicine (in press)*
Alternative Explanations for HIV Decline

5. Biomedical interventions

PMTCT, VCT, ART - *introduced too late*

Blood/injection safety, STI control - *introduced much earlier*

... *but may have contributed by making transmission more fragile*

Reduced virulence of infection - *no data*
6. Behaviour Change Interventions

Programme Mapping: Policy & Leadership

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>NACP formed</td>
</tr>
<tr>
<td></td>
<td>ZAN formed</td>
</tr>
<tr>
<td></td>
<td>STI control focus</td>
</tr>
<tr>
<td></td>
<td>High-level study tour to Uganda</td>
</tr>
<tr>
<td>1990</td>
<td>MOH makes AIDS public health issue</td>
</tr>
<tr>
<td></td>
<td>PLHIV go public</td>
</tr>
<tr>
<td>2005</td>
<td>2006-10: Zimbabwe National Strategic Plan - Behaviour Change Strategy</td>
</tr>
</tbody>
</table>

Source: Muchini et al. AIDS & Behavior 2010
## 6. Behaviour Change Interventions

### Programme Mapping: IPC

<table>
<thead>
<tr>
<th>Year</th>
<th>ASOs founded</th>
<th>Schools programmes</th>
<th>Peer education</th>
<th>Information, education &amp; communication (IEC) materials</th>
<th>Church programmes</th>
<th>Inter-personal communication (IPC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IPC through family planning community-based distributors &amp; health workers: initial focus on family planning (oral contraception), then increasingly on STI control, condoms &amp; HIV prevention</td>
</tr>
<tr>
<td>1990</td>
<td>162</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>223</td>
<td>Min Education: compulsory HIV teaching from Grade 4 to Form 6</td>
<td></td>
<td>&quot;O&quot; level teacher/pupil booklets, magazines, videos on HIV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>366</td>
<td></td>
<td></td>
<td>33% of teachers trained in HIV life skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
<td></td>
<td>70% of youth cite school as source of info on HIV</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Muchini et al. AIDS & Behavior 2010

### Similar to other countries?
No particular emphasis on faithfulness vs. abstinence or condom use

Focus group participants acknowledged role of programmes but unable to identify specific interventions that had made an impact

Stakeholders considered an impact of behaviour change programmes to be plausible
Linking Programmes to Behaviour Change

Manicaland Study, Eastern Zimbabwe

Programmes
- media campaigns
- schools programmes
- VCT treatment

COMMUNITY
- social norms

SOCIAL NETWORK
- extended family
- household
- partner
- group membership

INDIVIDUAL
- sex, age, education, income
- psychosocial status
- self-efficacy
- knowledge
- risk perception

Behaviour
- adoption

Excess morbidity & mortality

Economic collapse

Source: Gregson, Nyamukapa, Schumacher et al. STDs (in press)

Theoretical Framework

PROGRAMMES

Psychosocial Status

Knowledge

Risk perception

Self efficacy

Behaviour Adoption

Sexually active

Multiple partners

Condom use consistent

Unfaithful spouse

HIV Infection

increased POVERTY

RELATIVE WITH AIDS

* NB Effects may differ depending on behaviour prior to exposure
Linking Programmes to Behaviour Change

Behavioural determinants of new HIV infection,
Manicaland, 1998-2003

Behaviour Adoption
- Sexually active
- Multiple partners
- Condom use consistent
- Unfaithful spouse

HIV Infection

Newly started sex (R1-R2)

Multiple partners (R1-R2)

Unprotected casual sex (R1-R2)

Spouse unfaithful (R2)

HIV incidence (pa)

Behavioural determinants of new HIV infection in Manicaland, 1998-2003

- Newly started sex
- Multiple partners
- Unprotected casual sex
- Spouse unfaithful

HIV incidence (pa)
Linking Programmes to Behaviour Change

Manicaland Study, Eastern Zimbabwe


† Measured in the closed cohort

Source: Gregson, Nyamukapa, Schumacher et al. STDs (in press)
Evidence for Programme Impact in Women, 1998-2003

Behaviour change ~ decreased risk or maintained low risk
Risk ~ ≥ 1 new sexual partner in the past year

Source: Gregson, Nyamukapa, Schumacher et al. STDs (in press)
Contextual Factors

Education & Marriage

% Married

% with Secondary Education

Botswana 2001
Namibia 2000
Lesotho 2004
Swaziland 2006
Malawi 2000
Zambia 2002
Mozambique 2003
Zimbabwe 2005
Contextual Factors


<table>
<thead>
<tr>
<th>Age-group</th>
<th>Education</th>
<th>Marriage</th>
<th>Social capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-24</td>
<td>Lower</td>
<td>Single</td>
<td>None</td>
</tr>
<tr>
<td>25-34</td>
<td>Secondary</td>
<td>Married</td>
<td>Yes</td>
</tr>
<tr>
<td>35-54</td>
<td></td>
<td>Formerly married</td>
<td></td>
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Men similar

Timing of exposure

Behaviour change ~ decreased risk or maintained low risk

Risk ~ ≥ 1 new sexual partner in the past year
Conclusions

Assessing the *impact* of national HIV/AIDS control programmes is important!

Useful insights on impact can be obtained through multi-method studies.

Zimbabwe = complex case due to simultaneous timing of programme scale-up, high mortality & economic ↓ with period of rapid reduction in HIV risk.

Evidence indicates that high AIDS mortality provided important *motivation* but that control programmes provided *knowledge* on how to prevent infection & *means* for effective protection (e.g. condoms & STI treatment).

Economic decline was an important secondary factor that occurred after behaviour began to change but probably helped to sustain behaviour change.
Acknowledgements

Clemens Benedikt, Bruce Campbell, Liz Corbett, Karl Dehne, Rob Dorrington, Sabada Dube, Geoff Garnett, Exnevia Gomo, Elizabeth Gonese, Tim Hallett, Daniel Halperin, John Hargrove, Rekopantswe Mate, Backson Muchini, Tapuwa Magure, Owen Mugurungi, Constance Nyamukapa, Christina Schumacher, Noah Taruberekera