Effective HIV/AIDS Prevention Approach: Complementarities and Externalities among HIV/AIDS education, male circumcision, and CCT

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- Number of people living with HIV: 34 million
- Number of people newly infected with HIV: 2.7 million
- Number of people dying from AIDS: 1.8 million

- Sub-Saharan Africa remains the region most heavily affected by HIV.
  - Number of people living with HIV: 22.9 million (67.4%)
  - Number of people newly infected with HIV: 1.9 million (70.4%)
  - Number of people dying from AIDS: 1.2 million (66.7%)
2. Global HIV/AIDS Epidemic Trend

- New Cases of AIDS Hit Plateau (NYT Nov. 21st, 2011)

Table 1.1 Key indicators for the HIV epidemic, 2002-2010

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of people living with HIV (in millions)</strong></td>
<td>29.5 [27.7-31.7]</td>
<td>30.2 [28.4-32.1]</td>
<td>30.7 [28.8-32.5]</td>
<td>31.0 [29.2-32.7]</td>
<td>31.4 [29.6-33.0]</td>
<td>31.8 [29.9-33.3]</td>
<td>32.3 [30.4-33.8]</td>
<td>32.9 [31.0-34.4]</td>
<td>34.0 [31.6-35.2]</td>
</tr>
<tr>
<td><strong>Number of people newly infected with HIV (in millions)</strong></td>
<td>3.1 [3.0-3.3]</td>
<td>3.0 [2.8-3.1]</td>
<td>2.9 [2.7-3.0]</td>
<td>2.8 [2.6-3.0]</td>
<td>2.8 [2.6-2.9]</td>
<td>2.7 [2.5-2.9]</td>
<td>2.7 [2.5-2.9]</td>
<td>2.7 [2.5-2.9]</td>
<td>2.7 [2.4-2.9]</td>
</tr>
<tr>
<td><strong>Number of people dying from AIDS-related causes (in millions)</strong></td>
<td>2.0 [1.8-2.3]</td>
<td>2.1 [1.9-2.4]</td>
<td>2.2 [2.0-2.5]</td>
<td>2.2 [2.1-2.5]</td>
<td>2.2 [2.1-2.4]</td>
<td>2.1 [2.0-2.3]</td>
<td>2.0 [1.9-2.2]</td>
<td>1.9 [1.7-2.1]</td>
<td>1.8 [1.6-1.9]</td>
</tr>
</tbody>
</table>
3. HIV/AIDS Prevention

Existing HIV/AIDS prevention approaches:

- Condom Distribution (Weller 1993)
- HIV/AIDS Education (Gallant and Maticka-Tyndale 2004; Duflo et al. 2007; Dupas 2011)
- HIV Voluntary Counseling and Testing (Coates et al. 2000; Thornton 2008)
- Male Circumcision (Auvert et al. 2005; Bailey et al. 2007; Gray et al. 2007)
- Conditional Cash Transfer (Baird et al. 2010; Kohler and Thornton 2010)
- HIV Treatment as Prevention (Cohen et al. 2011)

→ Single intervention may not be enough to reduce new HIV infection.
3. HIV/AIDS Prevention

Suggested HIV/AIDS prevention approaches:

• Complementarities:
  Combined intervention of existing HIV/AIDS prevention strategies may produce synergistic effects.
  – Modeling: Hallett et al. 2008 (Male circumcision + HIV/AIDS education)
  – Experiment: Duflo et al. 2011 (Subsidy + HIV/AIDS education)

• Externalities:
  Individual’s male circumcision uptake might be affected by that of peer groups. Externalities can play an important role to increase low uptake of desirable HIV/AIDS prevention intervention.
  – Treatment Externalities: Miguel and Kremer 2004
  – Social Externalities: Oster and Thornton 2011,
4. Setting

- 33 community day secondary schools (CDSS) in Lilongwe District, Malawi

- Target population: 9\textsuperscript{th} ~ 11\textsuperscript{th} grade students enrolled in 33 CDSSs

- Baseline survey: 7,680 students (3,832 males and 3,848 females) out of 10,715 enrolled students (72%); surveyed for demographics, socio-economic status, education, health, sexual behavior, social network, cognitive/non-cognitive testing, etc.
5. Research Design

• HIV/AIDS education and male circumcision
  – For each grade, randomly assign 0%, 50%, or 100% of education and male circumcision offer for the first year. In the second year, phase-in design takes place.
  – Free male circumcision offer with transportation subsidies (pick-up/voucher)
  – Education covers ABC policy, male circumcision benefit, and sugar daddy risk

• Conditional Cash Transfer:
  – For each grade, randomly assign 0% or 100% of the intervention
  – One-year program(tuition and monthly stipend). No phase-in.
5. Research Design

5-1. Complementarities

<table>
<thead>
<tr>
<th>Group</th>
<th>HIV/AIDS education</th>
<th>Male Circumcision</th>
<th>CCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>G2</td>
<td>0</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>G3</td>
<td>X</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>G4</td>
<td>x</td>
<td>X</td>
<td>0</td>
</tr>
<tr>
<td>G5</td>
<td>0</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>G6</td>
<td>0</td>
<td>X</td>
<td>0</td>
</tr>
<tr>
<td>G7</td>
<td>x</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>G8</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
5. Research Design

5-2. Externalities

- MC uptake rate 1: Group A/B (2\textsuperscript{nd}-year offer) vs. Group C/D (1\textsuperscript{st}-year offer)
- MC uptake rate 2: Group A vs. Group B
6. Estimation

6.1 Intention-to-treat analysis

\[ \text{Outcome}_{ijk} = \beta_0 + \beta_n \sum_{n=1}^{8} \text{Group}_n + \beta_9 X_{ijk} + \mu_k + \varepsilon_{ijk} \]

\text{Outcome}_{ijk} \text{ is an outcome variable of individual } i \text{ in class } j \text{ in school } k
\text{Group}_n \text{ is a dummy for each group}
X_{ijk} \text{ is a vector of control variables}
\mu_k \text{ is school fixed effect}
\varepsilon_{ijk} \text{ is an error term.}
6. Estimation

6.2 2SLS analysis

The second stage equation:

\[
\text{Outcome}_{ijk} = \beta_0 + \beta_1 E(EDU_{ijk}) + \beta_2 E(MC_{ijk}) + \beta_3 E(CT_{ijk}) + \beta_4 E(EDU_{ijk} \times MC_{ijk}) + \beta_5 E(EDU_{ijk} \times CT_{ijk}) + \beta_6 E(MC_{ijk} \times CT_{ijk}) + \beta_7 E(EDU_{ijk} \times MC_{ijk} \times CT_{ijk}) + \beta_8 X_{ijk} + \mu_k + \varepsilon_{ijk}
\]
6. Estimation

6.3 Externalities analysis

$$MC_{ijk} = \beta_0 + \beta_n \sum_{n=1}^{4} \text{Group}_n + \gamma_1 Z_{1ijk} + \gamma_2 Z_{2ijk} + \gamma_3 Z_{3ijk} + \beta_7 X_{ij} + \varepsilon_{ij}$$

- $Z_{1ijk}$ is class peer effect which is the proportion of students who get circumcised in the class of individual $i$ in his school when he gets a circumcision offer.
- $Z_{2ijk}$ is grade peer effect
- $Z_{3ijk}$ is school peer effect
7. Research Roadmap

- Baseline survey: January ~ May, 2012
- Follow-up survey: January ~ May, 2013

- Health-related outcomes and human capital development (cognitive and non-cognitive) will be the main topics of analysis.
# 8. Baseline Sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All (N = 6,900)</td>
<td>Boys (N=3,385)</td>
<td>Girls (N = 3,515)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>16.1499</td>
<td>1.96115</td>
<td>16.644</td>
<td>1.94933</td>
<td>15.6745</td>
<td>1.85218</td>
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<tr>
<td>Height</td>
<td>160.49</td>
<td>7.94426</td>
<td>164.495</td>
<td>7.7152</td>
<td>156.659</td>
<td>6.04747</td>
</tr>
<tr>
<td>Weight</td>
<td>53.0703</td>
<td>7.88804</td>
<td>54.3202</td>
<td>7.6316</td>
<td>51.8657</td>
<td>7.94498</td>
</tr>
<tr>
<td>Previous HIV/AIDS education</td>
<td>0.80614</td>
<td>0.39645</td>
<td>0.80487</td>
<td>0.39636</td>
<td>0.80736</td>
<td>0.39659</td>
</tr>
<tr>
<td>Knowing MC benefit</td>
<td>0.6231</td>
<td>0.6439</td>
<td>0.4182</td>
<td>0.4169</td>
<td>0.4194</td>
<td></td>
</tr>
<tr>
<td>Knowing Sugar-daddy risk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subject probability on HIV infection</td>
<td>16.4221</td>
<td>13.0991</td>
<td>17.7985</td>
<td>14.383</td>
<td>15.1003</td>
<td>11.5836</td>
</tr>
<tr>
<td>Previous HIV VCT experience</td>
<td>0.47928</td>
<td>0.49961</td>
<td>0.47537</td>
<td>0.49947</td>
<td>0.48303</td>
<td>0.49978</td>
</tr>
<tr>
<td>Circumcision status</td>
<td></td>
<td></td>
<td>0.11237</td>
<td>0.31586</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous pregnancy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.01147</td>
<td>0.1065</td>
</tr>
<tr>
<td>Sexual relation</td>
<td>0.26359</td>
<td>0.4407</td>
<td>0.32053</td>
<td>0.46694</td>
<td>0.20659</td>
<td>0.40508</td>
</tr>
<tr>
<td>Transactional sex</td>
<td>0.0388</td>
<td>(27/696)</td>
<td>0.0213</td>
<td>(10/469)</td>
<td>0.0749</td>
<td>(17/227)</td>
</tr>
</tbody>
</table>

**Notes:** This is not the entire dataset. The alpha-version of the entire 7,680 dataset will be available in July, 2012.
8. Baseline Sample
9. Project Malawi Photos

- Baseline Survey
9. Project Malawi Photos

- HIV/AIDS Education
9. Project Malawi Photos

- Male Circumcision
9. Project Malawi Photos

• Conditional Cash Transfer