Growing gender disparity in HIV infection in Uganda and policy implications

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on behalf of Oliver Ratmann, Joseph Kagaayi, Melodie Monad, Rakai Health Sciences Program and PANGEA-HIV Consortium
Gender disparities in HIV incidence

Age and gender targeted HIV programming
Changing HIV epidemic dynamics

NUMBER OF NEW HIV INFECTIONS AND AIDS-RELATED DEATHS, EASTERN AND SOUTHERN AFRICA, 2000–2020

-43%  
-50%

Shifting patterns in HIV incidence

Age patterns of HIV incidence in eastern and southern Africa: a modelling analysis of observational population-based cohort studies

Risher et al. Lancet HIV. 2021

Akullian et al. PNAS. 2021
1. What are the recent trends in HIV incidence in women?
2. Are disparities between men and women closing or widening?
3. Which male populations drive incidence in women, and vice versa?
4. What are the best strategies to close gaps and improve population health?

**HIV surveillance framework:** The Rakai Community Cohort Study (RCCS)
African HIV surveillance efforts

- Clinical and programmatic data
  - Antenatal care clinics
  - Adult and child HIV care clinics

- National surveys (e.g. Population based HIV Impact Assessment Surveys [PHIAs])

- Clinical trials

- Key population programs/cohorts

- Longitudinal population-based HIV cohorts (e.g., the Rakai Community Cohort Study)
Utility of longitudinal population surveillance cohorts

DETAILS AND DENOMINATORS!

• Fine scale information on who is acquiring and transmitting virus at a population-level

• Longitudinal trends on key metrics

• Impact evaluation

• Nested studies with adequate control groups
The Rakai Community Cohort Study (RCCS)

- Adolescents and adults 15+ residing in 34 communities
- 30 rural agrarian and semi-urban trading communities under surveillance since 1999 (28 since 1994)
- ~20,000 study participants surveyed every 1.5-2 years
- >300k participants contributing >1 million bio specimens
Cross sectional/longitudinal studies of individuals

Cross sectional/longitudinal studies of cohabitating couples

Egocentric network data

Population trends

Randomized clinical trials (individual and community)

Molecular epidemiology

Basic laboratory research
Growing gender disparity in HIV infection in Africa: sources and policy implications


Rakai Health Sciences Program and the PANGEA-HIV consortium

doi: https://doi.org/10.1101/2023.03.16.23287351
Trends in HIV incidence in the RCCS, 2003 - 2018
• 1100 incident cases observed over 127k PY, 2003-2018

• Faster declines in HIV incidence in men than women, ages 25 and above.
60-80% decline, except women aged 25-49
• PANGEA-HIV: pan-African HIV pathogen genomics program integrated with population surveillance
**PANGEA-HIV:**
pan-African HIV pathogen genomics program integrated with population surveillance

<table>
<thead>
<tr>
<th></th>
<th>Participants with HIV</th>
<th>Participants reporting no ART use at first visit</th>
<th>Participants with HIV and with virus ever deep-sequenced †</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n)</td>
<td>(n)</td>
<td>(%)</td>
</tr>
<tr>
<td>Total</td>
<td>5682</td>
<td>4341</td>
<td>38 %</td>
</tr>
<tr>
<td>Female (Total)</td>
<td>3817</td>
<td>2836</td>
<td>34 %</td>
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<tr>
<td>Age</td>
<td></td>
<td></td>
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<tr>
<td>15-24</td>
<td>1066</td>
<td>817</td>
<td>40 %</td>
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<tr>
<td>25-34</td>
<td>2074</td>
<td>1488</td>
<td>36 %</td>
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<tr>
<td>35-49</td>
<td>1446</td>
<td>826</td>
<td>28 %</td>
</tr>
<tr>
<td>Male (Total)</td>
<td>1865</td>
<td>1506</td>
<td>47 %</td>
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<tr>
<td>Age</td>
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<td></td>
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<tr>
<td>15-24</td>
<td>272</td>
<td>220</td>
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<tr>
<td>25-34</td>
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<td>782</td>
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<td>984</td>
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<td>10</td>
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<td>–</td>
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<td>17</td>
<td>2015</td>
<td>646</td>
<td>933</td>
</tr>
<tr>
<td>18</td>
<td>1860</td>
<td>432</td>
<td>848</td>
</tr>
</tbody>
</table>

† Individuals with virus ever deep-sequenced were defined as HIV-positive individuals with deep-sequence output meeting minimum quality criteria, see Methods. ‡ Totals by round include individuals seen in other rounds.
PANGEA-HIV: Reconstructing source recipient pairs from deep sequence data

- HIV deep sequencing provides multiple sequence fragments per person
- Think: phylogeography between individuals
- Inference of transmission direction

Wymant et al. MBE 2017
Hall et al. Elife 2019
Ratmann et al. Nature Communications 2019
Ratmann et al. Lancet HIV 2020
Xi et al. JRSSC 2022
Transmission cohort, 2013-2018

Identified 236 heterosexual source-recipient pairs

Retained 227 in whom transmission was estimated to have occurred during the study period.
Dating the likely infection time with deep-sequence data

- Used phyloTSI algorithm
- Augmented infection time estimates with epidemiologic data

Golubchik et al. MedRxiv. 2022
• Age profile of male sources (blue), and female sources (pink)

• Blue + red = 100%
• Proportion of transmissions from men is increasing

• Transmissions from men are shifting to older ages
• Adolescent girls and young women are infected by unusually older male partners.

• As women age, age difference between woman and infecting partner decreases.
Possible mechanism:

- Decoupling of prevalence and population-level viral load (~ still infectious).
• Faster declines in population-level viral load in women.
• Substantial suppression gap by 2018 in men vs women
• Counterfactual simulations of modelled intervention scenarios on inferred transmission flows
• Having closed the viral load suppression gap between men and women, would have reduced HIV incidence by 50% in women over the last decade.

• Only a small number of men needed to treat to achieve substantial reductions in female HIV incidence.
Conclusion

- HIV incidence has declined faster among men than women.

- Average age of infection is increasing among women; and avg. age of transmission is increasing among men.

- While viral load suppression has increased in both genders, the viral load suppression gap has increased between men and women.

- Men are accounting for an increasing proportion of transmissions.

- Having closed the viral load suppression gap between men in women, would have reduced female HIV incidence by 50%.
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