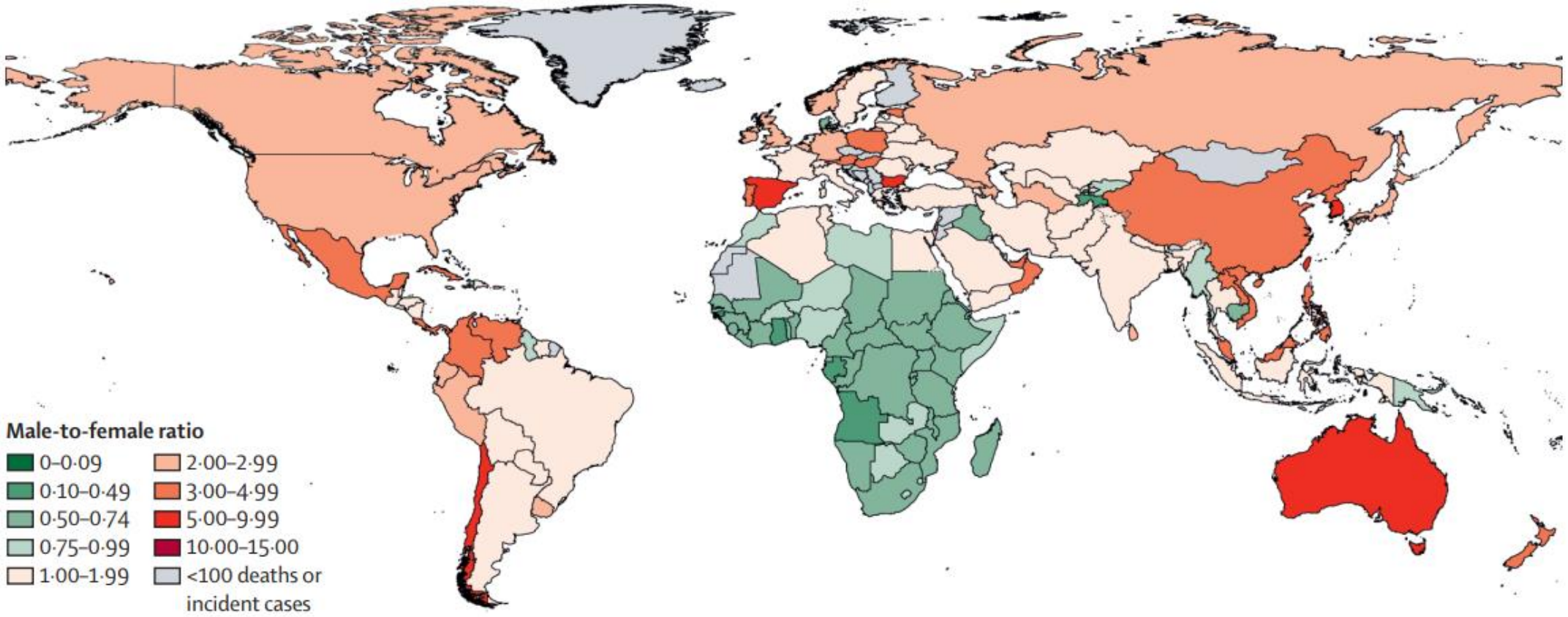
Growing gender disparity in HIV infection in Uganda and policy implications

Joseph Kagaayi

on behalf of Oliver Ratmann, Kate Grabowski, Melodie Monad, Rakai Health Sciences Program and PANGEA-HIV Consortium

Gender disparities in HIV incidence

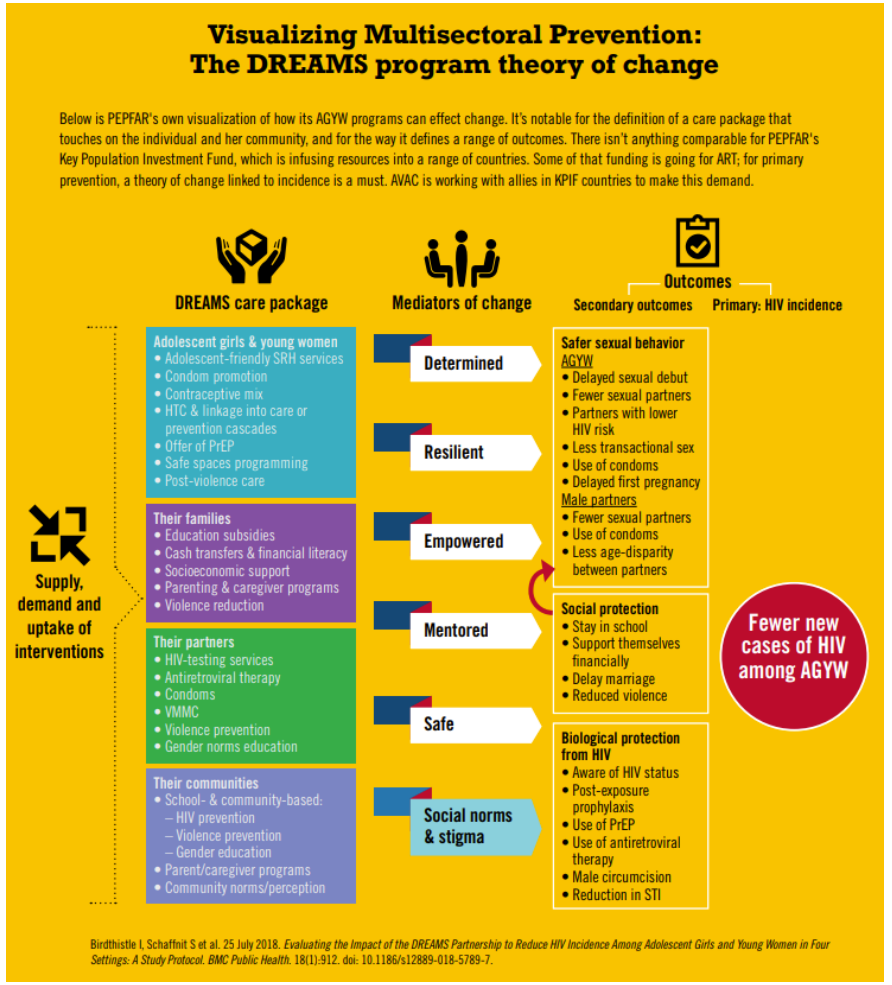


Jahagirdar et al. *Lancet HIV*. 2021

Age and gender targeted HIV programming

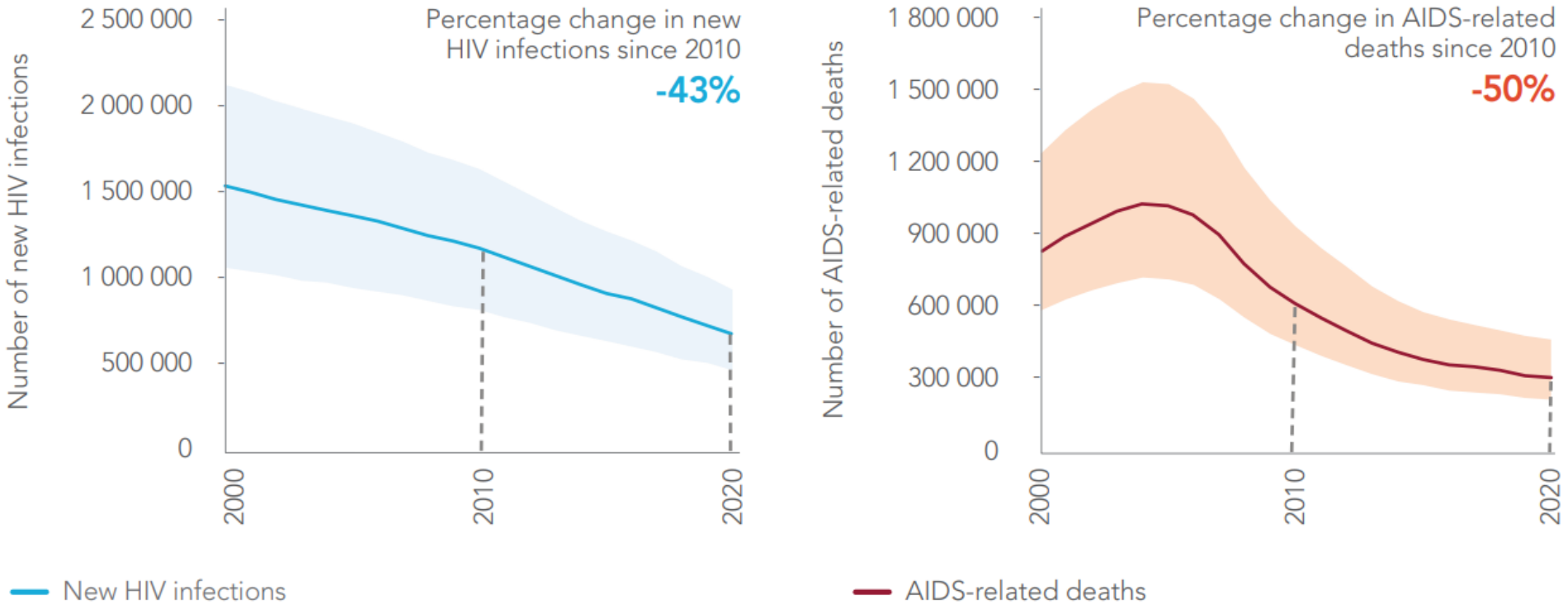
DREAMS

WORKING TOGETHER FOR AN AIDS-FREE FUTURE FOR GIRLS & WOMEN



Changing HIV epidemic dynamics

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



Source: UNAIDS epidemiological estimates, 2021 (https://aidsinfo.unaids.org/).

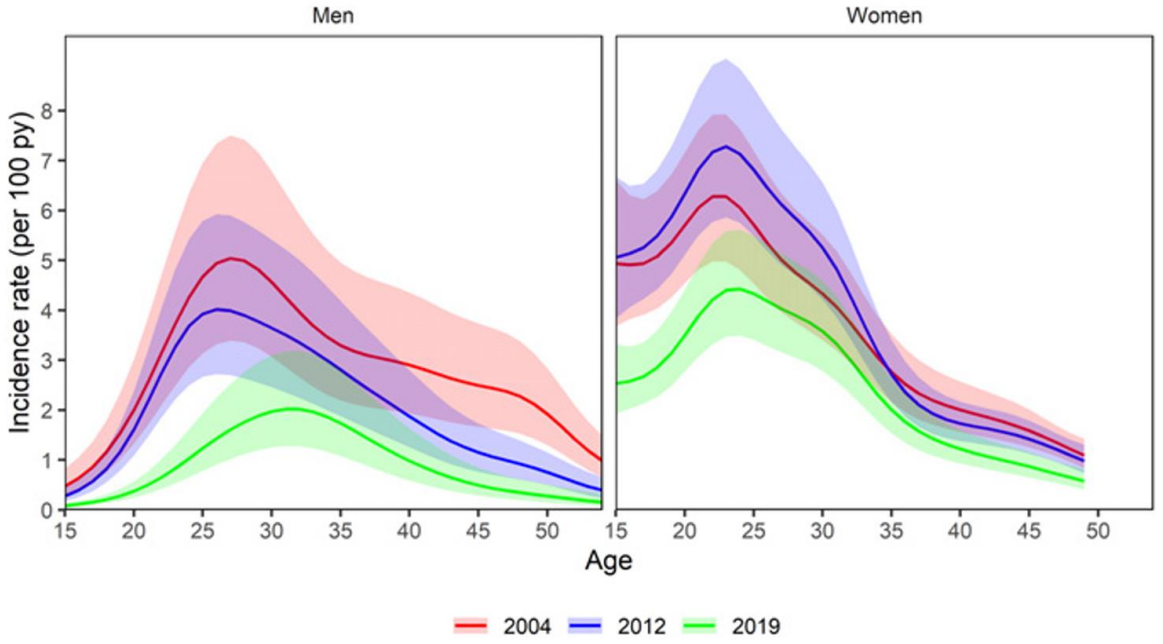
Shifting patterns in HIV incidence

Articles

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

Kathryn A Risher, Anne Cori, Georges Reniers, Milly Marston, Clara Calvert, Amelia Crampin, Tawanda Dadirai, Albert Dube, Simon Gregson, Kobus Herbst, Tom Lutalo, Louisa Moorhouse, Baltazar Mtenga, Dorean Nabukalu, Robert Newton, Alison J Price, Malebogo Tlhajoane, Jim Todd, Keith Tomlin, Mark Urassa, Alain Vandormael, Christophe Fraser, Emma Slaymaker, Jeffrey W Eaton, on behalf of the ALPHA Network

Risher et al. *Lancet HIV*. 2021

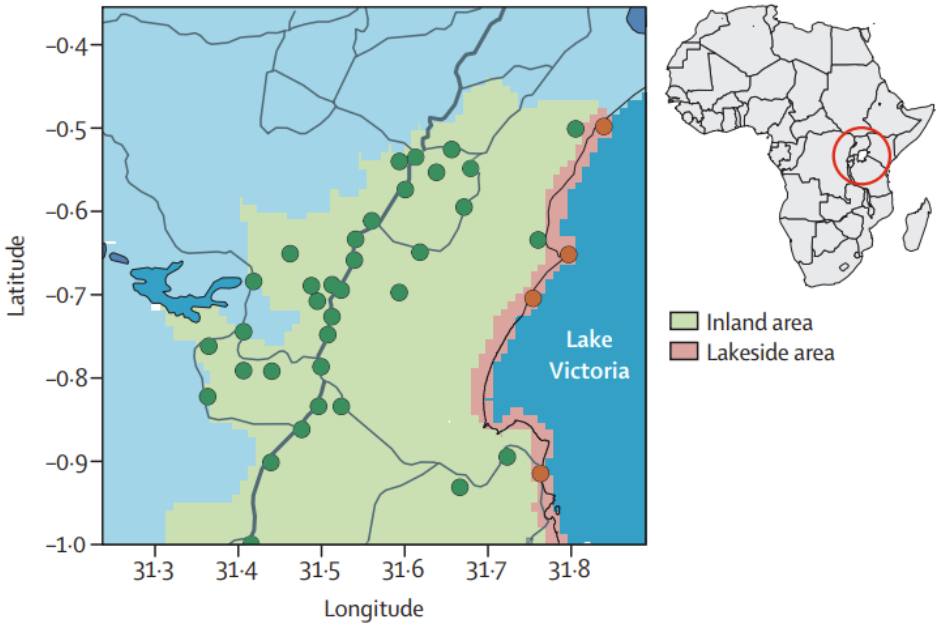


Akullian et al. *PNAS*. 2021

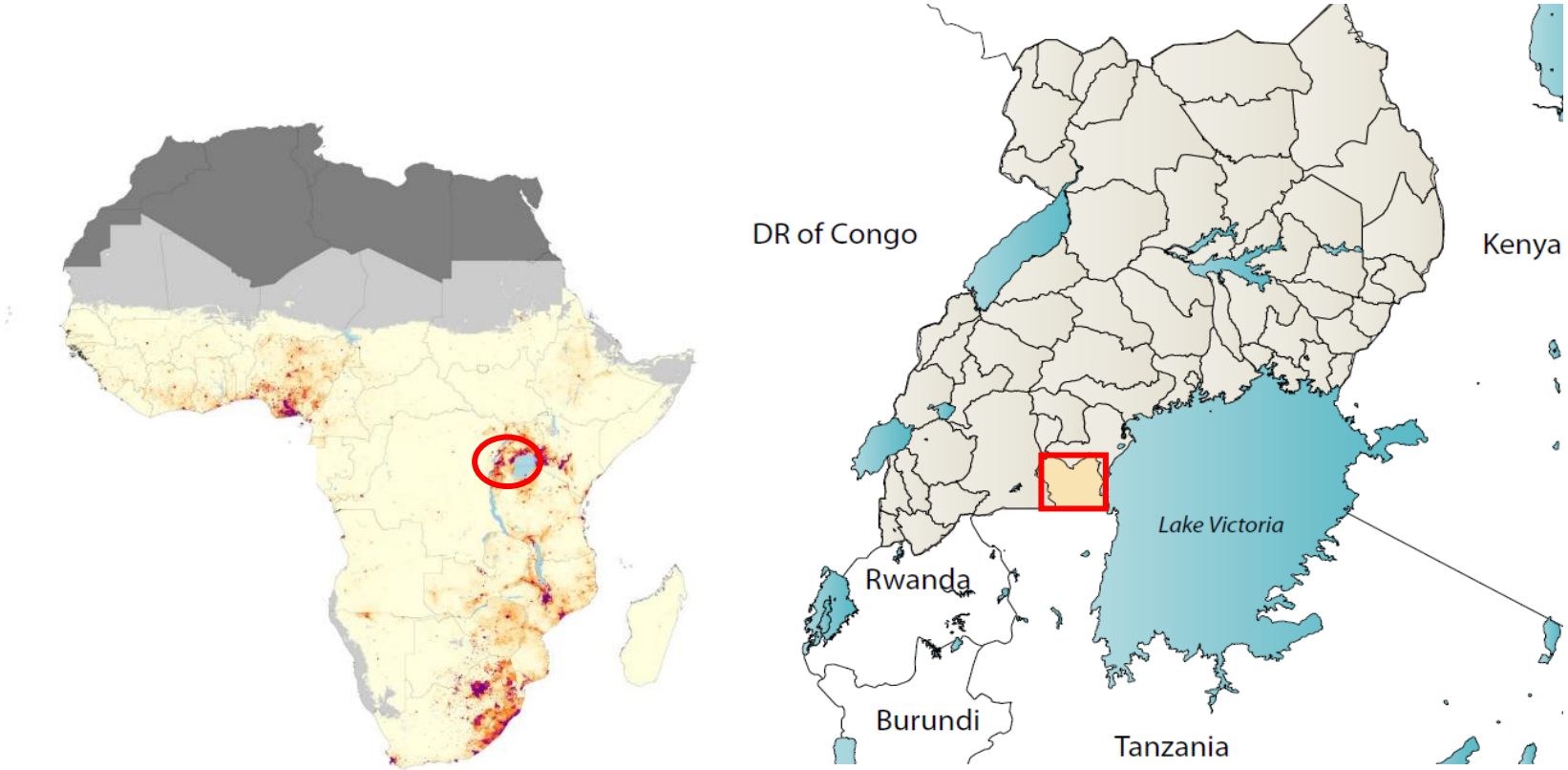
Shifting patterns in HIV transmission?

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)

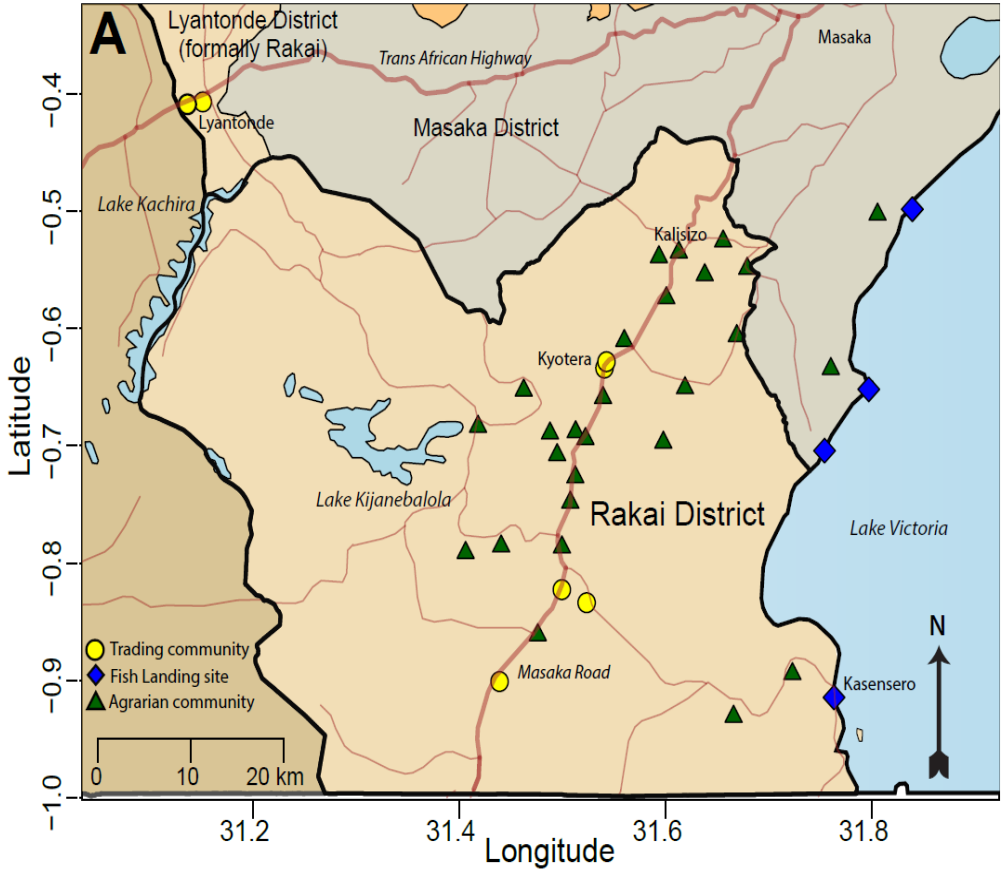


Rakai, Uganda



The Rakai Community Cohort Study (RCCS)

- Adolescents and adults 15+ residing in 34 communities
- 30 rural agrarian and semi-urban trading communities 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



Population census

Survey

Biospecimens/biometrics

Services

medRxiv
THE PREPRINT SERVER FOR HEALTH SCIENCES
Cold Spring Harbor Laboratory BMJ Yale
PANGEA HIV

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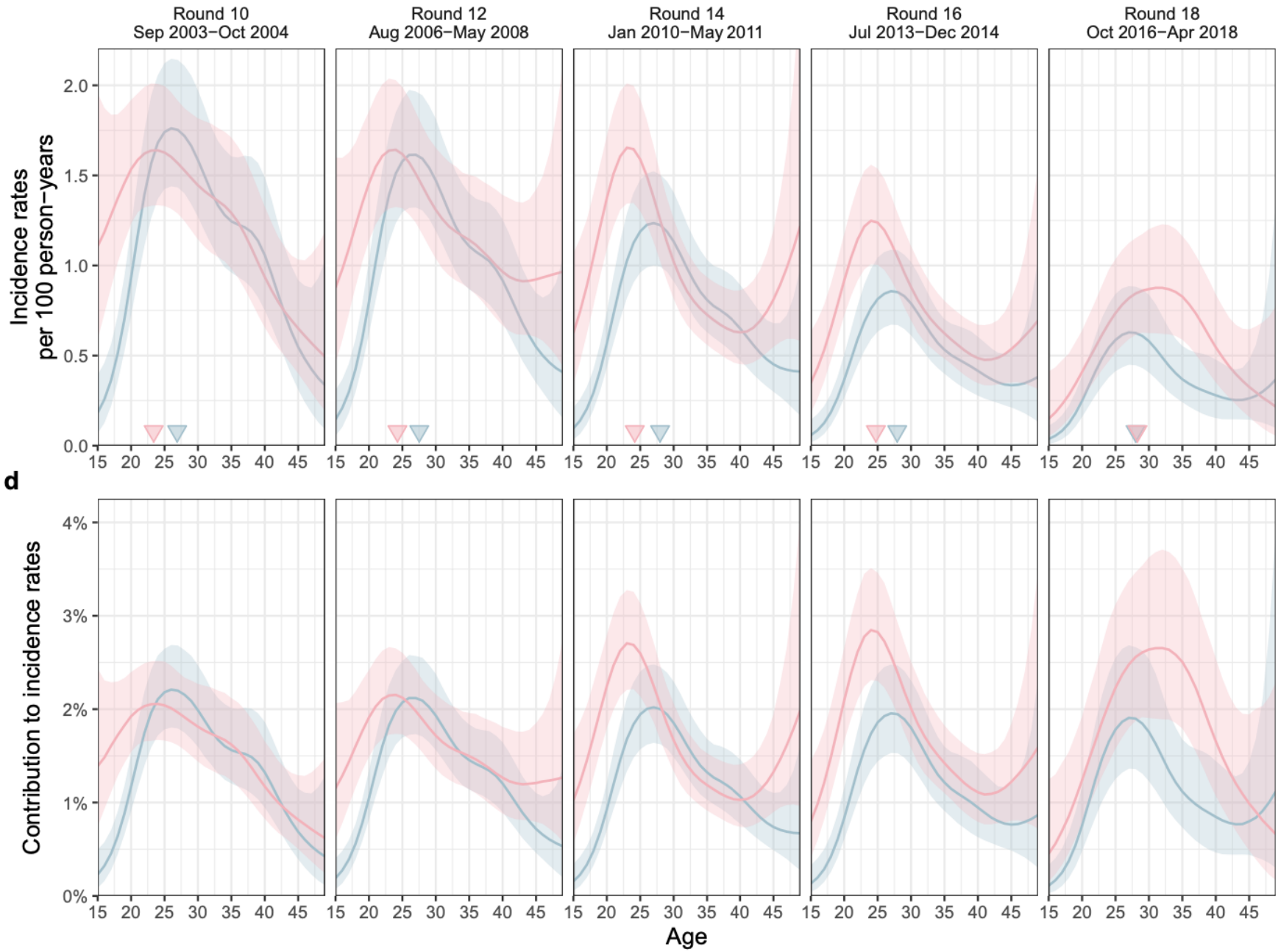
Growing gender disparity in HIV infection in Africa: sources and policy implications

Mélodie Monod, Andrea Brizzi, Ronald M Galiwango, Robert Ssekubugu, Yu Chen, Xiaoyue Xi, Edward Nelson Kankaka, Victor Ssempijja, Lucie Abeler Dörner, Adam Akullian, Alexandra Blenkinsop, David Bonsall, Larry W Chang, Shozen Dan, Christophe Fraser, Tanya Golubchik, Ronald H Gray, Matthew Hall, Jade C Jackson, Godfrey Kigozi, Oliver Laeyendecker, Lisa A. Mills, Thomas C. Quinn, Steven J. Reynolds, John Santelli, Nelson K. Sewankambo, Simon EF Spencer, Joseph Ssekasanvu, Laura Thomson, Maria J Wawer, David Serwadda, Peter Godfrey-Faussett, Joseph Kagaayi, M Kate Grabowski, Oliver Ratmann
Rakai Health Sciences Program and the PANGEA-HIV consortium

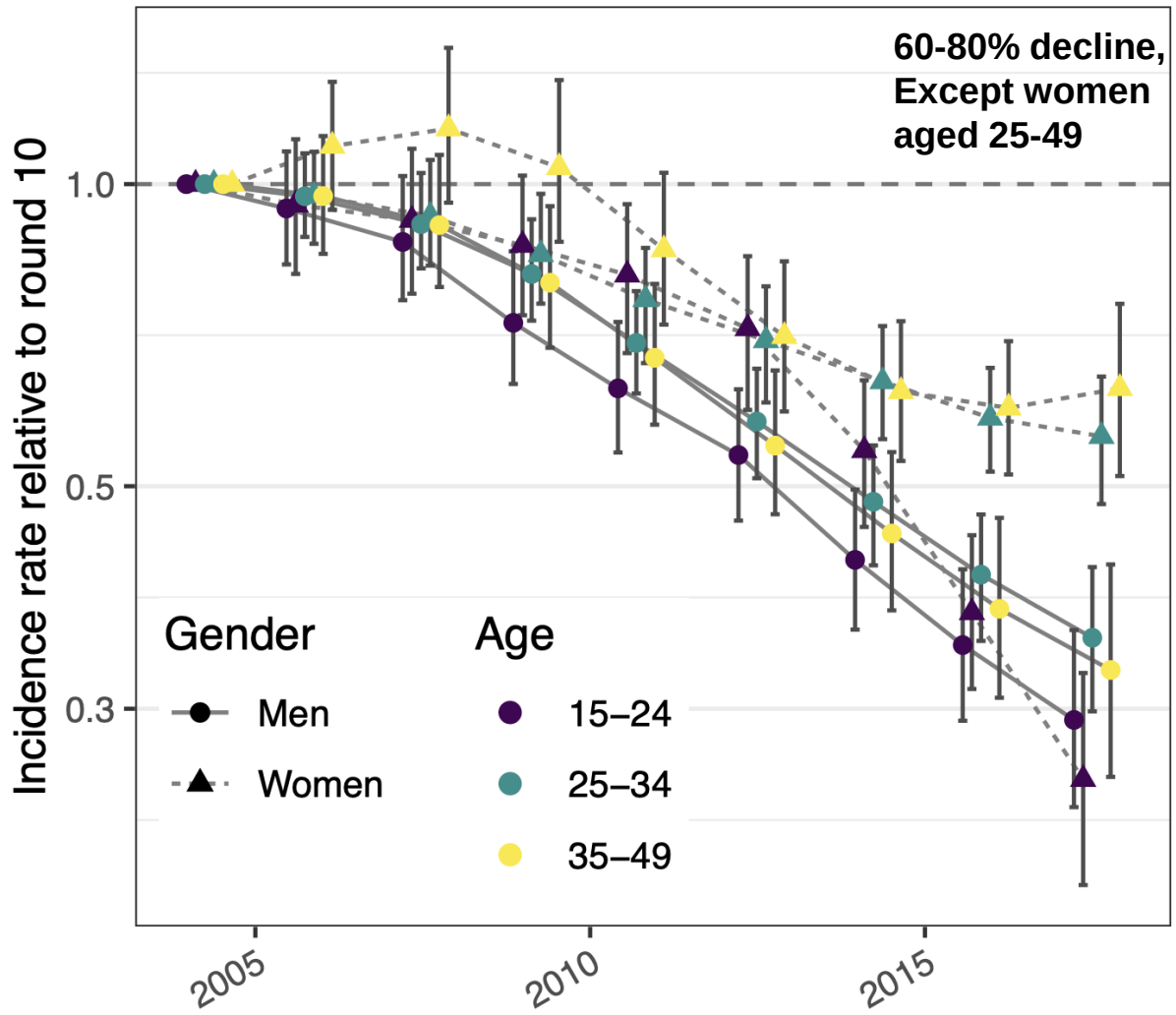
doi: https://doi.org/10.1101/2023.03.16.23287351

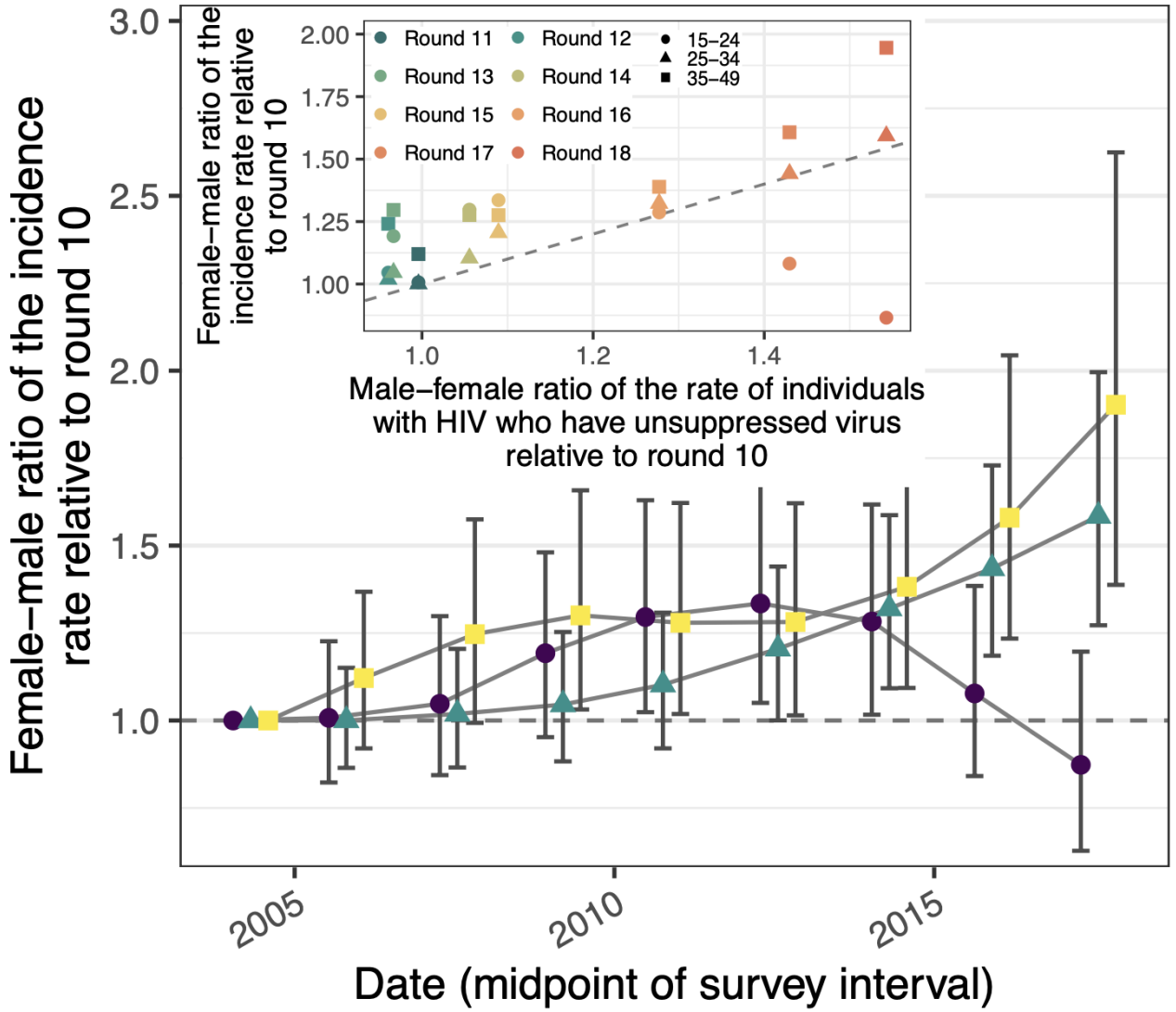
Trends in HIV incidence in the RCCS, 2003 - 2018

- 1100 incident cases observed over 127k PY, 2003-2018
- Faster declines in HIV incidence in men than women, ages 25 and above.

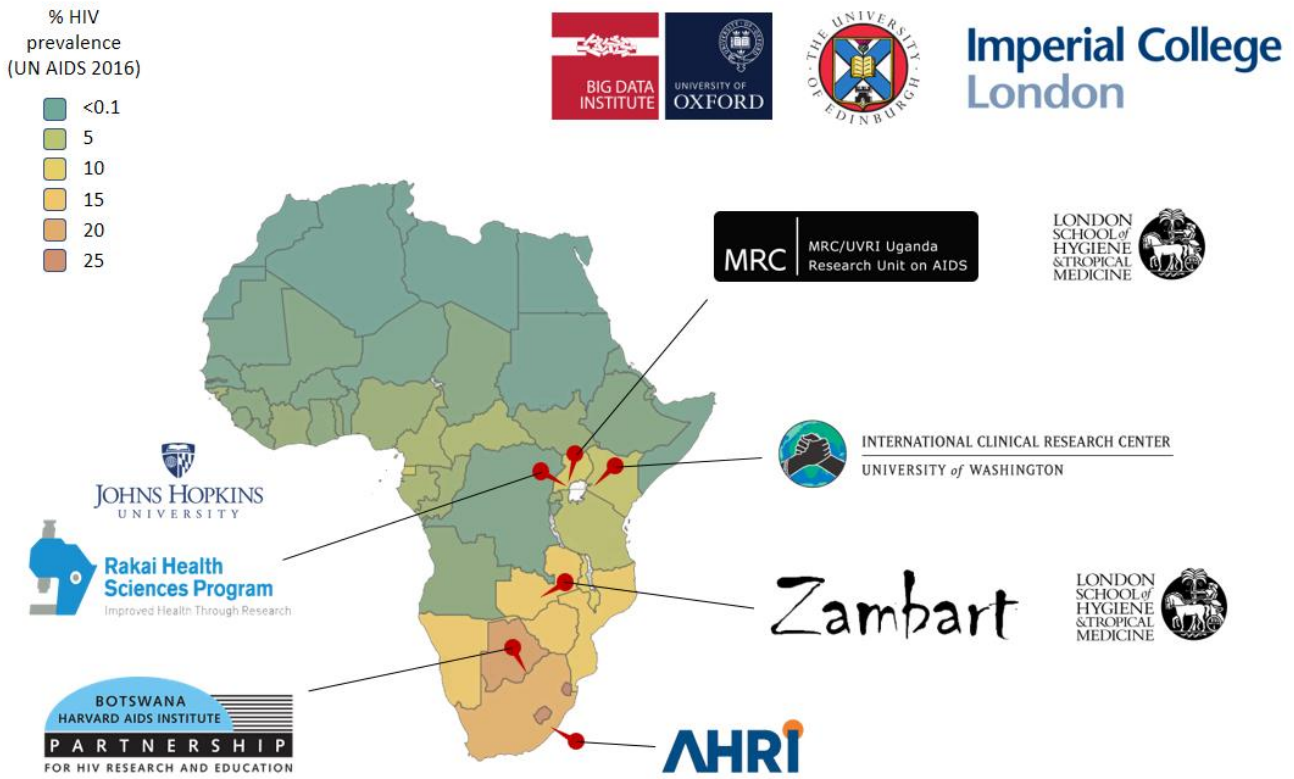


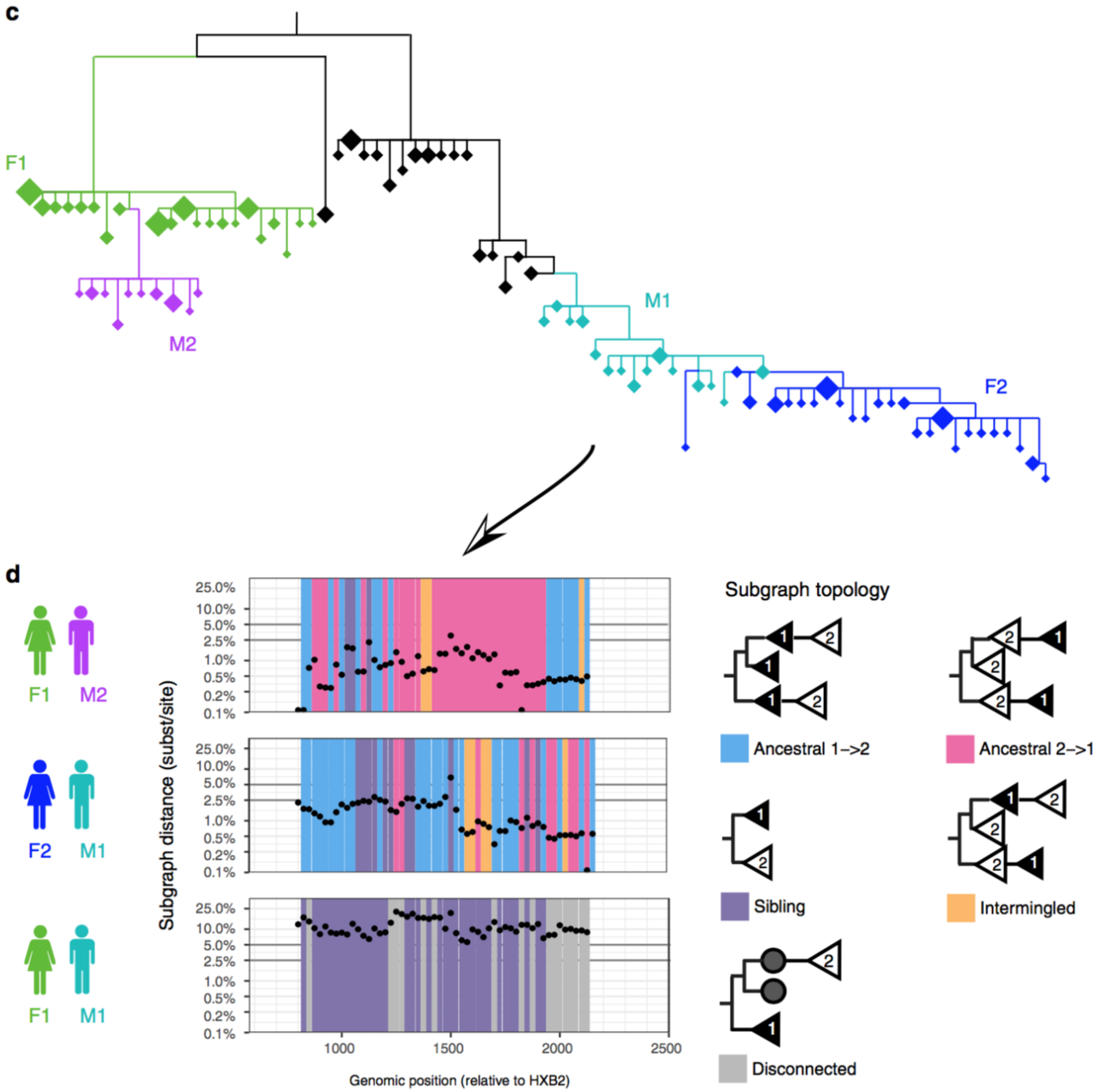
b


60-80% decline,
Except women
aged 25-49
Incidence rate relative to round 10
1.0
0.5
0.3
Gender
Men
Women
Age
15–24
25–34
35–49
2005
2010
2015


Female–male ratio of the incidence rate relative to round 10
3.0
2.5
2.0
1.5
1.0
Round 11
Round 12
Round 13
Round 14
Round 15
Round 16
Round 17
Round 18
15–24
25–34
35–49
Female–male ratio of the incidence rate relative to round 10
2.00
1.75
1.50
1.25
1.00
1.0
1.2
1.4
Male–female ratio of the rate of individuals with HIV who have unsuppressed virus relative to round 10
2005
2010
2015
Date (midpoint of survey interval)

- **PANGEA-HIV: pan-African HIV pathogen genomics program integrated with population surveillance**

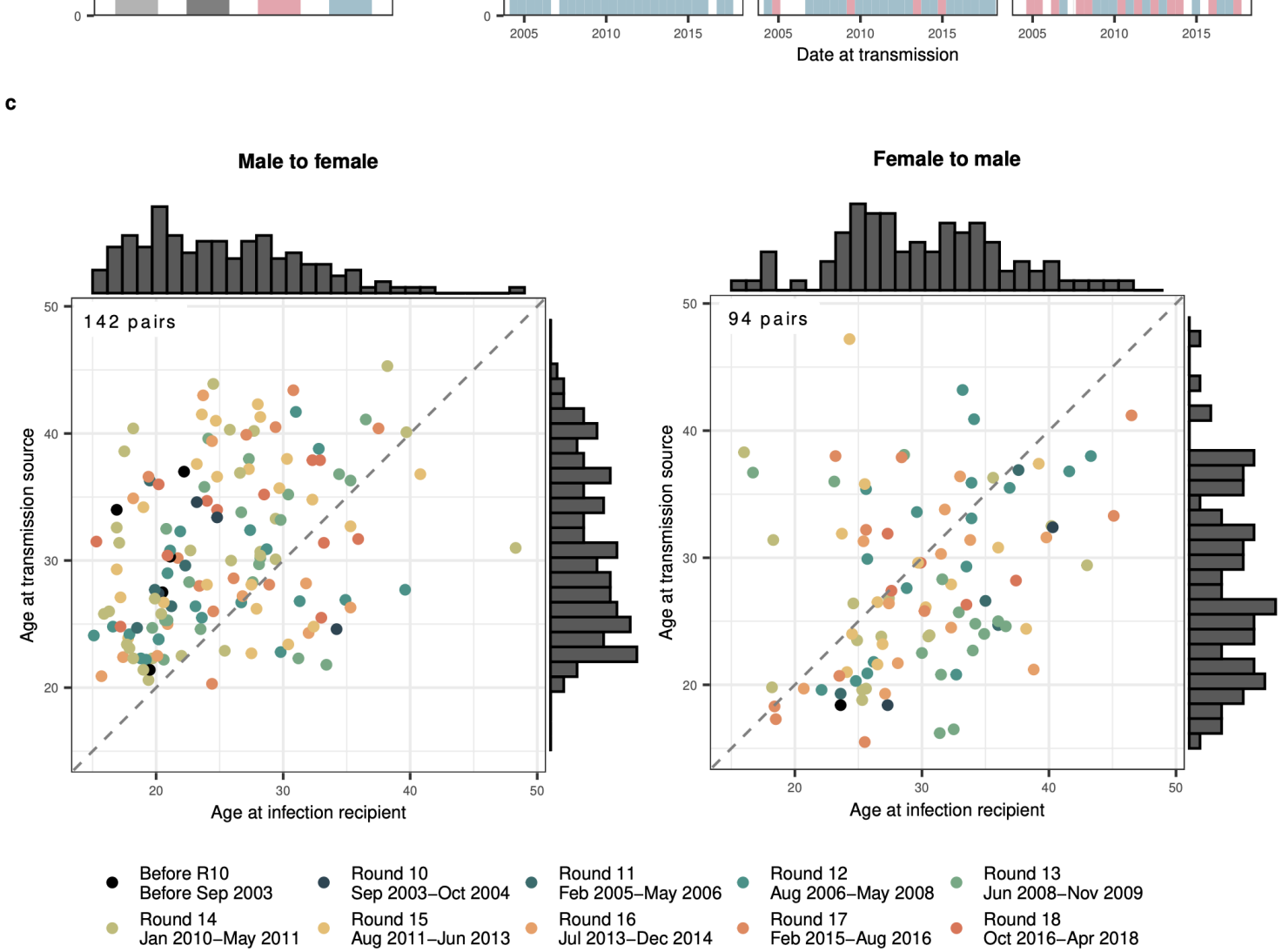




PANGEA-HIV: Reconstructing source recipient pairs from deep sequence data

- 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

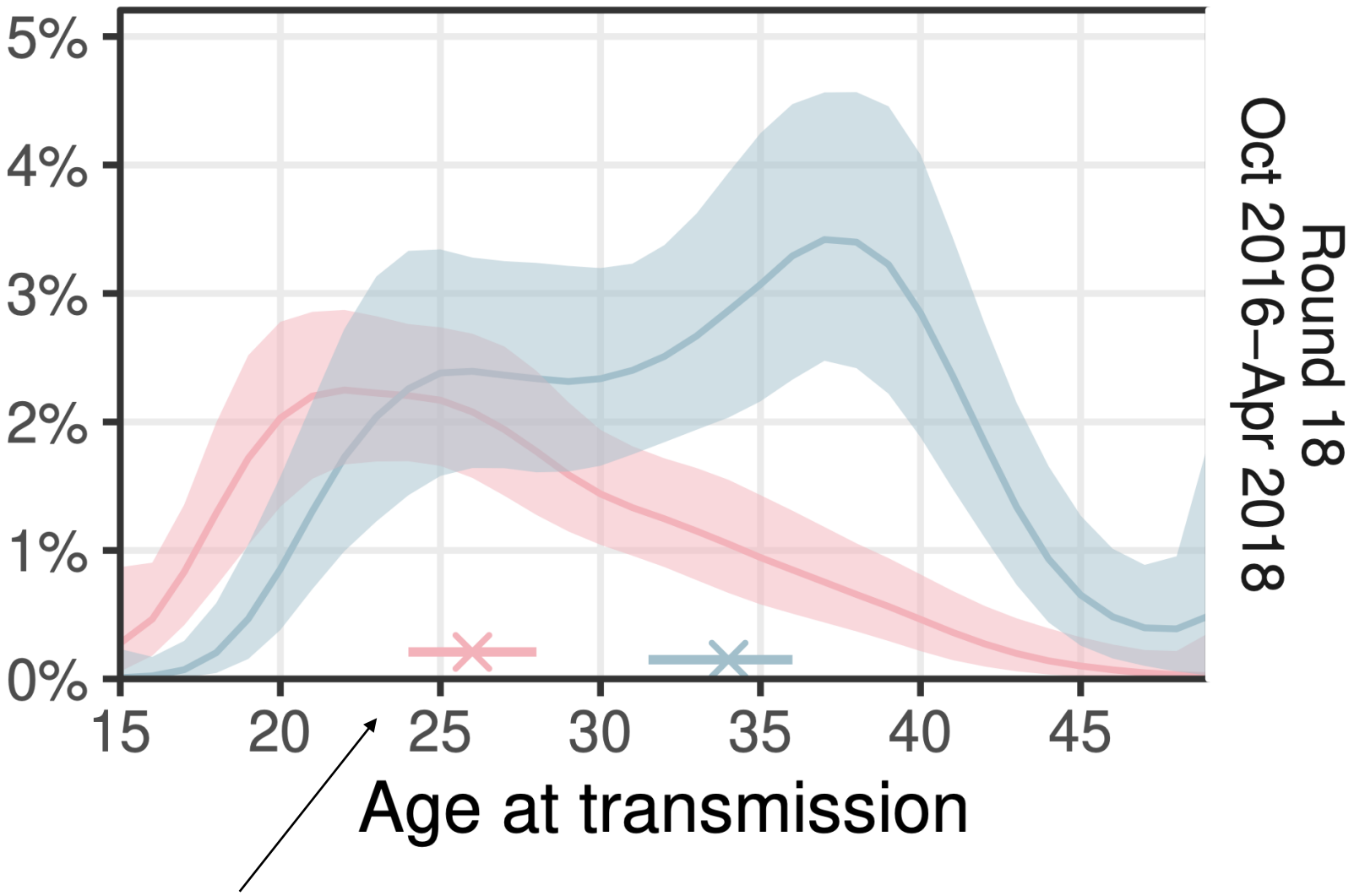


Transmission cohort, 2013-2018

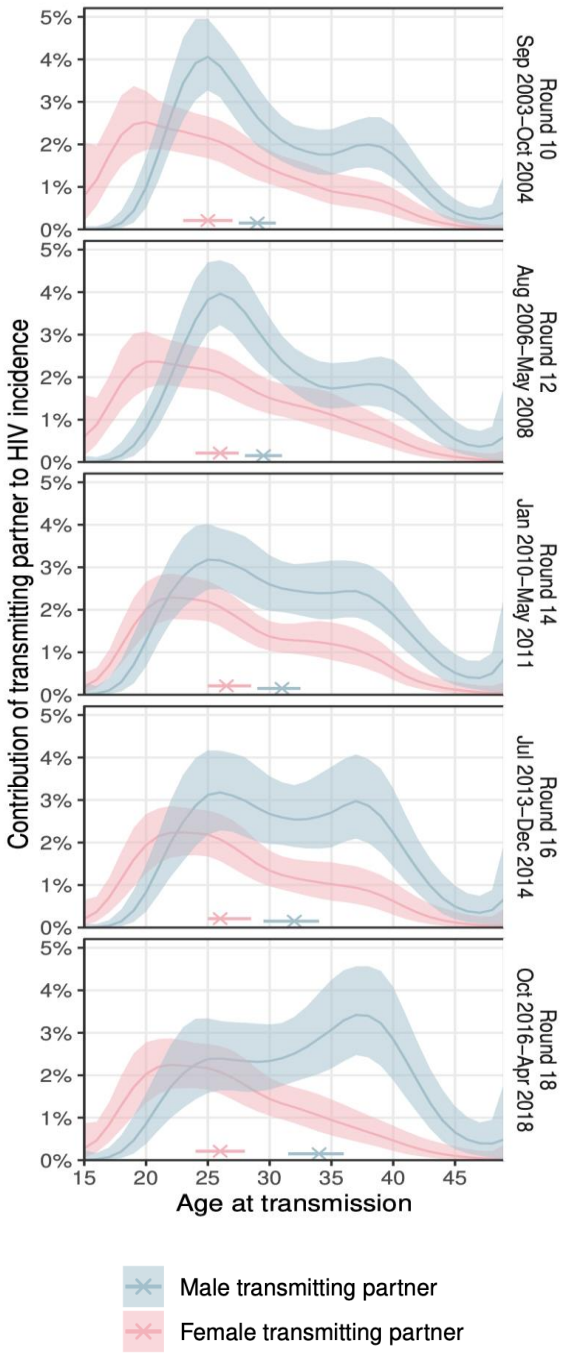
Identified 236 heterosexual source-recipient pairs

Retained 227 in whom transmission was estimated to have occurred during the study period.

- **Age profile of male sources (blue), and female sources (pink)**
- **Blue + red = 100%**

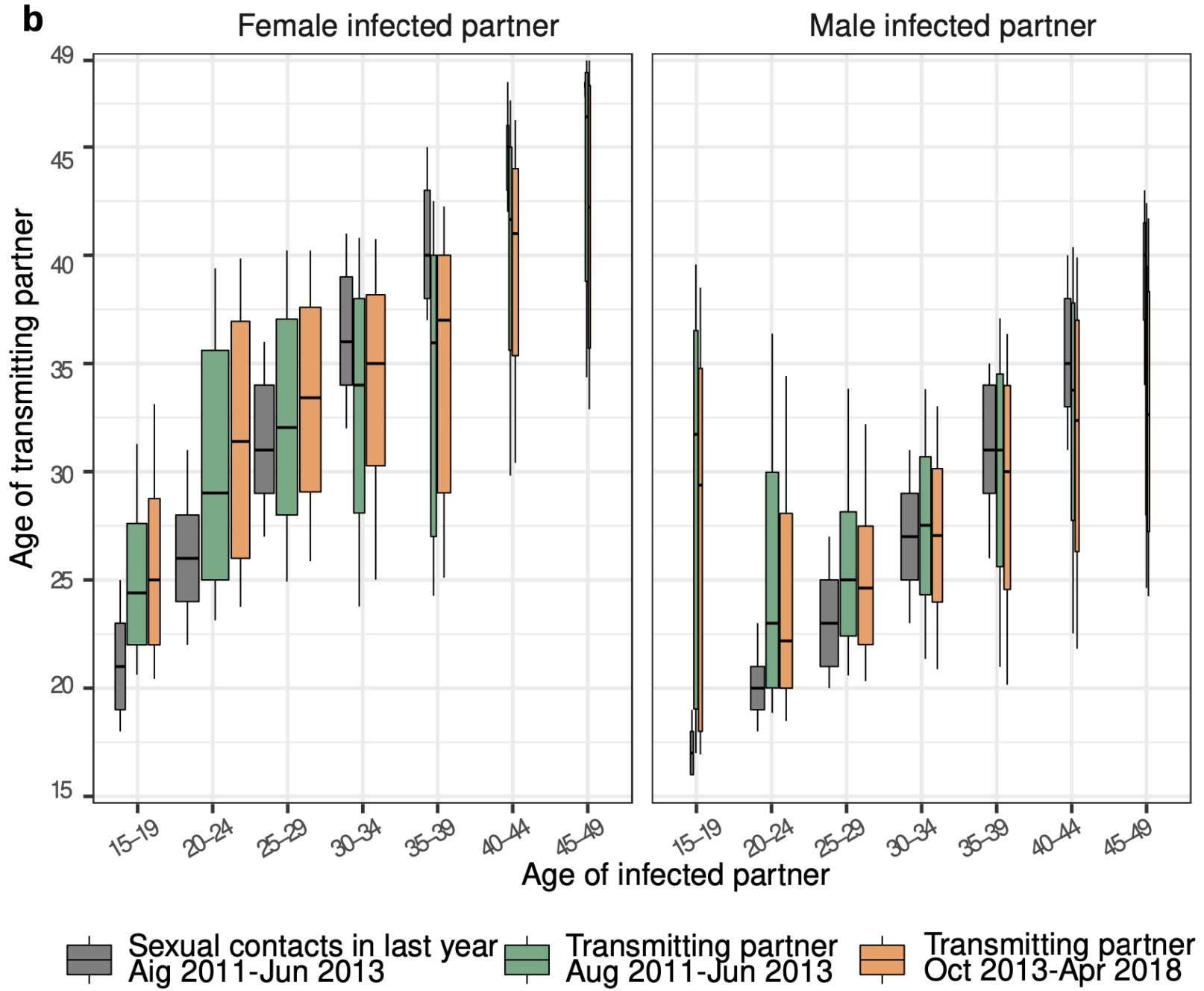


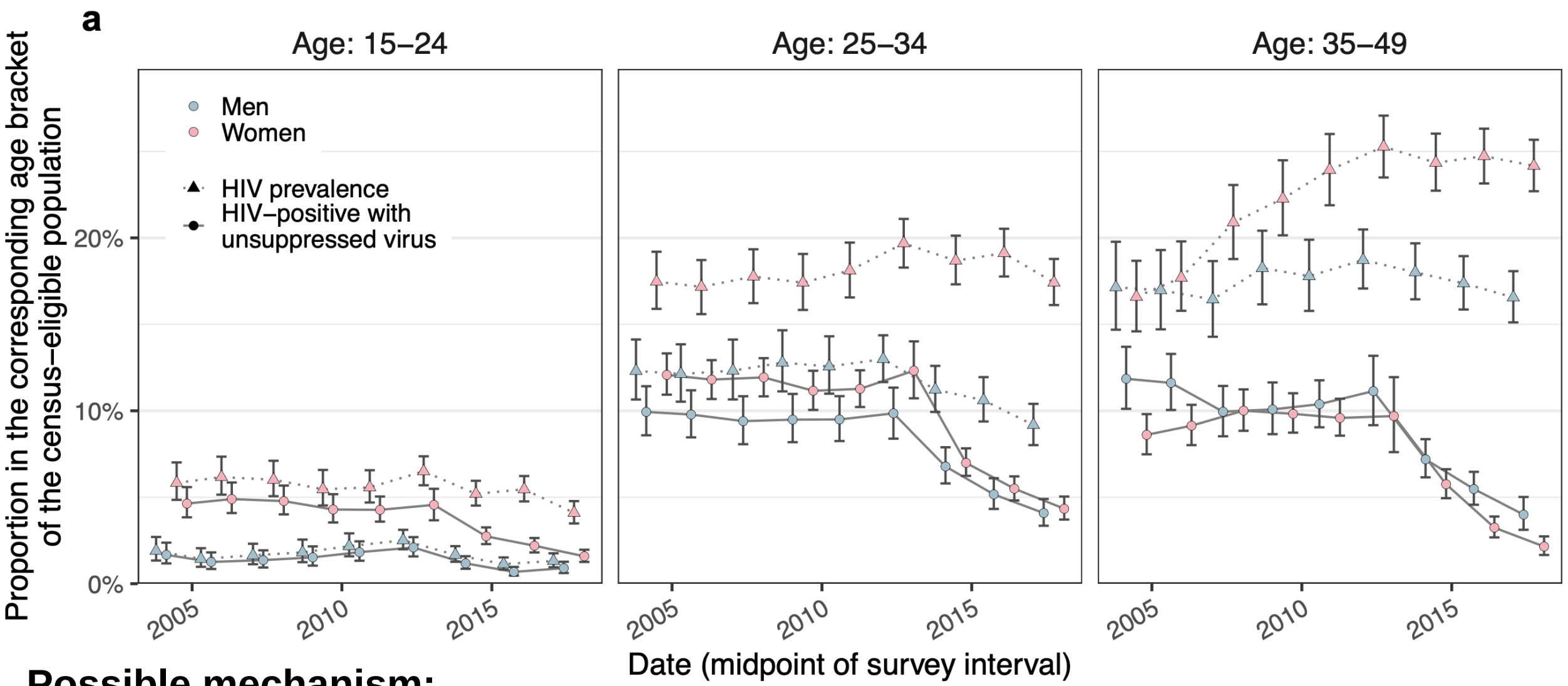
%transmission from men
57.9% [56.1-59.6]
61.9% [60.2-63.7]
62.8% [60.2-65.2]



- Proportion of transmissions from men is increasing
- Transmissions from men are shifting to older ages

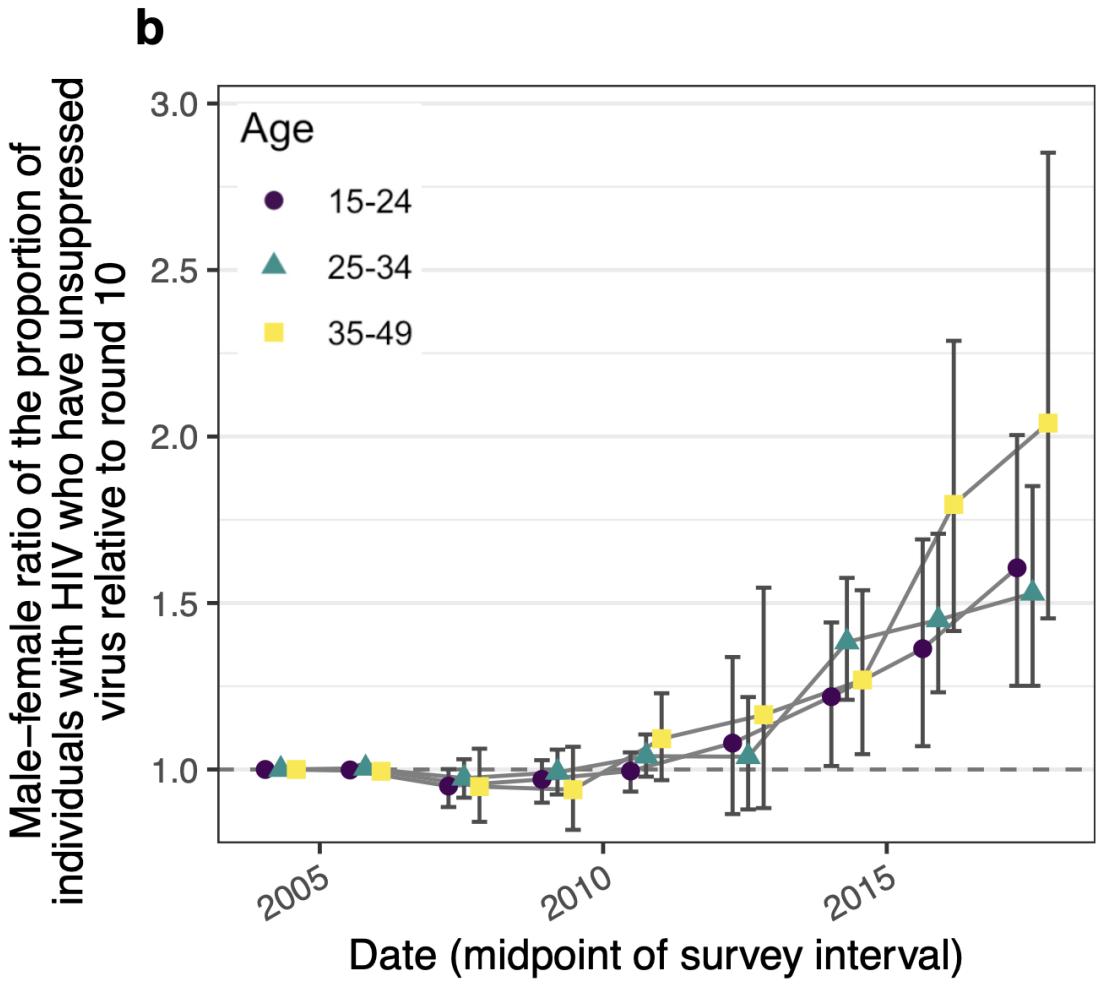
- Adolescent girls and young women are infected by unusually older male partners.
- As women age, age difference between woman and infecting partner decreases.

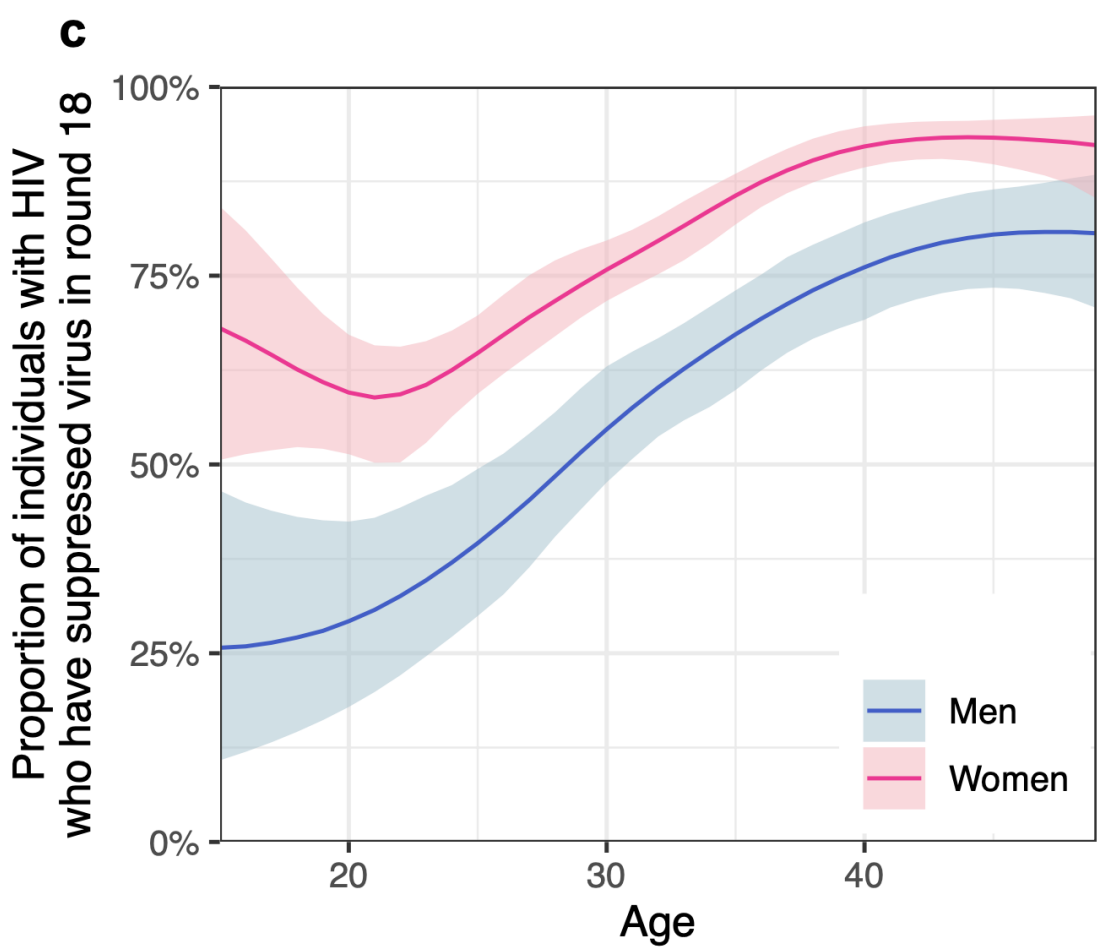




Possible mechanism:

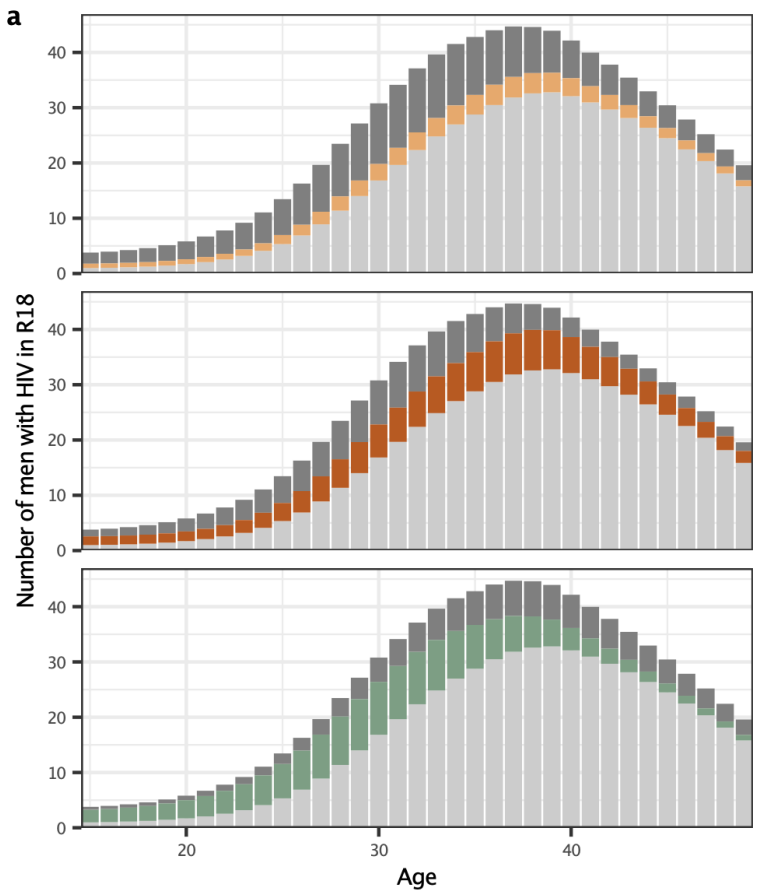
- Decoupling of prevalence and population-level viral load (~ still infectious).

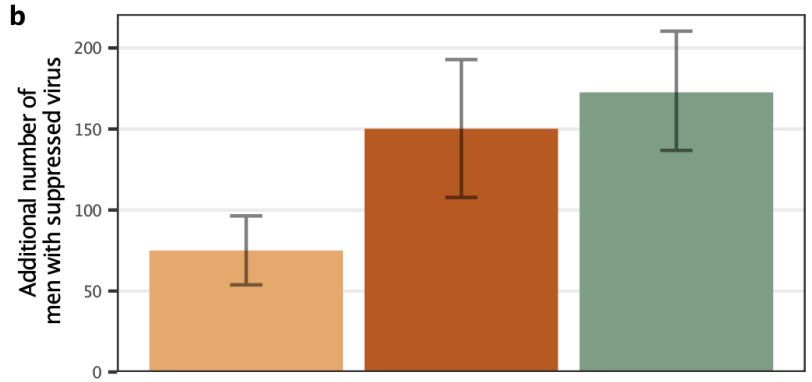


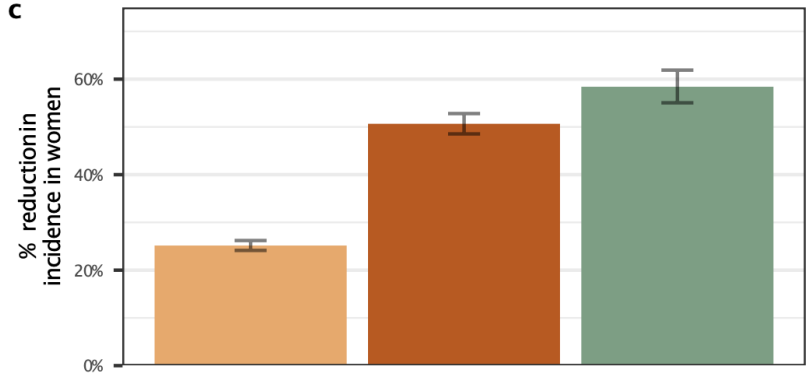


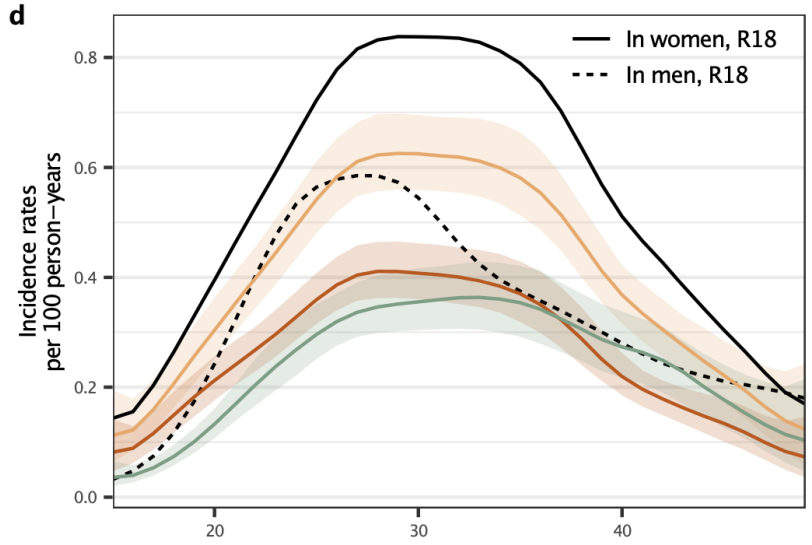
- Faster declines in population-level viral load in women.
- Substantial suppression gap by 2018 in men vs women

- Counterfactual simulations of modelled intervention scenarios on inferred transmission flows

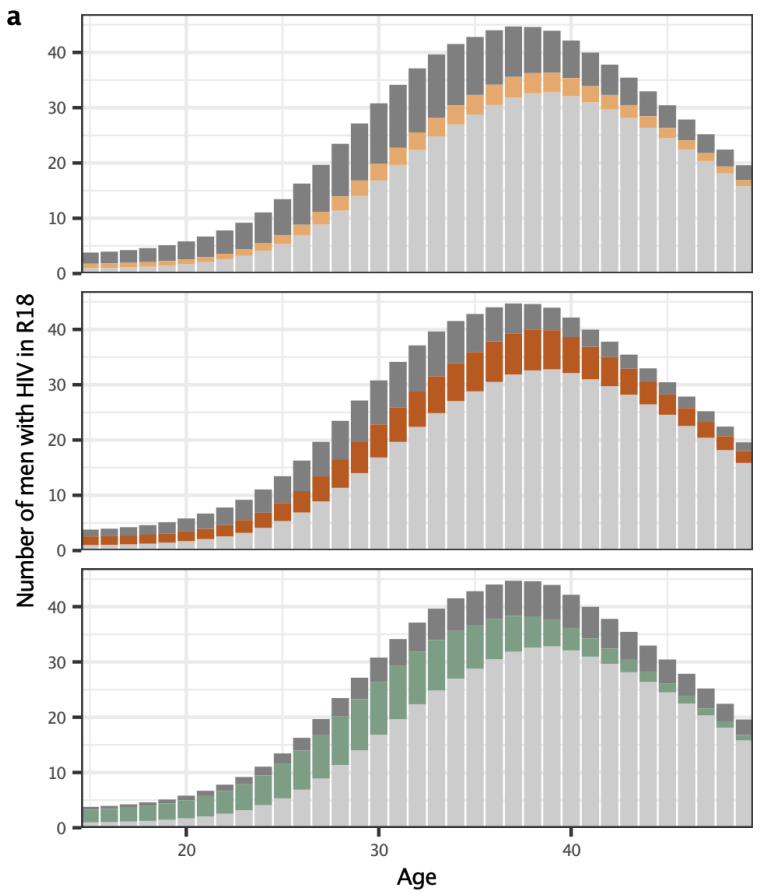


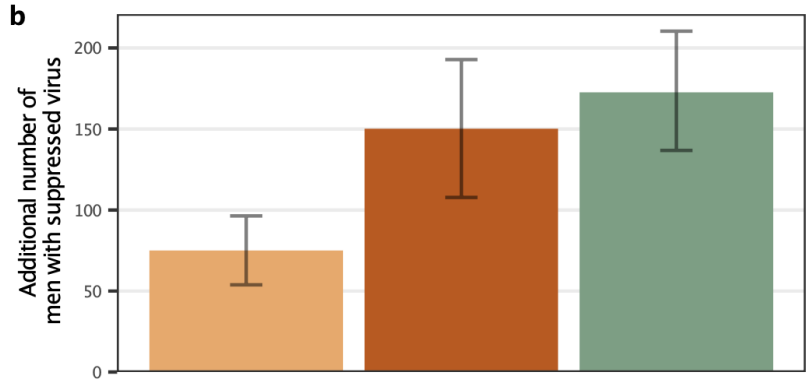


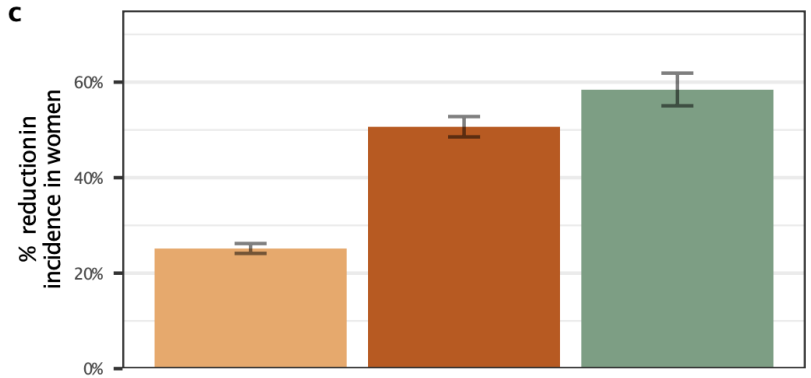


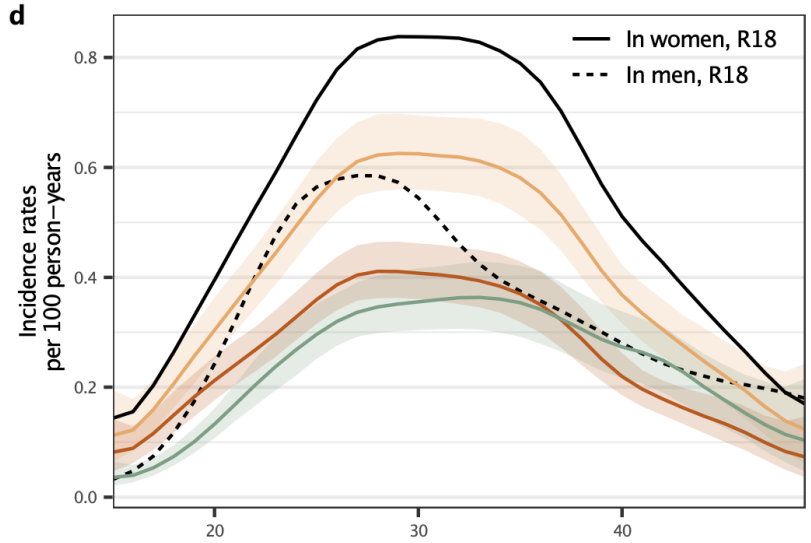


- Having closed the viral load suppression gap between men and women, would have reduced HIV incidence by 50% in women over the last decade.
- Only a small number of men needed to treat to achieve substantial reductions in female HIV incidence.









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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