Relationship between client age profile and unit cost among PEPFAR-supported voluntary medical male circumcision programs for HIV prevention, 2015

Division of Global HIV & TB, Center for Global Health, CDC, Atlanta, GA: Stephanie Davis, Hani Nasrallah, Sherri Pals, Carlos Toledo
Emory University, Rollins School of Public Health, Atlanta, GA: Brian Batayeh

Background

- Male circumcision reduces men's risk of acquiring HIV through heterosexual sex by about 60%.
- Voluntary medical male circumcision (VMMC) of males 10 years and older is a key component of U.S. President's Emergency Plan for AIDS Relief (PEPFAR)-supported HIV prevention in 14 southern and eastern African countries.
- Since 2015, PEPFAR's priority client age band for circumcision has been 15-29 years, for immediate HIV prevention. This "age pivot" is based on modeling results showing that circumcisions in this age band have the greatest immediate impact on the HIV epidemic.
- However, demand for VMMC is intrinsically higher in 10-14-year-olds, while the service package is the same across ages. The age pivot has raised concern that unit expenditures (UEs), expenditures per circumcision, may increase due to factors like increased demand creation costs.
- PEPFAR routinely collects annual expenditure and achievement data from the implementing partner organizations ("partners") it supports to conduct VMMC. Analysis of the 2015 data, collected before the "age pivot", allows exploration of whether this association existed at baseline.

Methods

- Routinely collected PEPFAR annual data from each partner in each country includes:
  - Expenditures: total expenditures on performing VMMC, summed across multiple expenditure categories.
  - Achievements: total number of circumcisions performed in each age band: 10-14, 15-19, 20-24, and 25-29 years.
- Inclusion criteria for partner-level observations: must have both age and expenditure data, and UE must be >$40 (lower values not plausible, as they indicate PEPFAR is not paying the entire cost).
- Analysis was performed at both the country level (combining all partners in-country) and the partner level (with partners working in multiple countries counted separately in each country).
- Descriptive analysis: Country-level client and partner-level age distributions and mean UEs.
- Regressions:
  - Log-transformed UE to more closely approximate a normal distribution.
  - Performed univariable regression (SAS Proc Reg) of log UE on each age band.
  - Performed multivariable regression (SAS Proc GLM Select and Proc Mixed) of log UE on each age band, adjusting for country (due to widely varying operating costs between countries).
- p-values not shown because not extrapolating from a sample to a larger population; the dataset is a virtual census of theentire population.

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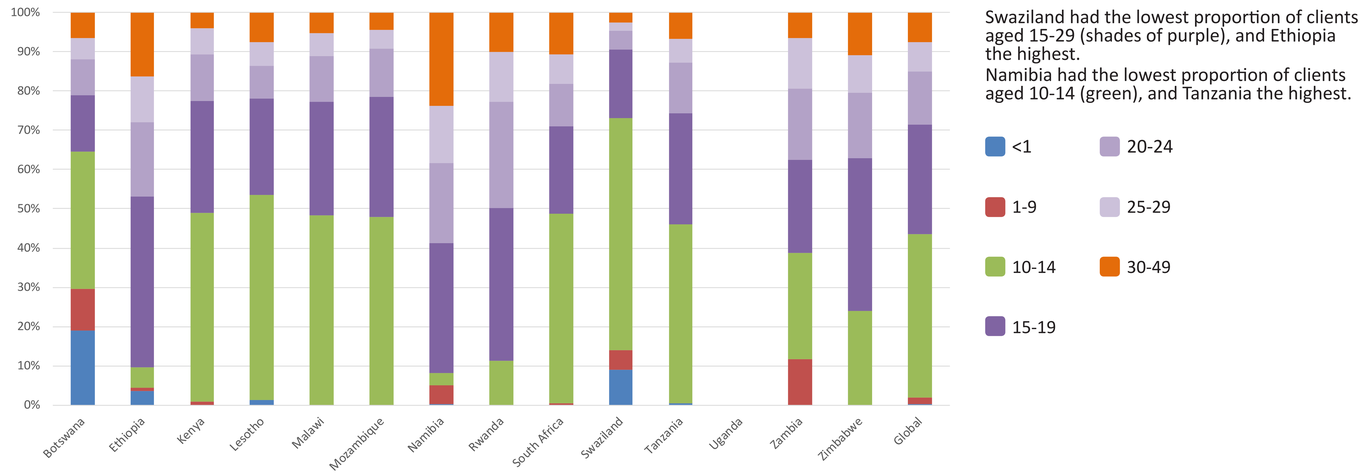
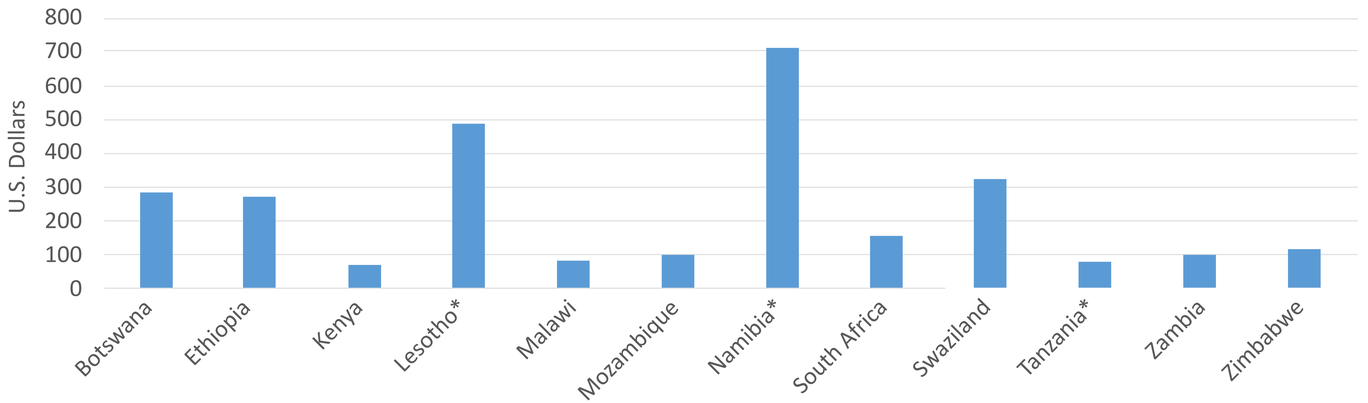
Figures and Tables

Figure 1: Proportion of Circumcision by Age, PEPPFAR 2015



Swaziland had the lowest proportion of clients aged 15-29 (shades of purple), and Ethiopia the highest.
Namibia had the lowest proportion of clients aged 10-14 (green), and Tanzania the highest.

Figure 2: Mean Unit Expenditure by Country



*Country has only one partner included in analysis

Table 1: Partner-Level Univariable Results: association of client age distribution with UE

Age Band	Anti-log Slope	Interpretation
10-14	0.99	For every 1 percent increase in the percent of VMMC's done in 10-14s, there was a 1 % decrease in UE
15-19	0.97	For every 1 percent increase in the percent of VMMC's done in 15-29s, there was a 3 % decrease in UE
20-24	1.03	For every 1 percent increase in the percent of VMMC's done in 20-24s, there was a 3 % decrease in UE
25-29	1.04	For every 1 percent increase in the percent of VMMC's done in 20-24s, there was a 4 % decrease in UE
15-29	1.003	An increase in the overall percentage VMMC's done in 15-29s has minimal association with UE (presumably the effect of increaing 15-19s cancels out the effect of increas-ing older groups)

Table 2: Partner-Level Multivariable results: association of client age distribution with UE, adjusted for country

Age Band	Anti-log Slope	Interpretation
10-14	.99	For every 1 percent increase in the percent of VMMC's done in 10-14s, there was a 1 % decrease in UE
15-19	.98	For every 1 percent increase in the percent of VMMC's done in 15-29s, there was a 2 % decrease in UE
20-24	1.03	For every 1 percent increase in the percent of VMMC's done in 20-24s, there was a 3 % decrease in UE
25-29	1.03	For every 1 percent increase in the percent of VMMC's done in 20-24s, there was a 3 % decrease in UE
25-29	1.02	For every 1 percent increase in the percent of VMMC's done in 15-29s, there was a 2 % decrease in UE
10-14 and 25-29 (pearson correlation coefficient = -.49)	.99 and 1.03	Controlling for the country and percent of VMMCs done in 10-14s, for every 1% increase in percent of VMMCs done in 25-29s, there was a 3% increase in UE

Results

- Descriptive
  - N=39 partners in 12 countries meeting inclusion criteria.
    - Rwanda excluded - all UEs below $40.
    - Uganda excluded – 2015 age band data not available.
  - Client age distributions varied widely across partners and countries (10-14 years: mean 63.1%, range 0.0-72.2%; 15-29 years: mean 48.2%, range 3.2-57.2%): Figure 1 shows country-level distributions.
  - UE also varied widely across partners and countries (mean $167.20; range $40.4-$727.10); Figure 2 shows country-level distributions.
- Associations between client age distribution and UE.
  - On univariable analysis (table 1), increases in the 10-14 and 15-19 age bands were associated with proportionate decreases in UE, but increases in the 20-24 and 25-29 age bands were associated with increases in UE. Increases in the combined 15-29 target age band were associated with trivial changes in UE.
  - On multivariable analysis (adjusting for country; table 2), results were similar, but for every 1% increase in the 15-29 age band, UE increased 2%.

Conclusions

- Associations between age distributions and UE are in the expected direction, but of modest magnitude.
  - Increasing proportion of clients 10-19 is associated with slightly decreased UE; increasing proportion of clients 20-29 is associated with slightly increased UE.
  - Increasing proportion 15-29, the target age range, is associated with slightly increased UE.

Limitation

- No age-band-specific UE data available, so this analysis examined UE associations with overall age distribution; similar to an ecological study, with similar limitations.
- UE data only captures PEPFAR funding and some UEs clearly suggest co-funding by another source; dropping <$40 UE is an imperfect correction for this.
- This cross-sectional study shows current associations with current programs, but may not reflect what will happen if partners deliberately shift their age distribution; correlation does not necessarily imply causation.
- Small dataset.
- Possible unmeasured confounders.

Recommendations and Context

- The higher immediate impact on the HIV epidemic from focusing the VMMC program on males 15-29 may come at the cost of increases in UE. However, these are probably not large enough to reverse savings from increasing program efficiency in places where this is not yet optimized.
- While attractive from a cost perspective, circumcising 10-19-year-olds does not have the same immediate impact on HIV acquisition in men, or onward transmission to young women, as circumcising 20-29-year-olds.