

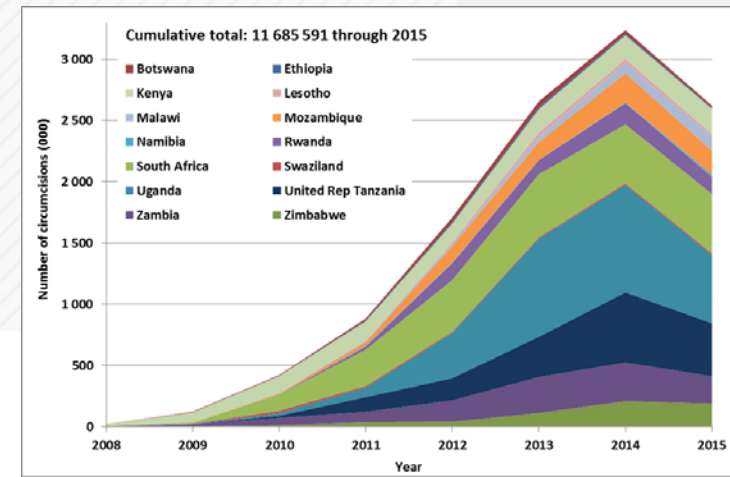
VMMC Prioritization and Strategies Informed by Mathematical Models

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First VMMC Cost and Impact Models

- First models of VMMC impact published 2006 – 2009
- Njeuhmeli *et al.* (2011) estimated from DMPPT model
 - 20.3 million circumcisions required to achieve 80% coverage in 15-49 yr age group by 2015 and maintain 80% coverage through 2025
 - Would cost US\$ 2bn, avert 3.36 m HIV infections, and avert US\$ 16.5 bn treatment costs
- Rapid expansion of VMMC programmes 2011 – 2016 with estimated total ~14 m MCs



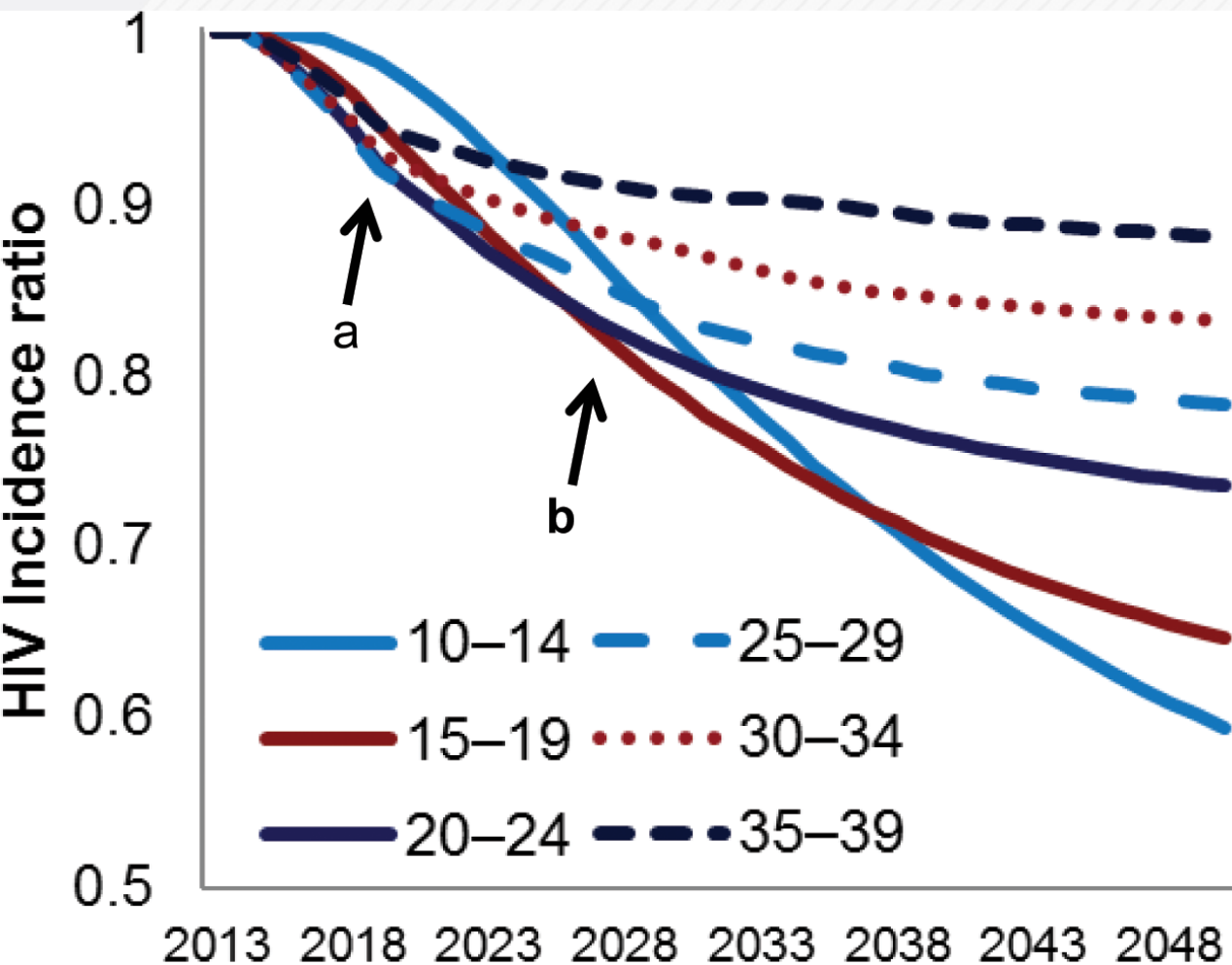
Updated VMMC Models 2015-17

- Updated models
 - Revised (DMPPT) and new (World Bank, Weill-Cornell, CDC) models
 - Key differences from earlier models
 - Non-uniform circumcision coverage by age group
 - Updated HIV incidence estimates
 - Lower annual ARV treatment costs
 - Slower and non-uniform circumcision scale-up
- WHO-UNAIDS consolidated review of all models
 - Implications for optimal use of resources 2016-21 and sustainability of VMMC programmes into future

Age Targeting

- Updated models can assess relative impact of targeting different 5-year age bands
- Results very consistent across models and priority countries

Relative Impact of Scaling up in Specific 5-year Age Strata



Reduction in HIV incidence by age group, 2014–2050. Each line represents HIV incidence ratio under scenario in which only indicated 5-year age group circumcised.

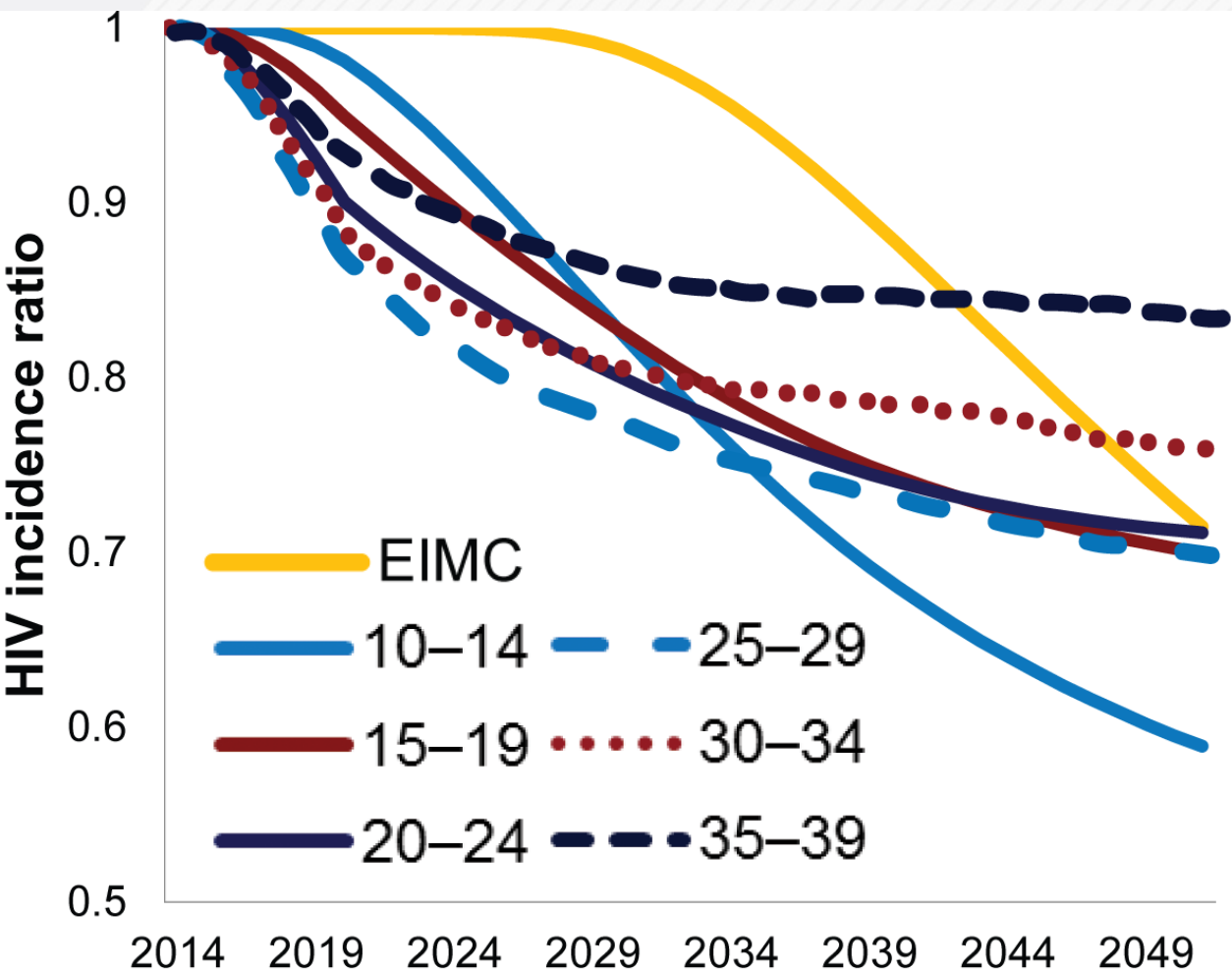
Marker **a** represents 5-yr period from 2014. Marker **b** represents a 15-yr period from 2014.

(doi:10.1371/journal.pone.0157071.g001)

Relative Impact of Scaling up in Specific 5-year Age Strata

- Short-term impact
 - Greatest if circumcise age groups at highest current HIV risk
- Medium-term impact
 - Greatest if circumcise age groups soon to enter highest HIV risk
 - Least if circumcise men 30 years or older
- Example from South Africa, but similar results obtained in other priority countries

Early Infant Male Circumcision (EIMC)



Early infant circumcision has similar relative impact as circumcising 10-14 year age stratum, but delayed by about 20 years.

(doi:10.1371/journal.pone.0159167.g001)

Early Infant Male Circumcision (EIMC)

- With no EIMC programme, maintaining circumcision coverage requires fewer total annual circumcisions but concentrated in a single age stratum (e.g. 10-14 years, 'adolescent programme')
- Once EIMC coverage is 80%, adolescent programme phases out approx. 15 years later
- With partial EIMC programme, smaller adolescent programme, but is required indefinitely

Prioritizing Region and/or Risk Group

- Region
 - In most countries data not sufficiently detailed to explore prioritization by age and region
 - Clear regional differences in HIV incidence in Kenya and Malawi which lead to obvious prioritization
 - Urban areas in general have higher HIV incidence than rural areas
- Risk group
 - Models show substantial impact of prioritizing men at higher sexual risk (e.g. multiple partners). Implies should focus on e.g. STI clinic patients, (some) occupational groups, ...

UNAIDS Fast Track Target Circumcision Numbers

Estimated number of circumcisions required by country to achieve 80% or 90% coverage in 10-29 yr age group by 2020

Source: UNAIDS

Country	% in 2015	Target 80%	Target 90%
Botswana	31%	240,000	280,000
Ethiopia (Gambela)	75%	10,000	19,000
Kenya (Nyanza)	72%	290,000	505,000
Lesotho	69%	55,000	100,000
Malawi	26%	2.5 million	3.0 million
Mozambique	57%	2.2 million	2.9 million
Namibia	27%	310,000	370,000
Rwanda	35%	1.3 million	1.6 million
South Africa	56%	2.7 million	3.9 million
South Sudan	26%	1.8 million	2.1 million
Swaziland	32%	150,000	180,000
Uganda	53%	3.6 million	4.6 million
Tanzania	84%	1.1 million	2.4 million
Zambia	37%	2.0 million	2.4 million
Zimbabwe	22%	2.2 million	2.6 million
Total		20.4 million	26.8 million