Supplementary Online Content

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This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods.

Primary Exposure Variables: community MMC coverage in men and self-reported and clinic-based ART coverage in HIV-positive men and women by time period

Community MMC coverage among males 15-49 years old was calculated for each time period, based on data from the survey rounds conducted during that period. First, the number of men reporting circumcised at each survey round (N_{circ}) together with the number of men surveyed at that round (N_m) were determined, then period-level MMC coverage was estimated as the sum of N_{circ} divided by the sum of N_m over the survey rounds in each period (i.e. $\sum N_{circ} / N_m$). This period level measure is essentially the weighted average of survey round-specific MMC prevalence per period.

Community ART coverage in men and women was also calculated based on survey rounds in each period. Both self-reported and clinic-based ART coverage were estimated. Self-reported ART coverage was estimated based on the number of HIV-positive individuals reporting use of ART at each survey round. For clinic based ART coverage, ART use was determined from the Rakai Health Sciences Program's HIV care clinic database. An HIV-positive person was deemed to be on ART if the clinic data recorded he/she had initiated ART by the date of the survey. Period-level ART coverage was subsequently estimated as described above for period-level MMC coverage.

Other Potential Confounders at the Community Level

Age and sexual behaviors are individual level risk factors for HIV acquisition. To summarize community members' age and sexual behaviors into community level characteristics, for each time period we estimated the community level proportions of men and women in the age groups of 15-19, 20-24, 25-29, 30-34, 35-39, and 40-49, the proportions reporting multiple sexual partnerships and the proportion of sexually active men and women reporting non-use (i.e. never-use) of condoms in the past year. In addition, a prior Rakai study showed that the majority HIV transmissions occurred within community boundaries[8], thus we considered community HIV prevalence in the opposite sex as a potential surrogate for HIV exposure. Data for each variable were first estimated by survey round, and the period level proportions were then calculated as described above for MMC coverage.

Time period as a potential confounder

There may be unmeasured temporal change not explained by the changes in MMC and ART coverage or changes in community characteristics above. Therefore, an indicator variable of time period was included serving as a surrogate marker of unmeasured societal change over time.

eTable 1. Incidence rate ratios of **male** community incidence from models where MMC and ART were modeled separately using data from the 45 communities (including 15 communities surveyed from 1999-2011 and 30 communities surveyed from 1999-2013), adjusting for potential community confounder variables significant at p≤0.10 in bivariable analyses

	Multivariable Models for MMC, excluding Female ART Coverage*			**Multivariable Models for Female ART Coverage, excluding MMC Coverage****		
Every 10% increase in:	**IRR**	**95%CI**	**p-value**	**IRR**	**95%CI**	**p-value**
MMC coverage	0.87	0.82-0.93	<.001	NA		
Self-reported ART coverage in women	NA			0.97	0.81-1.17	0.75
HIV prevalence in women	1.42	1.17-1.72	<0.001	1.44	1.15-1.79	0.001
Male age distribution						
% of 15-19	NA			NA		
% of 20-24	1.34	0.88-2.04	0.17	1.51	0.95-2.39	0.08
% of 25-29	1.00	0.63-1.57	0.99	1.02	0.62-1.67	0.94
% of 30-34	NA			NA		
% of 35-39	1.08	0.64-1.80	0.78	1.14	0.66-1.96	0.64
% of 40-49	0.96	0.70-1.31	0.79	1.01	0.71-1.44	0.96
Proportion of men reporting multiple sex partnerships past year	1.22	0.99-1.52	0.06	1.12	0.91-1.37	0.29
Proportion of sexually active men reporting no condom use past year	0.92	0.81-1.06	0.26	0.93	0.81-1.07	0.33
Period[#]						
Period 1 (mid-1999 to mid-2004)	ref			ref		
Period 2 (mid-2004 to late-2007)	0.83	0.62-1.12	0.23	0.80	0.50-1.26	0.33
Period 3 (late 2007 to mid-2013)	1.16	0.85-1.59	0.34	0.96	0.55-1.69	0.90
MMC coverage modeled as a categorical variable				NA		
≤10%	ref					
>10 to ≤20%	0.88	0.62-1.25	0.49			
>20 to ≤30%	0.65	0.46-0.91	0.01			
>30 to ≤40%	0.70	0.48-1.02	0.07			
>40%	0.61	0.43-0.87	0.007			
ART coverage in women modeled as a categorical variable	NA					
<=20%				ref		
>20%				0.79	0.62-0.99	0.04

MMC: medical male circumcision. IRR: incidence rate ratio. CI: confidence interval. NA: not applicable in the Multivariable model because it was not included in the model.

[#] : The surveys occurred continuously throughout the year, with communities surveyed in the same order during each round. The survey in a given round provides the endpoints and person time for the preceding interval, as well as the baseline observations and start of person time measurement for the succeeding interval of observation. Therefore, the end of a time period also serves as the beginning of the next period, and there are no fixed dates for the beginning and end of the time periods used.

*: The multivariate models included the primary exposure of MMC coverage in men and covariates of community HIV prevalence in women, proportions of men in age groups of 20-24, 25-29, 35-39 and 40-49, proportion of men reporting multiple sex partnership, proportion of sexually active men reporting no condom use, and the indicator variable for time period.

**: The multivariate models included the primary exposure of ART coverage in HIV-positive women and covariates of community HIV prevalence in women, proportions of men in age groups of 20-24, 25-29, 35-39 and 40-49, proportion of men reporting multiple sex partnership, proportion of sexually active men reporting no condom use, and the indicator variable for time period.

eTable 2. Incidence rate ratios of **female** community incidence from models where MMC and ART were modeled separately using data from the 45 communities (including 15 communities surveyed from 1999-2011 and 30 communities surveyed from 1999-2013), with potential community confounder variables significant at p≤0.10 in bivariable analyses

	Multivariable Models for MMC, excluding ART Coverage*			Multivariable Models for Male ART Coverage, excluding MMC Coverage**		
Every 10% increase in:	**IRR**	**95%CI**	**p-value**	**IRR**	**95%CI**	**p-value**
MMC coverage	0.99	0.93-1.06	0.87	NA		
Self-reported ART coverage in men	NA			0.98	0.89-1.08	0.65
HIV prevalence in men	1.30	1.01-1.67	0.04	1.30	1.00-1.69	0.05
Female age distribution						
% of 15-19	NA			NA		
% of 20-24	1.31	0.94-1.82	0.11	1.31	0.96-1.80	0.09
% of 25-29	NA			NA		
% of 30-34	0.95	0.72-1.26	0.74	0.95	0.72-1.26	0.71
% of 35-39	1.04	0.71-1.52	0.85	1.04	0.71-1.53	0.85
% of 40-49	1.10	0.84-1.45	0.50	1.10	0.83-1.46	0.50
Proportion of women reporting multiple sex partnerships past year	1.96	1.26-3.07	0.003	1.95	1.23-3.09	0.004
Proportion of sexually active women reporting no condom use past year	NA			NA		
Period[#]						
Period 1 (mid-1999 to mid-2004)	ref			ref		
Period 2 (mid-2004 to late-2007)	0.92	0.73-1.17	0.50	0.94	0.73-1.22	0.33
Period 3 (late 2007 to mid-2013)	0.99	0.74-1.31	0.92	1.03	0.73-1.45	0.87
MMC coverage modeled as categorical				NA		
≤10%	ref					
>10 to ≤20%	1.16	0.79-1.72	0.45			
>20 to ≤30%	1.22	0.86-1.73	0.27			
>30 to ≤40%	1.03	0.72-1.47	0.88			
>40%	1.15	0.82-1.62	0.42			
ART coverage in men modeled as categorical	NA					
<=20%				ref		
>20%				0.87	0.73-1.04	0.13

MMC: medical male circumcision. IRR: incidence rate ratio. Adj IRR: adjusted IRR. CI: confidence interval. NA: not applicable in the Multivariable model because it was not included in the model.

[#] : The surveys occurred continuously throughout the year, with communities surveyed in the same order during each survey round. The survey in a given round provides the endpoints and person time for the preceding interval, as well as the baseline observations and start of person time measurement for the succeeding interval of observation. Therefore, the end of a time period also serves as the beginning of the next period, and there are no fixed dates for the beginning and end of the time periods used.

*: The multivariate models included the primary exposure of MMC coverage in men and covariates of community HIV prevalence in men, proportions of women in age groups of 20-24, 30-34, 35-39 and 40-49, proportion of women reporting multiple sex partnership, and the indicator variable for time period.

**: The multivariate models included the primary exposure of ART coverage in HIV-positive men and covariates of community HIV prevalence in men, proportions of women in age groups of 20-24, 30-34, 35-39 and 40-49, proportion of women reporting multiple sex partnership, , and the indicator variable for time period.

eTable 3. Incidence rate ratios of community-level HIV incidence **in men** from bivariable and multivariable models based on the sensitivity analysis using the 30 communities consistently surveyed from 1999-2013 (ART coverage based on self-reports)

	Bivariable Model			Multivariable Model*		
	IRR	95%CI	p-value	Adj IRR	95%CI	p-value
Each 10% increment in MMC coverage	0.89	0.82-0.98	0.02	0.90	0.82-0.99	0.04
Each 10% increment in self-reported female ART coverage	0.92	0.84-1.00	0.05	0.96	0.82-1.12	0.59
Each 10% increment in HIV prevalence in women	1.29	1.10-1.53	0.002	1.28	1.08-1.52	0.005
Each 10% increment in % of men aged (years):						
15-19	0.90	0.70-1.14	0.38	NA		
20-24	1.39	1.05-1.84	0.02	1.28	0.90-1.82	0.18
25-29	1.17	0.81-1.67	0.40	NA		
30-34	1.01	0.70-1.47	0.95	NA		
35-39	0.85	0.56-1.27	0.42	NA		
40-49	0.85	0.53-1.07	0.11	NA		
Each 10% increment in % of men reporting multiple sex partners in past year	1.30	1.11-1.51	0.001	1.27	1.01-1.59	0.04
Each 10% increment in % of sexually active men reporting no condom use in past year	0.93	0.79-1.09	0.35	NA		
Period[#]						
Period 1 (mid-1999 to mid-2004)	ref			ref		
Period 2 (mid-2004 to late-2007)	0.81	0.60-1.09	0.17	0.99	0.63-1.56	0.98
Period 3 (late 2007 to mid-2013)	0.73	0.59-0.92	0.006	1.36	0.71-2.61	0.36
MMC coverage modeled as a categorical variable	**Bivariable Model**			**Full Multivariable Model***		
Observed community HIV incidence rate per 100PYs **Mean**	IRR	95% CI	p-value	Adj IRR	95% CI	p-value

(95%CI)							
≤10%	1.69 (1.05-2.33)	ref			ref		
>10 to ≤20%	1.17 (0.73-1.61)	0.71	0.46-1.10	0.12	0.77	0.54-1.09	0.14
>20 to ≤30%	1.03 (0.68-1.39)	0.59	0.42-0.84	0.003	0.60	0.43-0.83	0.002
>30 to ≤40%	1.13 (0.78-1.47)	0.66	0.47-0.93	0.02	0.76	0.54-1.06	0.11
>40%	1.20 (0.74-1.67)	0.57	0.38-0.85	0.006	0.65	0.43-0.97	0.03
ART coverage in women modeled as a categorical variable							
	Observed community HIV incidence rate per 100PYs **Mean (95% CI)**	**IRR**	**95% CI**	**p-value**	**Adj IRR**	**95% CI**	**p-value**
<=20%	1.25 (1.01-1.48)	ref			ref		
>20%	1.04 (0.77-1.30)	0.84	0.66-1.07	0.16	0.93	0.73-1.18	0.55

MMC: medical male circumcision. IRR: incidence rate ratio. Adj IRR: adjusted IRR. CI: confidence interval. NA: not applicable in the multivariable model because p-value >0.10 in bivariable model.

[#] : The surveys occurred continuously throughout the year, with communities surveyed in the same order during each survey round. The survey in a given round provides the endpoints and person time for the preceding interval, as well as the baseline observations and start of person time measurement for the succeeding interval of observation. Therefore, the end of a time period also serves as the beginning of the next period, and there are no fixed dates for the beginning and end of the time periods used.

*: The multivariate model included both primary exposures of MMC coverage in men and ART coverage in HIV-positive women, as well as covariates of community HIV prevalence in women, proportion of men in age groups of 20-24, proportion of men reporting multiple sex partnership, and the indicator variable for time period.

eTable 4. Incidence rate ratios of community-level HIV incidence **in women** from bivariable and multivariable models based on the sensitivity analysis using the 30 communities consistently surveyed from 1999-2013 (ART coverage based on self-reports)

	Bivariable Model			Multivariable Model*		
	IRR	95%CI	p-value	Adj IRR	95%CI	p-value
Each 10% increment in MMC coverage	0.98	0.91-1.05	0.50	1.05	0.97-1.13	0.25
Each 10% increment in self-reported male ART coverage	0.95	0.88-1.03	0.19	1.04	0.94-1.14	0.47
Each 10% increment in HIV prevalence in men	1.48	1.13-1.94	0.004	1.29	0.96-1.73	0.09
Each 10% increment in % of women aged (years):						
15-19	0.89	0.68-1.16	0.39	NA		
20-24	1.46	1.20-1.79	<0.001	1.59	1.11-2.22	0.007
25-29	1.28	0.93-1.76	0.13	NA		
30-34	0.80	0.63-1.03	0.08	0.92	0.67-1.25	0.58
35-39	0.65	0.40-1.06	0.08	0.99	0.64-1.55	0.98
40-49	0.81	0.48--1.05	0.09	1.21	0.94-1.55	0.14
Each 10% increment in % of women reporting multiple sex partners in past year	2.24	1.32-3.82	0.003	1.69	1.06-2.68	0.03
Each 10% increment in % of sexually active women reporting no condom use in past year	0.84	0.68-1.04	0.11	NA		
Period[#]						
Period 1 (mid-1999 to mid-2004)	ref			NA		
Period 2 (mid-2004 to late-2007)	0.89	0.68-1.15	0.36	NA		
Period 3 (late 2007 to mid-2013)	0.85	0.71-1.03	0.10	NA		

MMC coverage modeled as a categorical variable		Bivariable Model			Full Multivariable Model*		
	Observed community HIV incidence rate per 100PYs **Mean (95% CI)**	IRR	95% CI	p-value	Adj IRR	95% CI	p-value
≤10%	1.15 (0.71-1.60)	ref			ref		
>10 to ≤20%	1.28 (1.07-	0.96	0.63-1.47	0.85	1.07	0.73-1.57	0.72

	1.49)						
>20 to ≤30%	1.23 (0.88-1.58)	1.01	0.69-1.47	0.96	1.18	0.84-1.68	0.34
>30 to ≤40%	1.09 (0.77-1.41)	0.85	0.59-1.24	0.14	1.10	0.77-1.57	0.59
>40%	1.58 (0.97-2.19)	0.99	0.66-1.49	0.96	1.34	0.96-1.88	0.09
ART coverage in men modeled as a categorical variable							
	Observed community HIV incidence rate per 100PYs **Mean (95% CI)**	**IRR**	**95% CI**	**p-value**	**Adj IRR**	**95% CI**	**p-value**
<=20%	1.26 (1.08-1.44)	ref			ref		
>20%	1.31 (0.89-1.74)	0.84	0.68-1.03	0.09	0.82	0.64-1.05	0.12

MMC: medical male circumcision. IRR: incidence rate ratio. Adj IRR: adjusted IRR. CI: confidence interval. NA: not applicable in the multivariable model because p-value >0.10 in the bivariable model.

[#] : The surveys occurred continuously throughout the year, with communities surveyed in the same order during each survey round. The survey in a given round provides the endpoints and person time for the preceding interval, as well as the baseline observations and start of person time measurement for the succeeding interval of observation. Therefore, the end of a time period also serves as the beginning of the next period, and there are no fixed dates for the beginning and end of the time periods used.

*: The multivariate model included both of the primary exposures of MMC coverage in men and ART coverage in HIV-positive men, as well as covariates of community HIV prevalence in men, proportions of women in age groups of 20-24, 30-34, 35-39 and 40-49, and proportion of women reporting multiple sex partnership.

eTable 5. Incidence rate ratios of community-level HIV incidence **in men** from bivariable and multivariable models based on data from the 45 communities (including 15 communities surveyed from 1999-2011 and 30 communities surveyed from 1999-2013) using ART coverage estimated from clinic records

	Bivariable Model			Multivariable Model*		
	IRR	95%CI	p-value	Adj IRR	95%CI	p-value
Each 10% increment in MMC coverage	0.85	0.79-0.92	<.001	0.87	0.82-0.93	<.001
Each 10% increment in self-reported female ART coverage	0.89	0.81-0.97	0.01	0.99	0.83-1.17	0.90
Each 10% increment in HIV prevalence in women	1.57	1.31-1.87	<.001	1.42	1.17-1.73	<0.001
Each 10% increment in % of men aged (years):						
15-19	0.91	0.72-1.15	0.43	NA		
20-24	1.66	1.27-2.16	0.002	1.34	0.88-2.04	0.17
25-29	1.28	0.95-1.73	0.10	1.00	0.63-1.59	0.99
30-34	0.86	0.61-1.23	0.42	NA		
35-39	0.68	0.46-1.00	0.05	1.07	0.63-1.82	0.79
40-49	0.63	0.45-0.88	0.007	0.96	0.70-1.32	0.79
Each 10% increment in % of men reporting multiple sex partners in past year	1.29	1.10-1.51	0.002	1.22	0.99-1.52	0.06
Each 10% increment in % of sexually active men reporting no condom use in past year	0.87	0.76-0.99	0.03	0.93	0.80-1.07	0.29
Period[#]						
Period 1 (mid-1999 to mid-2004)	ref			ref		
Period 2 (mid-2004 to late-2007)	0.71	0.55-0.91	0.007	0.84	0.56-1.26	0.41
Period 3 (late 2007 to mid-2013)	0.69	0.57-0.84	<0.001	1.20	0.73-1.95	0.48
MMC coverage modeled as a categorical variable	**Bivariable Model**			**Full Multivariable Model***		
Observed community HIV incidence rate per 100PYs **Mean (95% CI)**	IRR	95% CI	p-value	Adj IRR	95% CI	p-value

≤10%	1.69 (1.05-2.33)	ref			ref		
>10 to ≤20%	1.19 (0.86-1.52)	0.71	0.48-1.06	0.09	0.89	0.62-1.26	0.50
>20 to ≤30%	1.01 (0.75-1.28)	0.54	0.38-0.77	<0.001	0.65	0.46-0.91	0.01
>30 to ≤40%	0.93 (0.68-1.17)	0.54	0.37-0.77	<0.001	0.70	0.48-1.02	0.06
>40%	1.03 (0.71-1.35)	0.49	0.34-0.72	<0.001	0.61	0.43-0.87	0.006
ART coverage in women modeled as a categorical variable							
	Observed community HIV incidence rate per 100PYs **Mean (95% CI**	**IRR**	**95% CI**	**p-value**	**Adj IRR**	**95% CI**	**p-value**
<=20%	1.18 (1.01-1.35)	ref			ref		
>20%	0.81 (0.62-1.00)	0.79	0.62-1.00	0.05	0.92	0.70-1.21	0.55

MMC: medical male circumcision. IRR: incidence rate ratio. Adj IRR: adjusted IRR. CI: confidence interval. NA: not applicable in the multivariable model because p-value >0.10 in the bivariable model.

[#] : The surveys occurred continuously throughout the year, with communities surveyed in the same order during each survey round. The survey in a given round provides the endpoints and person time for the preceding interval, as well as the baseline observations and start of person time measurement for the succeeding interval of observation. Therefore, the end of a time period also serves as the beginning of the next period, and there are no fixed dates for the beginning and end of the time periods used.

*: The multivariate model included both primary exposures of MMC coverage in men and ART coverage in HIV-positive women, as well as covariates of community HIV prevalence in women, proportions of men in age groups of 20-24, 25-29, 35-39 and 40-49, proportion of men reporting multiple sex partnership, proportion of sexually active men reporting no condom use, and the indicator variable for time period.

eTable 6. Incidence rate ratios of community-level HIV incidence **in women** from bivariable and multivariable models based on data from the 45 communities (including 15 communities surveyed from 1999-2011 and 30 communities surveyed from 1999-2013) using ART coverage estimated from clinic records

	Bivariable Model			Multivariable Model*		
	IRR	95%CI	p-value	Adj IRR	95%CI	p-value
Each 10% increment in MMC coverage	0.94	0.89-0.99	0.02	1.00	0.93-1.07	0.93
Each 10% increment in self-reported male ART coverage	0.91	0.85-0.97	0.007	0.97	0.86-1.09	0.62
Each 10% increment in HIV prevalence in men	1.62	1.31-2.01	<.001	1.30	1.00-1.70	0.05
Each 10% increment in % of women aged (years):						
15-19	0.94	0.76-1.18	0.61	NA		
20-24	1.42	1.20-1.69	<.001	1.30	0.93-1.82	0.12
25-29	1.24	0.94-1.63	0.12	NA		
30-34	0.77	0.62-0.96	0.02	0.94	0.71-1.26	0.69
35-39	0.71	0.47-1.06	0.10	1.03	0.71-1.50	0.88
40-49	0.67	0.47-0.96	0.03	1.10	0.83-1.44	0.52
Each 10% increment in % of women reporting multiple sex partners in past year	2.54	1.58-4.09	<0.001	1.93	1.21-3.07	0.006
Each 10% increment in % of sexually active women reporting no condom use in past year	0.90	0.78-1.06	0.20	NA		
Period[#]						
Period 1 (mid-1999 to mid-2004)	ref			ref		
Period 2 (mid-2004 to late-2007)	0.83	0.68-1.01	0.07	0.95	0.73-1.23	0.68
Period 3 (late 2007 to mid-2013)	0.80	0.69-0.94	0.005	1.05	0.73-1.50	0.80
MMC coverage modeled as a categorical variable		Bivariable Model		Full Multivariable Model*		
	Observed community HIV incidence rate per 100PYs **Mean (95% CI)**	IRR	95% CI	p-value	Adj IRR	95% CI	p-value
≤10%	1.15 (0.71-	ref			ref		

	1.60)						
>10 to ≤20%	1.33 (1.12-1.54)	1.00	0.66-1.50	0.99	1.16	0.79-1.72	0.45
>20 to ≤30%	1.18 (0.94-1.42)	0.96	0.67-1.40	0.85	1.22	0.85-1.76	0.28
>30 to ≤40%	0.96 (0.74-1.17)	0.78	0.54-1.13	0.19	1.03	0.72-1.46	0.88
>40%	1.39 (0.97-1.81)	0.87	0.59-1.28	0.47	1.16	0.81-1.64	0.42
ART coverage in men modeled as a categorical variable							
	Observed community HIV incidence rate per 100PYs **Mean (95% CI)**	**IRR**	**95% CI**	**p-value**	**Adj IRR**	**95% CI**	**p-value**
<=20%	1.23 (1.10-1.37)	ref			ref		
>20%	1.00 (0.68-1.33)	0.74	0.62-0.88	<0.001	0.80	0.65-0.98	0.03

MMC: medical male circumcision. IRR: incidence rate ratio. Adj IRR: adjusted IRR. CI: confidence interval. NA: not applicable in the multivariable model because p-value >0.10 in the bivariable model.

[#] : The surveys occurred continuously throughout the year, with communities surveyed in the same order during each survey round. The survey in a given round provides the endpoints and person time for the preceding interval, as well as the baseline observations and start of person time measurement for the succeeding interval of observation. Therefore, the end of a time period also serves as the beginning of the next period, and there are no fixed dates for the beginning and end of the time periods used.

*: The full multivariate model included both of the primary exposures of MMC coverage in men and ART coverage in HIV-positive men, as well as covariates of community HIV prevalence in men, proportions of women in age groups of 20-24, 30-34, 35-39 and 40-49, proportion of women reporting multiple sex partnership, and the indicator variable for time period.

eTable 7. Incidence rate ratios of community-level HIV incidence **in men** from bivariable and multivariable models based on data from the 30 communities consistently surveyed from 1999-2013 and using ART coverage estimated from clinic records

		Bivariable Model			Multivariable Model*		
		IRR	95%CI	p-value	Adj IRR	95%CI	p-value
Each 10% increment in MMC coverage		0.89	0.82-0.98	0.02	0.90	0.82-0.99	0.03
Each 10% increment in self-reported female ART coverage		0.91	0.82-1.00	0.05	0.96	0.81-1.15	0.68
Each 10% increment in HIV prevalence in women		1.29	1.10-1.53	0.002	1.27	1.07-1.49	0.005
Each 10% increment in % of men aged (years):							
15-19		0.90	0.70-1.14	0.38	NA		
20-24		1.39	1.05-1.84	0.02	1.27	0.89-1.80	0.12
25-29		1.17	0.81-1.67	0.40	NA		
30-34		1.01	0.70-1.47	0.95	NA		
35-39		0.85	0.56-1.27	0.42	NA		
40-49		0.85	0.53-1.07	0.11	NA		
Each 10% increment in % of men reporting multiple sex partners in past year		1.30	1.11-1.51	0.001	1.27	1.00-1.60	0.05
Each 10% increment in % of sexually active men reporting no condom use in past year		0.93	0.79-1.09	0.35	NA		
Period[#]							
Period 1 (mid-1999 to mid-2004)		ref			ref		
Period 2 (mid-2004 to late-2007)		0.81	0.60-1.09	0.17	0.98	0.63-1.52	0.93
Period 3 (late 2007 to mid-2013)		0.73	0.59-0.92	0.006	1.32	0.71-2.48	0.38
MMC coverage modeled as a categorical variable		**Bivariable Model**			**Full Multivariable Model***		
	Observed community HIV incidence rate per 100PYs **Mean (95% CI)**	IRR	95% CI	p-value	Adj IRR	95% CI	p-value
≤10%	1.69 (1.05-2.33)	ref			ref		
>10 to ≤20%	1.17 (0.73-1.61)	0.71	0.46-1.10	0.12	0.76	0.53-1.08	0.13
>20 to ≤30%	1.03 (0.68-1.39)	0.59	0.42-0.84	0.003	0.60	0.43-0.84	0.003
>30 to ≤40%	1.13 (0.78-1.47)	0.66	0.47-0.93	0.02	0.74	0.52-1.05	0.09
>40%	1.20 (0.74-1.67)	0.57	0.38-0.85	0.006	0.65	0.43-0.97	0.04
ART coverage in women modeled as							

a categorical variable							
	Observed community HIV incidence rate per 100PYs **Mean (95% CI)**	**IRR**	**95% CI**	**p-value**	**Adj IRR**	**95% CI**	**p-value**
<=20%	1.29 (1.06-1.52)	ref			ref		
>20%	0.91 (0.66-1.16)	0.81	0.63-1.03	0.09	0.90	0.70-1.17	0.43

MMC: medical male circumcision. IRR: incidence rate ratio. Adj IRR: adjusted IRR. CI: confidence interval. NA: not applicable in the multivariable model because p-value >0.10 in bivariable model.

[#] : The surveys occurred continuously throughout the year, with communities surveyed in the same order during each survey round. The survey in a given round provides the endpoints and person time for the preceding interval, as well as the baseline observations and start of person time measurement for the succeeding interval of observation. Therefore, the end of a time period also serves as the beginning of the next period, and there are no fixed dates for the beginning and end of the time periods used.

*: The multivariate model included both primary exposures of MMC coverage in men and ART coverage in HIV-positive women, as well as covariates of community HIV prevalence in women, proportion of men in age groups of 20-24, proportion of men reporting multiple sex partnership, and the indicator variable for time period.

eTable 8. Incidence rate ratios of community-level HIV incidence **in women** from bivariable and multivariable models based on data from the 30 communities consistently surveyed from 1999-2013 and using ART coverage estimated from clinic records

		Bivariable Model			Multivariable Model*		
		IRR	95%CI	p-value	Adj IRR	95%CI	p-value
Each 10% increment in MMC coverage		0.98	0.91-1.05	0.50	1.04	0.96-1.13	0.31
Each 10% increment in self-reported male ART coverage		0.94	0.86-1.02	0.13	1.06	0.94-1.19	0.32
Each 10% increment in HIV prevalence in men		1.48	1.13-1.94	0.004	1.28	0.96-1.71	0.09
Each 10% increment in % of women aged (years):							
15-19		0.89	0.68-1.16	0.39	NA		
20-24		1.46	1.20-1.79	<0.001	1.64	1.15-2.33	0.006
25-29		1.28	0.93-1.76	0.13	NA		
30-34		0.80	0.63-1.03	0.08	0.92	0.67-1.27	0.61
35-39		0.65	0.40-1.06	0.08	0.97	0.64-1.56	0.99
40-49		0.81	0.48--1.05	0.09	1.23	0.95-1.59	0.12
Each 10% increment in % of women reporting multiple sex partners in past year		2.24	1.32-3.82	0.003	1.74	1.11-2.72	0.02
Each 10% increment in % of sexually active women reporting no condom use in past year		0.84	0.68-1.04	0.11	NA		
Period[#]							
Period 1 (mid-1999 to mid-2004)		ref			NA		
Period 2 (mid-2004 to late-2007)		0.89	0.68-1.15	0.36	NA		
Period 3 (late 2007 to mid-2013)		0.85	0.71-1.03	0.10	NA		
MMC coverage modeled as a categorical variable		Bivariable Model			Full Multivariable Model*		
	Observed community HIV incidence rate per 100PYs **Mean (95% CI)**	IRR	95% CI	p-value	Adj IRR	95% CI	p-value
≤10%	1.15 (0.71-1.60)	ref			ref		
>10 to ≤20%	1.28 (1.07-1.49)	0.96	0.63-1.47	0.85	1.07	0.74-1.57	0.71
>20 to ≤30%	1.23 (0.88-1.58)	1.01	0.69-1.47	0.96	1.16	0.81-1.67	0.42
>30 to ≤40%	1.09 (0.77-1.41)	0.85	0.59-1.24	0.14	1.10	0.76-1.59	0.60
>40%	1.58 (0.97-2.19)	0.99	0.66-1.49	0.96	1.31	0.91-1.88	0.15
ART coverage in men modeled as a		IRR	95% CI	p-value	Adj IRR	95% CI	p-value

categorical variable							
	Observed community HIV incidence rate per 100PYs **Mean (95% CI)**						
<=20%	1.30 (1.12-1.48)	ref			ref		
>20%	1.09 (0.60-1.57)	0.76	0.62-0.93	0.009	0.85	0.67-1.09	0.20

MMC: medical male circumcision. IRR: incidence rate ratio. Adj IRR: adjusted IRR. CI: confidence interval. NA: not applicable in the multivariable model because p-value >0.10 in the bivariable model.

[#] : The surveys occurred continuously throughout the year, with communities surveyed in the same order during each survey round. The survey in a given round provides the endpoints and person time for the preceding interval, as well as the baseline observations and start of person time measurement for the succeeding interval of observation. Therefore, the end of a time period also serves as the beginning of the next period, and there are no fixed dates for the beginning and end of the time periods used.

*: The multivariate model included both of the primary exposures of MMC coverage in men and ART coverage in HIV-positive men, as well as covariates of community HIV prevalence in men, proportions of women in age groups of 20-24, 30-34, 35-39 and 40-49, and proportion of women reporting multiple sex partnership.

eTable 9. Distributions of gender-specific community-level characteristics by time period of the 30 communities consistently surveyed from 1999-2013

Community level characteristics in men	PERIOD 1# (mid-1999 to mid-2004)		PERIOD 2# (mid-2004 to late-2007)		PERIOD 3# (late 2007 to mid-2013)		Community level characteristics in women	PERIOD 1# (mid-1999 to mid-2004)		PERIOD 2# (mid-2004 to late-2007)		PERIOD 3# (late 2007 to mid-2013)	
	Median	IQR	Median	IQR	Median	IQR		Median	IQR	Median	IQR	Median	IQR
MMC coverage in men (%) *	16.8	10.3-27.0	22.0	17.5-35.3	38.3	30.1-47.2							
ART coverage in HIV+ men (%)	0	0-0 (range: 0-2.1)	6.7	2.9-12.5	20.9	15.6-30.2	**ART coverage in HIV+ women (%)**	0	0-0 (range: 0-2.0)	10.3	7.1-14.3	26.7	22.0-33.1
Male age distribution (%):							**Female age distribution (%)**						
15-19	18.8	16.3-21.6	17.7	13.9-21.1	20.8	18.8-25.6	*15-19*	19.2	16.8-21.1	16.0	13.4-17.4	17.3	13.0-21.3
20-24	21.4	18.8-24.9	19.2	17.7-23.1	16.5	14.9-18.1	*20-24*	25.1	23.2-27.4	23.0	19.9-27.0	18.4	16.4-20.7
25-29	20.6	18.6-22.0	20.1	17.6-22.8	17.1	15.8-19.1	*25-29*	19.9	17.7-23.6	22.7	18.6-24.6	19.8	16.8-24.0
30-34	15.8	13.8-18.0	16.7	15.4-19.2	16.6	13.1-19.3	*30-34*	11.8	11.1-13.6	15.0	13.5-18.0	18.2	16.0-20.3
35-39	10.3	8.4-12.3	11.7	10.0-14.3	13.2	11.8-14.9	*35-39*	9.2	7.8-11.2	8.8	7.6-10.8	12.1	10.5-13.0
40-49	11.7	9.6-14.2	13.4	10.1-15.4	14.3	12.9-17.0	*40-49*	13.0	11.0-16.5	15.3	11.6-18.9	13.4	11.7-16.3
% of men reporting	40.1	36.4-43.2	37.3	35.1-44.5	31.6	27.9-35.4	**% of women**	5.3	4.1-6.3	5.0	3.6-6.5	5.0	3.8-6.3

multiple partnerships in the past year							**reporting multiple partnerships in the past year**					
% of sexually active men reporting no-condom use past year	45.2	40.9-51.3	43.2	38.5-47.0	48.8	46.5-52.5	**% of sexually active women reporting no-condom use past year**	71.5	68.3-75.7	64.8	59.8-70.7	67.2	63.7-70.8
Male HIV prevalence (%)	12.0	9.3-14.5	10.4	8.6-12.6	11.1	8.5-12.0	**Female HIV prevalence (%)**	15.0	13.6-18.3	14.6	11.6-18.9	16.3	13.2-19.8
Total PYs in men	300.39	213.42 - 486.55	170.28	111.65 - 286.68	344.80	234.99-586.57	**Total PYs in women**	382.35	245.28-601.88	216.19	155.28 - 386.30	404.89	281.70 - 713.08
Male HIV incidence per 100PYs	1.20	0.86-2.08	0.77	0.46-2.11	0.96	0.59-1.36	**Female HIV incidence per 100PYs**	1.23	0.86-1.61	1.08	0.79-1.44	1.01	0.84-1.45
Total number of men per community*	412.5	280-648	181	119-279	314.5	219-512	**Total number of women per community****	572.5	363-855	260.5	152-386	425.5	302-662

MMC: medical male circumcision. PYs: person years. IQR: inter quartile range.

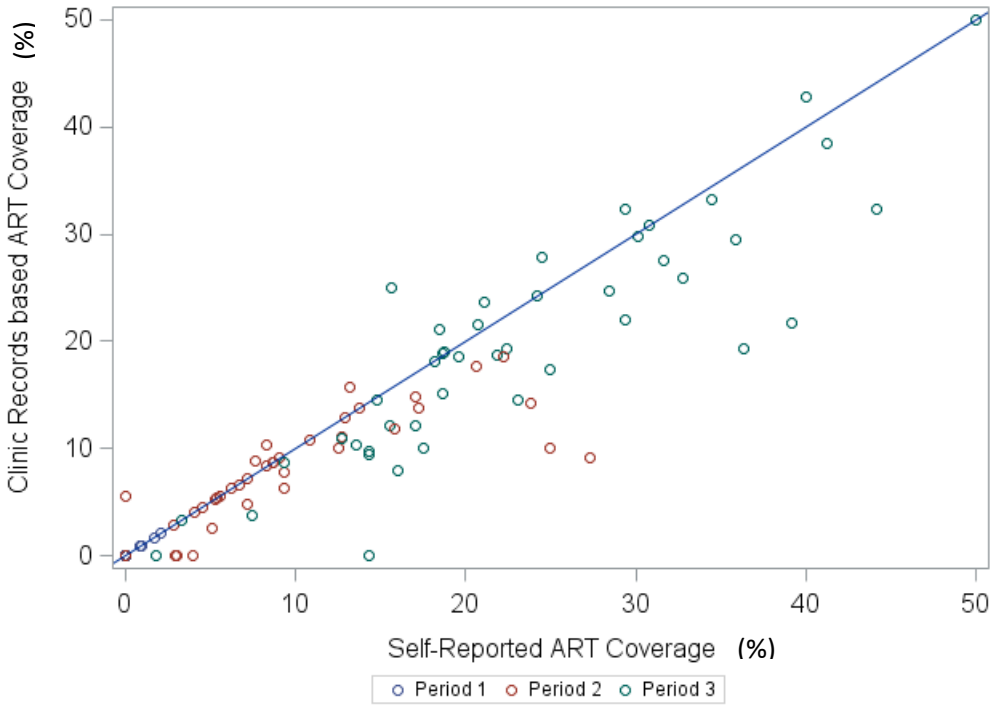
[#] : The surveys occurred continuously throughout the year, with communities surveyed in the same order during each survey round. The survey in a given round provides the endpoints and person time for the preceding interval, as well as the baseline observations and start of person time measurement for the succeeding interval of observation. Therefore, the end of a time period also serves as the beginning of the next period, and there are no fixed dates for the beginning and end of the time periods used.

*: MMC scale-up was mainly targeted on non-Muslim men as Muslims practice infant circumcision. The composition of Muslims and non-Muslims was stable in Rakai: non-Muslim men constituted 85.1%, 84.3% and 84.5% of the male population in Period 1, 2 and 3, respectively.

**: The total number of men/women for a community during a time period was the sum of the number of men/women in all survey rounds in the period. Overall, there were 7,251 men and 9,645 women who participated at least one survey round in period 15,783 men and 7,538 women who participated at least one survey in period 2, and 7,988 men and 10,251 women who participated at least one survey in period 3.

eFigure 1. Scatterplot showing the comparison between community level ART coverage estimated from self-reports and estimated from clinic records by sex for the 45 communities (including 15 communities surveyed from 1999-2011, and 30 communities surveyed from 1999-2013). In each plot, each point indicates the ART coverage for one community during one time period: the x-axis is the coverage estimated from self-reports, and the y-axis is the coverage estimated from clinic records. For period 3, the self-reported ART coverage for 15 communities were estimated from surveys conducted up to 2011, and the self-reported ART coverage for the other 30 communities were estimated from surveys conducted up to 2013

ART coverage in men (Pearson correlation coefficient r=0.95, p<.00001)



· ART coverage in women (Pearson correlation coefficient r=0.96, p<.00001)