Supplementary Appendix

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

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Impact of a Universal HIV Testing and Expanded Treatment Strategy on Population HIV Incidence in a Community-Randomized Trial

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Method of Randomization

The name of each community in the first pair of matched communities was written on a piece of paper and placed inside an opaque plastic ball; the name of one community was put into one ball, and the name of the other community was put into another ball of the same color (e.g. red). The two plastic balls were then placed in a bowl or sack and shuffled.

The names of the study arms, “Control” and “Intervention,” were each written on a piece of paper and put into an opaque plastic ball of another color (e.g. blue) and placed in a second bowl or sack and shuffled.

A designated person picked a ball from bowl/sack 1 and announced the name of the community, and a staff member held up a sign with the name. Another designated person picked a ball from sack 2 and announced the study-arm assignment, and another staff member held up a sign with the assignment and stood next to the first name sign. Another designated person revealed the remaining balls and the remaining signs were held up together.

This completed the assignment for the first pair. The same procedure was followed for each subsequent pair. This procedure was conducted in the presence of witnesses who were not part of the study team.

Figure S1. Summary of HIV Acquisition and Completeness of HIV-1 RNA Assessment among N=8,974 Participants with a HIV-Negative Test Result at Enrollment to Ya Tsie According to Randomization Arm.

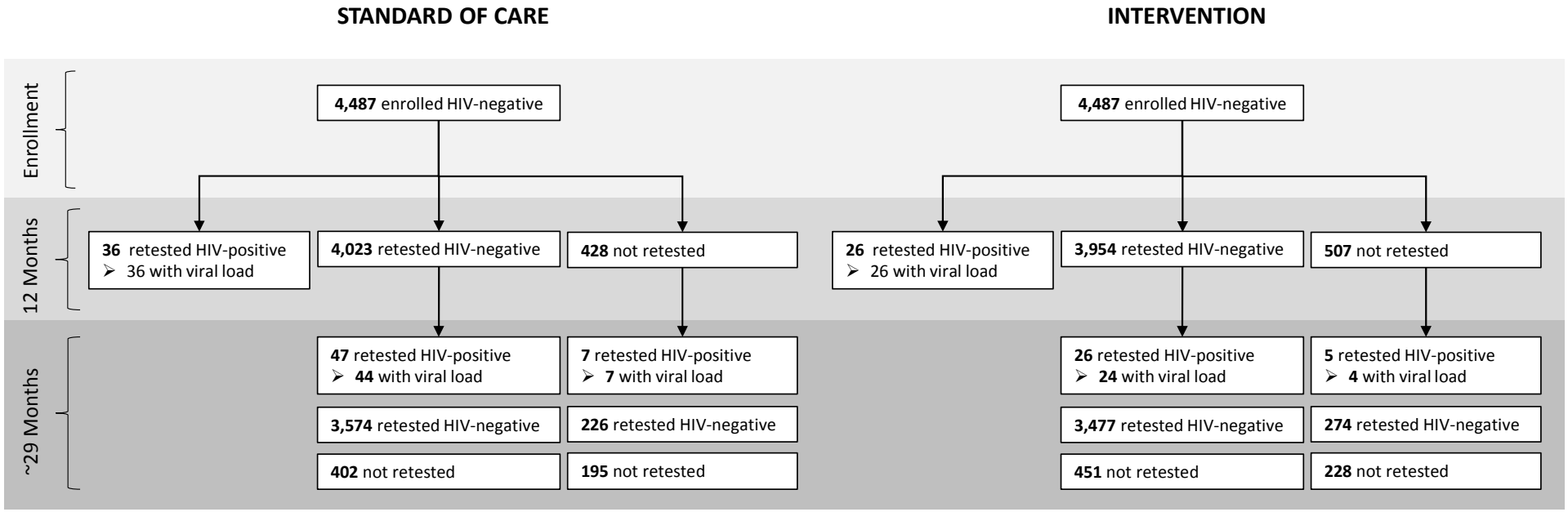

Figure S2. Recruitment, Eligibility, and Enrollment of Participants for a One-Time, End-of-Study Survey in Six Communities (3 Matched Pairs) in the Ya Tsie Study at the Household and Participant Levels According to Randomization Arm.

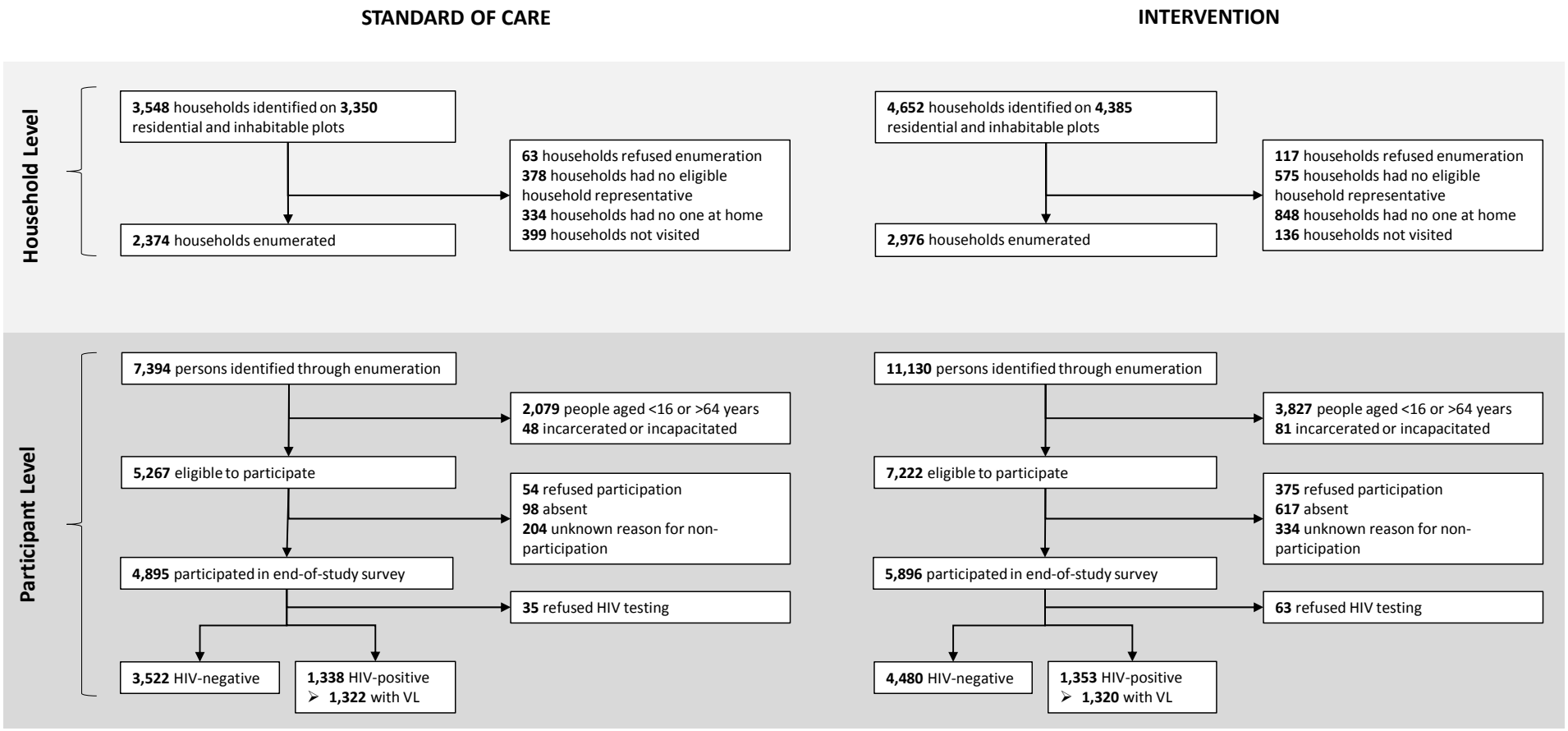

Table S1. Age and Sex Distribution of Communities Participating in Ya Tsie According to Botswana Census and Enumerated, Eligible Household Members, and Enrolled Participants.

	Population, N (%)		
	2011 Botswana Census	Enumerated, eligible Ya Tsie household members	Enrolled Ya Tsie participants
Females			
16–24 years	15,731 (17%)	2,321 (15%)	1,979 (16%)
25–34 years	14,911 (16%)	2,586 (17%)	2,242 (18%)
35–44 years	9,450 (10%)	1,868 (12%)	1,592 (13%)
45–54 years	7,290 (8%)	1,445 (9%)	1,232 (10%)
55–64 years	4,905 (5%)	1,120 (7%)	1,005 (8%)
Males			
16–24 years	14,055 (15%)	1,874 (12%)	1,434 (11%)
25–34 years	11,714 (12%)	1,742 (11%)	1,270 (10%)
35–44 years	7,760 (8%)	1,213 (8%)	838 (7%)
45–54 years	4,943 (5%)	809 (5%)	573 (5%)
55–64 years	3,248 (3%)	596 (4%)	445 (4%)

Table S2. Baseline Characteristics of N=147 Participants Who Seroconverted after a HIV-Negative Test Result at Enrollment to the HIV Incidence Cohort of Ya Tsie, According to Randomization Arm.

Characteristic (*n* with data)	Randomization arm, N (%) Standard of care (N=90)	Intervention (N=57)
Age at enrollment (*n*=147)		
16–24 years	40 (44%)	25 (44%)
25–34 years	37 (41%)	17 (30%)
35–44 years	5 (6%)	10 (18%)
45–54 years	1 (1%)	3 (5%)
55–64 years	7 (8%)	2 (4%)
Female gender (*n*=147)	70 (78%)	49 (86%)
Relationship (*n*=146)		
Single/never married	82 (92%)	54 (95%)
Married	4 (4%)	3 (5%)
Widowed, divorced, or separated	3 (3%)	0 (0%)
Education (*n*=147)		
Primary or less	16 (18%)	9 (16%)
Junior secondary	41 (46%)	30 (53%)
Senior secondary	23 (26%)	15 (26%)
Higher than senior secondary	10 (11%)	3 (5%)
Income (*n*=147)		
None	50 (56%)	35 (61%)
<$96 per month	17 (19%)	12 (21%)
$96 to $477 per month	21 (23%)	9 (16%)
>$477 per month	2 (2%)	1 (2%)
Alcohol consumption, past 1 month (*n*=146)		
Never	61 (69%)	43 (75%)
Less than once per week	10 (11%)	4 (7%)
Once per week	4 (4%)	5 (9%)
2–3 times per week	7 (8%)	4 (7%)
More than 3 times per week	7 (8%)	1 (2%)
Number of sexual partners, past 12 months[a] (*n*=129)		
None	8 (10%)	7 (14%)
1 partner	38 (49%)	33 (65%)
2 partners	26 (33%)	9 (18%)
3 partners	4 (5%)	1 (2%)
4 or more partners	2 (3%)	1 (2%)
Concurrent sexual partnerships, past 12 months[b] (*n*=114)	32 (46%)	11 (25%)
Alcohol use by participant and/or partner during last sex[a] (*n*=134)	15 (19%)	7 (13%)
Self-reported circumcised[c] (*n*=28)	5 (25%)	2 (25%)

[a] Proportions calculated among *n*=135 participants reporting any lifetime sexual activity.

[b] Proportions calculated among *n*=114 participants reporting one or more sexual partners during the past 12 months.

[c] Proportions calculated among *n*=28 HIV-negative men aged 16–49 years.

Table S3. Multivariate-Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) Obtained from a Logistic Regression Model for Enrollment among Enumerated, Eligible Household Members in Ya Tsie and Used to Adjust for Potential Selection Bias Due to Non-Participation.

Covariate	OR (95% CI)
Community (ref= Tsetsebjwe)	
Bokaa	0.30 (0.20–0.45)
Digawana	0.26 (0.17–0.40)
Gumare	0.63 (0.41–0.98)
Gweta	0.65 (0.41–1.03)
Lentsweletau	0.53 (0.35–0.83)
Lerala	0.65 (0.42–1.01)
Letlhakeng	0.42 (0.28–0.63)
Masunga	0.60 (0.38–0.94)
Mathangwane	0.50 (0.32–0.78)
Maunatlala	0.69 (0.42–1.13)
Metsimotlhabe	0.19 (0.13–0.28)
Mmadinare	0.42 (0.28–0.65)
Mmandunyane	0.50 (0.32–0.80)
Mmankgodi	0.38 (0.25–0.58)
Mmathethe	0.56 (0.35–0.89)
Molapowabojang	0.17 (0.11–0.25)
Nata	0.78 (0.49–1.26)
Nkange	0.43 (0.26–0.73)
Oodi	0.16 (0.11–0.24)
Otse	0.19 (0.13–0.29)
Rakops	0.49 (0.32–0.75)
Ramokgonami	0.88 (0.54–1.45)
Ranaka	0.17 (0.11–0.26)
Sebina	0.45 (0.28–0.72)
Sefhare	0.63 (0.40–1.00)
Sefophe	0.57 (0.37–0.88)
Shakawe	0.77 (0.49–1.21)
Shoshong	0.55 (0.35–0.86)
Tati Siding	0.41 (0.27–0.62)
Gender*Age (ref= Males 55–64 years)	
Females 16–24 years	2.48 (1.49–4.12)
Females 25–34 years	1.79 (1.23–2.61)
Females 35–44 years	1.36 (0.94–1.97)
Females 45–54 years	1.50 (1.03–2.19)
Females 55–64 years	1.59 (1.07–2.36)
Males 16–24 years	1.41 (0.84–2.35)
Males 25–34 years	0.97 (0.66–1.42)
Males 35–44 years	0.83 (0.57–1.22)
Males 45–54 years	0.80 (0.54–1.19)
Gender*Age*Present today (ref= Males 55–64 years / present today)	
Females 16–24 years / Not present	2.13 (1.26–3.60)
Females 25–34 years / Not present	1.92 (1.13–3.26)
Females 35–44 years / Not present	2.94 (1.69–5.11)
Females 45–54 years / Not present	2.46 (1.38–4.39)
Females 55–64 years / Not present	3.03 (1.59–5.77)
Males 16–24 years / Not present	2.63 (1.57–4.41)

Covariate	OR (95% CI)
Males 25–34 years / Not present	1.72 (1.02–2.90)
Males 35–44 years / Not present	2.26 (1.31–3.90)
Males 45–54 years / Not present	1.98 (1.10–3.55)
Gender*Age*Relation to head (ref= Males 55–64 years / Head of household)	
Females 16–24 years / Spouse or Partner	0.56 (0.18–1.72)
Females 16–24 years / Brother or Sister	1.12 (0.33–3.78)
Females 16–24 years / Son or Daughter	0.64 (0.18–2.32)
Females 16–24 years / Grandchild, Niece/Nephew	0.48 (0.22–1.07)
Females 16–24 years / All other persons	0.92 (0.45–1.87)
Females 25–34 years / Spouse or Partner	1.17 (0.37–3.72)
Females 25–34 years / Brother or Sister	0.85 (0.24–2.94)
Females 25–34 years / Son or Daughter	0.84 (0.40–1.79)
Females 25–34 years / Grandchild, Niece/Nephew	0.70 (0.36–1.35)
Females 25–34 years / All other persons	1.15 (0.34–3.86)
Females 35–44 years / Spouse or Partner	0.82 (0.23–2.89)
Females 35–44 years / Brother or Sister	0.58 (0.26–1.29)
Females 35–44 years / Son or Daughter	0.77 (0.39–1.53)
Females 35–44 years / Grandchild, Niece/Nephew	0.89 (0.21–3.73)
Females 35–44 years / All other persons	0.67 (0.18–2.53)
Females 45–54 years / Spouse or Partner	0.79 (0.35–1.79)
Females 45–54 years / Brother or Sister	0.77 (0.36–1.65)
Females 45–54 years / Son or Daughter	0.80 (0.15–4.35)
Females 45–54 years / Grandchild, Niece/Nephew	0.77 (0.15–3.80)
Females 45–54 years / All other persons	0.90 (0.38–2.12)
Females 55–64 years / Spouse or Partner	0.62 (0.15–2.56)
Females 55–64 years / Brother or Sister	0.72 (0.22–2.38)
Females 55–64 years / Son or Daughter	0.78 (0.21–2.83)
Females 55–64 years / Grandchild, Niece/Nephew	0.52 (0.23–1.14)
Females 55–64 years / All other persons	0.46 (0.22–0.94)
Males 16–24 years / Spouse or Partner	1.29 (0.41–4.09)
Males 16–24 years / Brother or Sister	0.78 (0.23–2.71)
Males 16–24 years / Son or Daughter	0.83 (0.39–1.76)
Males 16–24 years / Grandchild, Niece/Nephew	0.62 (0.31–1.22)
Males 16–24 years / All other persons	1.07 (0.33–3.53)
Males 25–34 years / Spouse or Partner	0.64 (0.18–2.26)
Males 25–34 years / Brother or Sister	0.50 (0.23–1.12)
Males 25–34 years / Son or Daughter	0.64 (0.32–1.30)
Males 25–34 years / Grandchild, Niece/Nephew	1.75 (0.49–6.25)
Males 25–34 years / All other persons	0.57 (0.15–2.12)
Males 35–44 years / Spouse or Partner	0.77 (0.31–1.91)
Males 35–44 years / Brother or Sister	0.56 (0.18–1.72)
Males 35–44 years / Son or Daughter	1.12 (0.33–3.78)
Males 35–44 years / Grandchild, Niece/Nephew	0.64 (0.18–2.32)
Males 35–44 years / All other persons	0.48 (0.22–1.07)
Males 45–54 years / Spouse or Partner	0.92 (0.45–1.87)
Males 45–54 years / Brother or Sister	1.17 (0.37–3.72)
Males 45–54 years / Son or Daughter	0.85 (0.24–2.94)
Males 45–54 years / Grandchild, Niece/Nephew	0.84 (0.40–1.79)
Males 45–54 years / All other persons	0.70 (0.36–1.35)
Present today (ref = Present)	
Not present	0.13 (0.08–0.20)

Covariate	OR (95% CI)
Relation to head (ref = Head of household)	
Spouse or Partner	1.18 (0.68–2.05)
Brother or Sister	0.71 (0.24–2.07)
Son or Daughter	1.01 (0.30–3.38)
Grandchild, Niece/Nephew	1.07 (0.57–2.04)
All other persons	1.18 (0.68–2.05)

Table S4. Multivariate-Adjusted Odds Ratios (ORs) and 95% Confidence Intervals (CIs) Obtained from a Pooled Logistic Regression Model for Death during Follow-Up in Ya Tsie and Used to Adjust for Potential Selection Bias Due to Dependent Censoring.

	OR (95% CI)
Randomized to intervention arm	0.62 (0.34–1.12)
Time on study, days	0.97 (0.96–0.97)
Time on study squared, days	1.00 (1.00–1.00)
Male sex	0.26 (0.16–0.41)
Age, at enrollment	
16–24 years	0.14 (0.04–0.47)
25–34 years	0.13 (0.04–0.43)
35–44 years	0.24 (0.07–0.77)
45–54 years	0.49 (0.20–1.23)
55–64 years	Ref.
Education, at enrollment	
Less than primary	1.46 (0.35–6.09)
Junior secondary	1.76 (0.41–7.60)
Senior secondary	1.31 (0.24–7.20)
Higher than senior secondary	Ref.
Education, during follow-up	
Less than primary	1.67 (0.26–10.7)
Junior secondary	0.52 (0.07–4.17)
Senior secondary	0.92 (0.09–9.04)
Higher than senior secondary	Ref.
Marital status at enrollment	
Widowed, divorced, or separated	Ref.
Single/never married	0.66 (0.21–2.11)
Married	0.63 (0.18–2.23)
Alcohol use, past 1 month at enrollment	
Never	0.59 (0.19–1.77)
Less than once per week	0.61 (0.16–2.39)
Once per week	0.42 (0.09–1.87)
2 –3 times per week	0.65 (0.19–2.27)
>3 times per week	Ref.
Alcohol use by participant and/or partner during most recent sex, at enrollment	0.94 (0.39–2.23)
Number of sexual partners, past 12 months at enrollment	
None	4.08 (1.21–13.7)
1 partner	2.63 (0.97, 1.01)
2 or more partners	Ref.
Missing[a]	1.08 (0.29–4.05)
Number of sexual partners, past 12 months during follow-up	
None	0.17 (0.05–0.58)
1 partner	0.27 (0.11–0.70)
2 or more partners	Ref.
Missing[a]	2.60 (0.61–11.1)

[a] Reference category is “not missing.”

Table S5. Summary of Incidence Ratios (IRs) and 95% Confidence Intervals (CIs) for HIV Incidence Adjusted for Potential Bias Due to Non-Participation and Dependent Censoring Due to Death and Obtained from a Weighted Cox Proportional Hazards Model with Robust Standard Errors.

	IR (95% CI)
Weighted model with baseline covariates	
Randomized to intervention arm	0.67 (0.46–0.98)
Male sex	0.26 (0.16–0.41)
Age, at enrollment	
16–24 years	0.85 (0.59–1.23)
25–34 years	0.60 (0.31–1.15)
35–44 years	0.20 (0.04–1.06)
45–54 years	0.42 (0.13–1.34)
55–64 years	Ref.
Education, at enrollment	
Less than primary	Ref.
Junior secondary	1.10 (0.51–2.37)
Senior secondary	0.93 (0.48–1.82)
Higher than senior secondary	0.44 (0.20–0.99)
Marital status at enrollment	
Married	0.44 (0.27–0.72)
Widowed, divorced, or separated	0.74 (0.20–2.79)
Single/never married	Ref.
Alcohol use, past 1 month at enrollment	
Never	Ref.
Less than once per week	1.73 (0.93–3.23)
Once per week	0.98 (0.50–1.92)
2–3 times per week	1.45 (0.73–2.86)
>3 times per week	1.86 (0.75–4.61)
Missing[a]	0.59 (0.25–1.41)
Alcohol use by participant and/or partner during most recent sex, at enrollment	1.86 (1.05–3.32)
Missing[a]	0.59 (0.25–1.41)
Number of sexual partners, past 12 months at enrollment	
None	Ref.
1 partner	0.96 (0.49–1.86)
2 or more partners	1.27 (0.60–2.68)
Missing[a]	1.77 (0.67–4.70)

[a] Reference category is “not missing.”

Table S6. Multivariable-Adjusted Hazard Ratios (HRs) and 95% Confidence Intervals (CIs) for Acquisition of HIV Infection during Study Follow-Up among N=8,974 Participants Testing HIV-Negative at Enrollment in Ya Tsie.

Covariate	HR (95% CI)
Randomized to intervention arm	0.70 (0.50–0.98)
Male sex	0.27 (0.17–0.42)
Age	
16–24 years	Ref.
25–34 years	0.90 (0.62–1.32)
35–44 years	0.62 (0.34–1.14)
45–54 years	0.16 (0.05–0.51)
55 years and older	0.33 (0.12–0.86)
Marital status	
Single/never married	Ref.
Married	0.42 (0.19–0.96)
Widowed, divorced, or separated	0.77 (0.21–2.75)
Missing[a]	14.34 (0.77–267.44)
Highest Level of Education Attained	
Non-formal or primary	Ref.
Junior secondary	1.01 (0.57–1.79)
Senior secondary	0.85 (0.45–1.60)
Higher than senior secondary (university diploma, etc.)	0.42 (0.20–0.92)
Alcohol consumption in past month	
Never	Ref.
Less than once per week	1.93 (1.09–3.43)
Once per week	1.05 (0.52–2.12)
2–3 times per week	1.37 (0.70–2.69)
>3 times per week	2.01 (0.90–4.51)
Missing[a]	3.03 (0.16–57.33)
Number of sexual partners, past 12 months	
None or not sexually active	Ref.
1 partner	0.91 (0.5–1.66)
2 partners	1.14 (0.59–2.19)
3 partners	1.60 (0.55–4.60)
>3 partners	1.48 (0.40–5.40)
Missing[a]	1.62 (0.70–3.74)
Alcohol use by respondent and/or partner during last sex	1.71 (1.03–2.82)
Missing[a]	0.53 (0.24–1.17)

Note: Except for the HR pertaining to the randomized intervention, none of the HRs included in the table should be interpreted causally nor have the CIs been adjusted for multiplicity; the corresponding variables do not describe randomized quantities and no attempt was made to adjust for potential confounding.

[a] Reference category is “not missing.”

Table S7. Initiation of Antiretroviral Treatment (ART) during Study Follow-Up and Timing of Initiation among N=979 HIV-Positive Participants Not on ART at Enrollment to the 20% Cohort of Ya Tsie, Overall and According to Randomization Arm.

		Randomization Arm, N (%)	
Characteristic (*n* with data)	**Overall (N= 979)**	**Standard of care (N=476)**	**Intervention (N=503)**
Initiated ART during study follow-up (*n*=942)	861 (91%)	396 (87%)	465 (96%)
Time to ART initiation[a] (*n*=780)			
<30 days	214 (27%)	75 (22%)	139 (32%)
30–90 days	143 (18%)	45 (13%)	98 (22%)
>90 days	423 (54%)	223 (65%)	200 (46%)
Median (25^{th}, 75^{th})	126 (27, 475)	367 (35, 638)	69 (23, 367)

[a] Proportions calculated among participants who initiated ART during study follow-up and who had an ART start date.