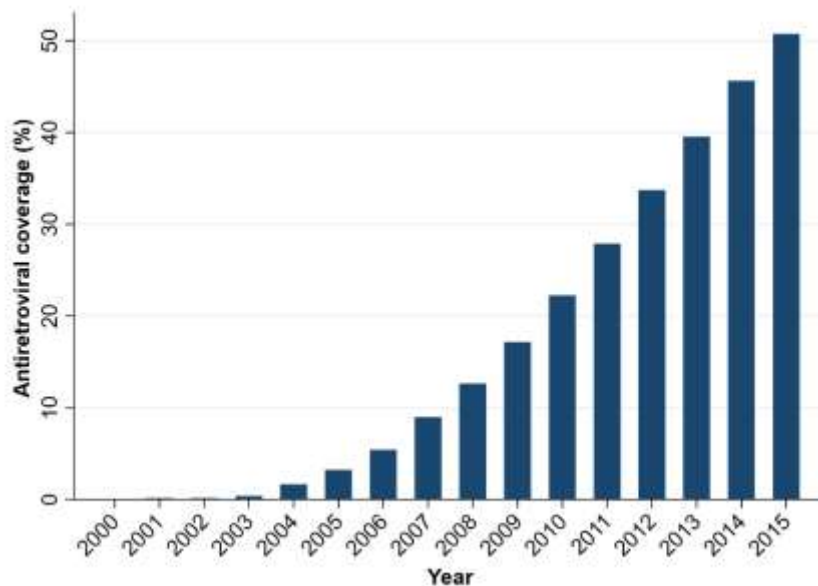


## **Appendix**

In this appendix, we provide additional details related to our study, including:

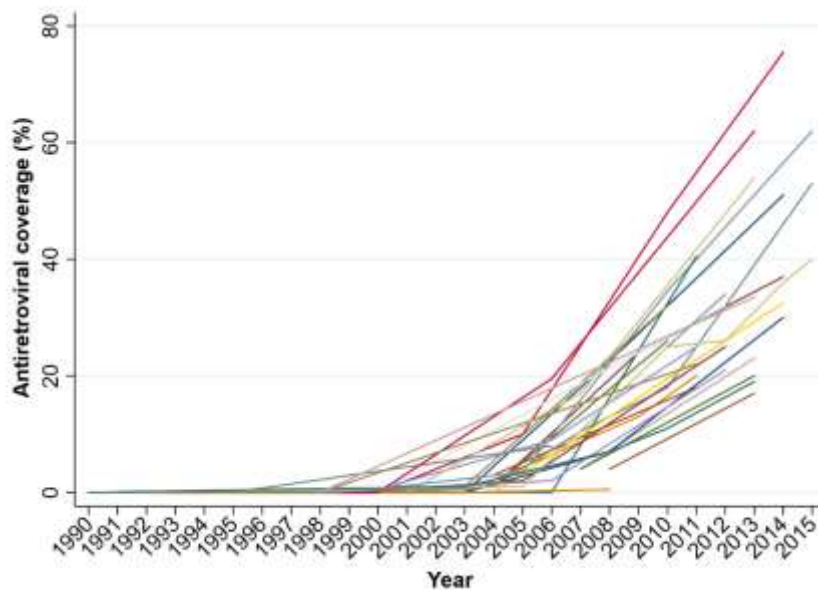
- **Figure S1.** Antiretroviral coverage in sub-Saharan Africa, by year
- **Figure S2.** Antiretroviral coverage in sub-Saharan Africa, by year and country
- **Figure S3.** Living arrangements of older adults, by age
- **Figure S4.** Proportion of older adults living without working-age adults, by ART coverage
- **Table S1.** ART coverage and living arrangements of older adults, by study countries and years
- **Table S2.** Living arrangements of older adults and ART coverage, full regression output
- **Table S3.** Living arrangements of older adults and ART coverage, by sex
- **Table S4.** Living arrangements of older adults and ART coverage, using Poisson models
- **Table S5.** Living arrangements of older adults and ART coverage, post-2000 surveys
- **Table S6.** Living arrangements of older adults and ART coverage, using quadratic in age
- **Table S7.** Living arrangements of older adults and ART coverage, weighted by population size
- **Table S8.** Using alternative definitions of an older adult (50 and 70 years old)

Figure S1. Antiretroviral coverage in sub-Saharan Africa, by year



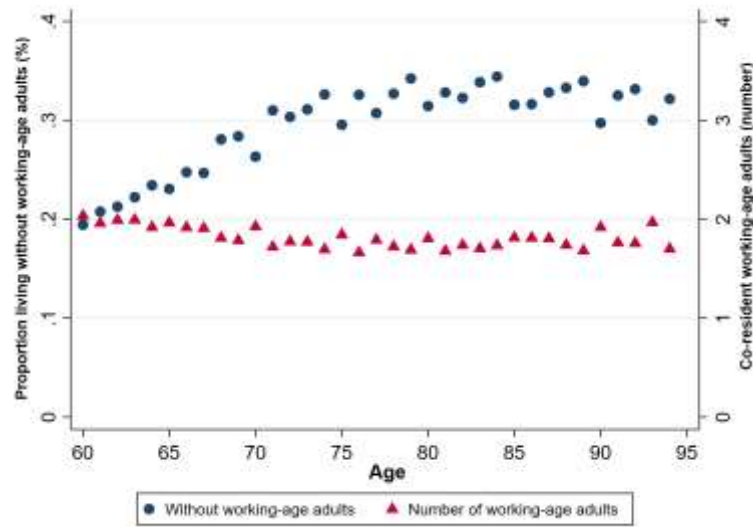
*Notes:* Figure shows average antiretroviral therapy (ART) coverage in sub-Saharan Africa. ART coverage was defined as the percentage of all people living with HIV who are receiving ART. ART coverage increased dramatically from the mid-2000s onwards. Source: annual UNAIDS estimates. Link: <http://aidsinfo.unaids.org/>.

Figure S2. Antiretroviral coverage in sub-Saharan Africa, by year and country



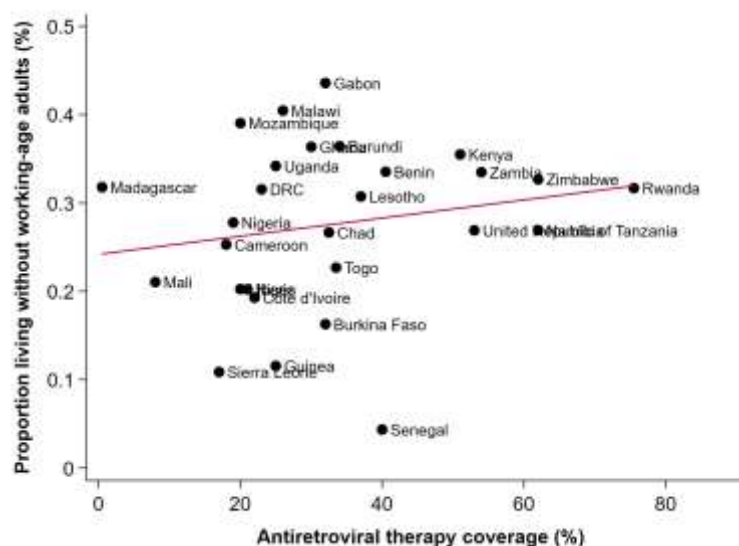
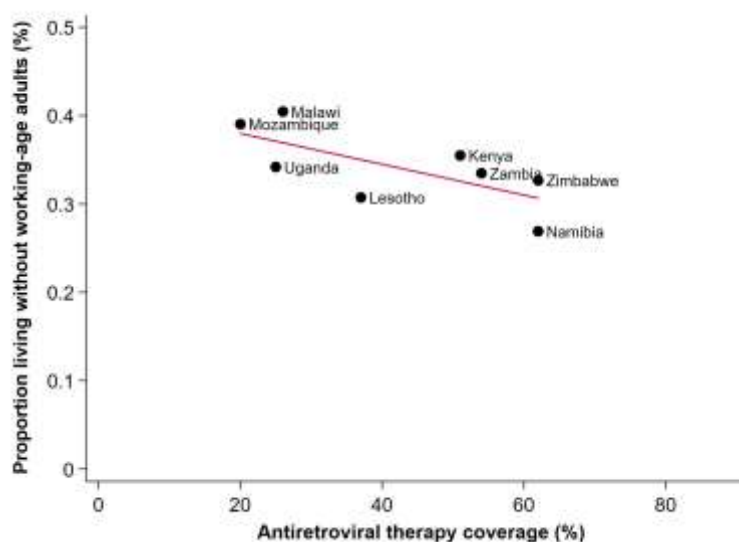
Notes: Figure shows ART coverage in the 28 sub-Saharan African countries included in our analysis in years when a Demographic and Health Survey, AIDS Indicator Survey, and/or Malaria Indicator Survey was conducted. ART coverage was defined as the percentage of all people living with HIV who are receiving antiretroviral therapy. ART coverage for each country-year observation is listed in Table S1. Source: annual UNAIDS estimates. Link: <http://aidsinfo.unaids.org/>.

Figure S3. Living arrangements of older adults, by age



*Notes:* Figure shows (i) the proportion of older adults (ages 60 or higher) living without working-age adults (ages of 18 to 59) (blue circles) and (ii) the number of working-age adults per household where an older adult lives (red triangles), by the age of respondents included in our analytical sample. Source: Demographic and Health Surveys, AIDS Indicator Surveys, and Malaria Indicator Surveys for 28 countries in sub-Saharan Africa, between 1991 – 2015.

Figure S4. Proportion of older adults living without working-age adults and ART coverage

(a) pooled sample ( $n = 28$  countries)(b) country HIV prevalence  $\geq 5\%$  ( $n = 8$  countries)

*Notes:* We used the most recently available Demographic and Health Survey, AIDS Indicator Survey, or Malaria Indicator Survey available for each country in our dataset to estimate the proportion of older adults living without working-age adults. ART coverage was defined as the percentage of all people living with HIV who are receiving antiretroviral therapy. ART coverage relates to the year of the most recently available survey. Figure (a) includes all countries and figure (b) includes countries with an HIV prevalence of 5% or higher. Countries are categorized based on adult HIV prevalence (ages 15-49) in 2015 (UNAIDS 2015).

Table S1. ART coverage and living arrangements of older adults, by study countries and years

Country	Survey year	ART coverage (%)	Lives without working-age adults (%)	Lives in missing generation household (%)	Working-age adults in household (number)
Benin	1996	0.0	23.2	5.0	2.1
Benin	2001	0.0	24.8	5.0	1.8
Benin	2006	0.0	27.6	6.1	1.7
Benin	2011	40.5	33.7	9.6	1.4
Burkina Faso	1993	0.0	15.3	3.6	2.5
Burkina Faso	1998	0.0	13.6	3.2	2.4
Burkina Faso	2003	1.0	15.9	3.4	2.7
Burkina Faso	2010	32.0	16.9	4.0	2.1
Burundi	2010	25.0	37.3	8.2	1.1
Burundi	2012	34.0	36.5	10.2	1.1
Cameroon	2004	3.0	25.4	4.8	1.9
Cameroon	2011	18.0	24.3	5.7	2.0
Chad	2004	0.0	23.4	5.4	1.8
Chad	2014	32.5	26.8	9.1	1.7
Côte d'Ivoire	1994	0.0	11.0	2.4	3.6
Côte d'Ivoire	1998	0.0	8.7	1.3	3.7
Côte d'Ivoire	2011	22.0	19.2	4.6	2.3
Democratic Republic of Congo	2007	4.0	22.5	4.2	2.0
Democratic Republic of Congo	2013	23.0	30.2	6.6	1.6
Gabon	2000	0.0	31.3	3.4	1.9
Gabon	2012	32.0	34.0	2.8	1.5
Ghana	1993	0.0	43.4	10.8	1.1
Ghana	1998	0.0	41.6	8.2	1.1
Ghana	2003	0.0	33.3	7.3	1.4
Ghana	2008	7.0	33.8	6.2	1.3
Ghana	2014	30.0	39.7	7.5	1.1
Guinea	1999	0.0	10.8	4.0	2.7
Guinea	2005	2.0	13.9	4.4	2.4
Guinea	2012	25.0	11.0	4.2	2.6
Kenya	1993	0.0	34.5	6.1	1.4
Kenya	1998	0.0	40.4	5.8	1.2
Kenya	2003	0.0	33.6	5.1	1.4
Kenya	2008	22.5	33.5	6.3	1.3
Kenya	2014	51.0	35.0	7.9	1.2
Lesotho	2004	1.0	26.9	7.7	1.7
Lesotho	2009	24.0	26.0	7.7	1.8
Lesotho	2014	37.0	30.5	9.4	1.5
Liberia	2007	4.0	17.9	6.1	1.9
Liberia	2013	20.0	19.1	6.7	2.0
Madagascar	1992	0.0	26.9	7.1	1.7
Madagascar	1997	0.0	27.4	7.5	1.6
Madagascar	2003	0.0	30.3	6.3	1.4
Madagascar	2008	0.5	32.9	7.9	1.3
Malawi	1992	0.0	37.4	11.3	1.1
Malawi	2000	0.0	38.6	10.9	1.2
Malawi	2004	1.0	44.6	14.4	1.0
Malawi	2010	26.0	40.0	13.2	1.1
Mali	1995	0.0	19.2	4.5	2.4
Mali	2006	8.0	20.4	4.3	1.9

Mozambique	1997	0.0	34.1	5.2	1.4
Mozambique	2003	0.0	32.4	7.0	1.5
Mozambique	2009	13.0	50.5	10.5	0.8
Mozambique	2011	20.0	41.5	9.0	1.1
Namibia	1992	0.0	19.3	6.8	2.5
Namibia	2000	0.0	21.9	8.7	1.9
Namibia	2006	19.5	22.3	6.2	1.9
Namibia	2013	62.0	24.0	8.0	1.8
Niger	1998	0.0	17.5	7.9	2.3
Niger	2006	2.0	16.5	6.9	2.1
Niger	2012	21.0	21.8	8.5	1.6
Nigeria	1990	0.0	20.2	4.9	2.2
Nigeria	2003	1.0	19.5	3.1	2.1
Nigeria	2008	7.0	29.0	4.4	1.6
Nigeria	2010	11.0	24.2	6.5	1.8
Nigeria	2013	19.0	27.6	4.8	1.6
Rwanda	1992	0.0	29.4	11.2	1.4
Rwanda	2000	0.0	36.8	12.8	1.1
Rwanda	2005	10.0	31.8	10.2	1.2
Rwanda	2010	48.0	34.7	9.8	1.2
Rwanda	2014	75.5	32.3	8.0	1.3
Senegal	1992	0.0	5.5	1.7	4.0
Senegal	2005	1.0	4.1	1.1	4.6
Senegal	2010	25.0	2.8	0.9	4.9
Senegal	2012	26.0	2.7	0.2	5.1
Senegal	2014	36.0	3.4	0.5	4.8
Senegal	2015	40.0	4.4	1.1	4.5
Sierra Leone	2008	4.0	11.7	5.8	2.2
Sierra Leone	2013	17.0	11.1	5.3	2.4
Togo	1998	0.0	25.2	7.0	1.8
Togo	2013	33.5	20.1	5.8	2.2
Uganda	1995	0.0	38.6	12.6	1.2
Uganda	2000	0.5	40.0	12.0	1.2
Uganda	2006	9.0	35.6	13.1	1.3
Uganda	2011	25.0	35.0	12.6	1.3
United Republic of Tanzania	1991	0.0	20.4	4.7	2.1
United Republic of Tanzania	1996	0.0	26.2	4.9	1.7
United Republic of Tanzania	1999	0.0	21.4	4.3	1.9
United Republic of Tanzania	2003	0.5	26.1	7.3	1.8
United Republic of Tanzania	2004	1.0	25.4	5.0	1.9
United Republic of Tanzania	2007	10.5	26.2	6.7	1.7
United Republic of Tanzania	2010	18.0	27.2	6.9	1.7
United Republic of Tanzania	2011	25.0	24.5	7.1	1.8
United Republic of Tanzania	2015	53.0	27.7	7.5	1.7
Zambia	1992	0.0	25.2	4.5	1.8
Zambia	1996	0.0	25.7	6.2	1.8
Zambia	2001	0.0	27.4	7.1	1.6
Zambia	2007	17.0	35.7	10.1	1.3
Zambia	2013	54.0	33.3	8.5	1.4
Zimbabwe	1994	0.0	22.5	6.3	1.8
Zimbabwe	1999	0.0	30.7	8.7	1.4
Zimbabwe	2005	3.5	28.6	11.2	1.5
Zimbabwe	2010	34.5	30.7	10.8	1.4
Zimbabwe	2015	62.0	33.4	10.3	1.3

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*Notes:* Sources: 103 Demographic and Health Surveys, AIDS Indicator Surveys, and Malaria Indicator Surveys for 28 countries in sub-Saharan Africa, between 1991 – 2015; annual UNAIDS estimates.

Table S2. Living arrangements of older adults and ART coverage, full regression output

<i>Subsample</i>	<u>Country HIV prevalence &gt; 5%</u>			<u>Country HIV prevalence ≥ 1%</u>			<u>Country HIV prevalence &lt; 1%</u>		
	<b>Lives without working-age adults (1=yes, 0=no)</b>	<b>Lives in missing generation household (1=yes, 0=no)</b>	<b>Working-age adults in household (number)</b>	<b>Lives without working-age adults (1=yes, 0=no)</b>	<b>Lives in missing generation household (1=yes, 0=no)</b>	<b>Working-age adults in household (number)</b>	<b>Lives without working-age adults (1=yes, 0=no)</b>	<b>Lives in missing generation household (1=yes, 0=no)</b>	<b>Working-age adults in household (number)</b>
<i>Model</i>	<b>Probit</b>	<b>Probit</b>	<b>OLS</b>	<b>Probit</b>	<b>Probit</b>	<b>OLS</b>	<b>Probit</b>	<b>Probit</b>	<b>OLS</b>
<i>Predictor</i>									
ART coverage (%)	-0.007*** (0.002)	-0.002*** (0.001)	0.023*** (0.007)	-0.001*** (0.000)	-0.001*** (0.000)	0.004* (0.002)	0.002 (0.003)	-0.002 (0.002)	0.012 (0.022)
Age (years)	0.004*** (0.000)	-0.001*** (0.000)	-0.008*** (0.001)	0.005*** (0.000)	-0.0002*** (0.000)	-0.007*** (0.001)	0.004*** (0.000)	0.001*** (0.000)	-0.002 (0.002)
Female (1=yes, 0=no)	0.115*** (0.003)	0.059*** (0.002)	-0.228*** (0.012)	0.117*** (0.002)	0.053*** (0.001)	-0.218*** (0.009)	0.087*** (0.004)	0.035*** (0.002)	-0.197*** (0.026)
Schooling (years)	0.003*** (0.001)	-0.002*** (0.000)	-0.014*** (0.003)	0.003*** (0.000)	-0.001*** (0.000)	-0.011*** (0.002)	0.004*** (0.001)	-0.0004 (0.001)	-0.059*** (0.008)
Urban (1=yes, 0=no)	-0.044*** (0.009)	-0.032*** (0.005)	0.242*** (0.032)	-0.031*** (0.005)	-0.018*** (0.003)	0.277*** (0.023)	-0.008 (0.007)	-0.004 (0.004)	0.213*** (0.078)
Electricity (1=yes, 0=no)	-0.009 (0.011)	-0.033*** (0.007)	0.257*** (0.036)	-0.033*** (0.005)	-0.019*** (0.003)	0.355*** (0.023)	-0.058*** (0.008)	-0.033*** (0.006)	1.392*** (0.090)
Radio (1=yes, 0=no)	-0.128*** (0.005)	-0.024*** (0.003)	0.459*** (0.017)	-0.130*** (0.003)	-0.027*** (0.002)	0.559*** (0.013)	-0.090*** (0.005)	-0.030*** (0.003)	0.821*** (0.041)
Bicycle (1=yes, 0=no)	-0.116*** (0.006)	-0.022*** (0.004)	0.412*** (0.024)	-0.143*** (0.004)	-0.030*** (0.002)	0.641*** (0.018)	-0.126*** (0.008)	-0.030*** (0.005)	0.931*** (0.056)
Observations	92,474	92,474	92,474	234,321	234,321	234,321	54,096	54,096	54,096
R-squared			0.107			0.148			0.305

Multivariable probit and OLS models. Regression coefficients reflect the changes in outcome variable given an increase in national ART coverage of 1%. Values from the probit models are marginal effects estimates and those from the ordinary least squares regression are coefficient estimates. All models control for age, sex, residence (urban or rural), education, measures of household wealth, survey year indicators, and country indicators. Countries are categorized based on adult HIV prevalence (ages 15-49) in 2015 (UNAIDS). \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Source: Demographic and Health Surveys, AIDS Indicator Surveys, and Malaria Indicator Surveys for 28 countries in sub-Saharan Africa, between 1991 – 2015.



Table S3. Living arrangements of older adults and ART coverage, by sex

<i>Dependent variable</i>	<b>Lives without working-age adults (1=yes, 0=no)</b>	<b>Lives in missing generation household (1=yes, 0=no)</b>	<b>Working-age adults in household (number)</b>
<i>Model</i>	<b>Probit</b>	<b>Probit</b>	<b>OLS</b>
<i>Subsample: Female</i>			
<i>Predictor: ART coverage (%)</i>			
Country HIV prevalence $\geq$ 5% ( $n = 50,076$ )	-0.006*** (0.002)	-0.003*** (0.001)	0.022*** (0.007)
Country HIV prevalence $\geq$ 1% ( $n = 123,836$ )	-0.002*** (0.001)	-0.001*** (0.000)	0.005** (0.002)
Country HIV prevalence $<$ 1% ( $n = 26,255$ )	0.001 (0.004)	-0.003 (0.002)	0.011 (0.023)
<i>Subsample: Male</i>			
<i>Predictor: ART coverage (%)</i>			
Country HIV prevalence $\geq$ 5% ( $n = 42,671$ )	-0.007*** (0.002)	-0.001 (0.001)	0.021*** (0.007)
Country HIV prevalence $\geq$ 1% ( $n = 119,277$ )	-0.001 (0.000)	0.000 (0.000)	0.001 (0.002)
Country HIV prevalence $<$ 1% ( $n = 27,963$ )	0.003 (0.003)	-0.001 (0.001)	0.013 (0.023)

Multivariable probit and OLS models. Regression coefficients reflect the changes in outcome variable given an increase in national ART coverage of 1%. Values from the probit models are marginal effects estimates and those from the ordinary least squares regression are coefficient estimates. All models control for age, residence (urban or rural), education, measures of household wealth, survey year indicators, and country indicators. Countries are categorized based on adult HIV prevalence (ages 15-49) in 2015 (UNAIDS). \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Demographic and Health Surveys, AIDS Indicator Surveys, and Malaria Indicator Surveys for 28 countries in sub-Saharan Africa, between 1991 – 2015.

Table S4. Living arrangements of older adults and ART coverage, using Poisson models

<i>Dependent variable</i>	Lives without working-age adults (1=yes, 0=no)	Lives in missing generation household (1=yes, 0=no)	Working-age adults in household (number)
<i>Model</i>	Poisson	Poisson	Poisson
<i>Predictor: ART coverage (%)</i>			
Country HIV prevalence $\geq$ 5% ( $n=92,474$ )	-0.007*** (0.002)	-0.002*** (0.001)	0.018*** (0.004)
Country HIV prevalence $\geq$ 1% ( $n=234,321$ )	-0.001*** (0.000)	-0.001*** (0.000)	0.002 (0.000)
Country HIV prevalence < 1% ( $n=54,096$ )	0.003 (0.004)	-0.002 (0.002)	0.010 (0.010)

Multivariable Poisson models. Regression coefficients reflect the changes in outcome variable given an increase in national ART coverage of 1%. Values are marginal effects estimates. All models control for age, sex, residence (urban or rural), education, measures of household wealth, survey year indicators, and country indicators. Countries are categorized based on adult HIV prevalence (ages 15-49) in 2015 (UNAIDS). \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Demographic and Health Surveys, AIDS Indicator Surveys, and Malaria Indicator Surveys for 28 countries in sub-Saharan Africa, between 1991 – 2015.

Table S5. Living arrangements of older adults and ART coverage, using post-2000 surveys

<i>Dependent variable</i>	<b>Lives without working-age adults (1=yes, 0=no)</b>	<b>Lives in missing generation household (1=yes, 0=no)</b>	<b>Working-age adults in household (number)</b>
<i>Model</i>	<b>Probit</b>	<b>Probit</b>	<b>OLS</b>
<i>Predictor: ART coverage (%)</i>			
Country HIV prevalence $\geq$ 5% ( $n=74,061$ )	-0.007*** (0.002)	-0.002** (0.001)	0.028*** (0.006)
Country HIV prevalence $\geq$ 1% ( $n=193,881$ )	-0.002*** (0.001)	-0.001*** (0.000)	0.008*** (0.002)
Country HIV prevalence < 1% ( $n=43,575$ )	n/a	n/a	n/a

Multivariable probit and OLS models. Regression coefficients reflect the changes in outcome variable given an increase in national ART coverage of 1%. Values from the probit models are marginal effects estimates and those from the ordinary least squares regression are coefficient estimates. All models control for age, sex, residence (urban or rural), education, measures of household wealth, survey year indicators, and country indicators. In the subsample of HIV prevalence < 1%, the country variable drops out because of collinearity with few country-year observations. Countries are categorized based on adult HIV prevalence (ages 15-49) in 2015 (UNAIDS). \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Demographic and Health Surveys, AIDS Indicator Surveys, and Malaria Indicator Surveys for 28 countries in sub-Saharan Africa, between 2000 – 2015.

Table S6. Living arrangements of older adults and ART coverage, using quadratic in age

<i>Dependent variable</i>	<b>Lives without working-age adults (1=yes, 0=no)</b>	<b>Lives in missing generation household (1=yes, 0=no)</b>	<b>Working-age adults in household (number)</b>
<i>Model</i>	<b>Probit</b>	<b>Probit</b>	<b>OLS</b>
<i>Predictor: ART coverage (%)</i>			
Country HIV prevalence $\geq$ 5% ( $n=92,474$ )	-0.007*** (0.002)	-0.002*** (0.001)	0.023*** (0.007)
Country HIV prevalence $\geq$ 1% ( $n=234,321$ )	-0.001*** (0.000)	-0.001*** (0.000)	0.003* (0.002)
Country HIV prevalence $<$ 1% ( $n=54,096$ )	0.002 (0.003)	-0.002 (0.002)	0.012 (0.022)

Multivariable probit and OLS models. Regression coefficients reflect the changes in outcome variable given an increase in national ART coverage of 1%. Values from the probit models are marginal effects estimates and those from the ordinary least squares regression are coefficient estimates. All models control for age, age squared, sex, area of residence, education, measures of household wealth, survey year indicators, and country indicators. Countries are categorized based on adult HIV prevalence (ages 15-49) in 2015 (UNAIDS). \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Demographic and Health Surveys, AIDS Indicator Surveys, and Malaria Indicator Surveys for 28 countries in sub-Saharan Africa, between 1991 – 2015.

Table S7. Living arrangements of older adults and ART coverage, weighted by population size

<i>Dependent variable</i>	<b>Lives without working-age adults (1=yes, 0=no)</b>	<b>Lives in missing generation household (1=yes, 0=no)</b>	<b>Working-age adults in household (number)</b>
<i>Model</i>	<b>Probit</b>	<b>Probit</b>	<b>OLS</b>
<i>Predictor: ART coverage (%)</i>			
Country HIV prevalence $\geq$ 5% ( $n=92,474$ )	-0.009*** (0.002)	-0.002** (0.001)	0.031*** (0.005)
Country HIV prevalence $\geq$ 1% ( $n=234,321$ )	-0.002** (0.001)	-0.000* (0.000)	0.005* (0.003)
Country HIV prevalence $<$ 1% ( $n=54,096$ )	0.001 (0.004)	-0.003* (0.002)	0.025 (0.022)

Multivariable probit and OLS models. Regression coefficients reflect the changes in outcome variable given an increase in national ART coverage of 1%. Values from the probit models are marginal effects estimates and those from the ordinary least squares regression are coefficient estimates. All models control for age, sex, residence (urban or rural), education, measures of household wealth, survey year indicators, and country indicators. Countries are categorized based on adult HIV prevalence (ages 15-49) in 2015 (UNAIDS). \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Observations were reweighted with the country population size ages 60+ at the time of the survey. Source: Demographic and Health Surveys, AIDS Indicator Surveys, and Malaria Indicator Surveys for 28 countries in sub-Saharan Africa, between 1991 – 2015.

Table S8. Using alternative definitions of an older adult (50 and 70 years old)

<i>Dependent variable</i>	Lives without working-age adults (1=yes, 0=no)	Lives in missing generation household (1=yes, 0=no)	Working-age adults in household (number)
<i>Model</i>	Probit	Probit	OLS
<i>Subsample: Elderly defined as <math>\geq 70</math> years old</i>			
<i>Predictor: ART coverage (%)</i>			
Country HIV prevalence $\geq 5\%$ ( $n=40,238$ )	-0.009*** (0.002)	-0.004*** (0.001)	0.032*** (0.007)
Country HIV prevalence $\geq 1\%$ ( $n=99,967$ )	-0.001** (0.001)	-0.001*** (0.000)	0.004* (0.002)
Country HIV prevalence $< 1\%$ ( $n=21,959$ )	0.002 (0.003)	-0.001 (0.002)	0.019 (0.025)
<i>Subsample: Elderly defined as <math>\geq 50</math> years old</i>			
<i>Predictor: ART coverage (%)</i>			
Country HIV prevalence $\geq 5\%$ ( $n=173,655$ )	-0.004*** (0.002)	-0.001* (0.001)	0.014** (0.006)
Country HIV prevalence $\geq 1\%$ ( $n=442,938$ )	-0.001** (0.000)	-0.001*** (0.000)	0.002 (0.002)
Country HIV prevalence $< 1\%$ ( $n=107,638$ )	0.001 (0.003)	-0.003* (0.002)	0.015 (0.019)

Multivariable probit and OLS models. Regression coefficients reflect the changes in outcome variable given an increase in national ART coverage of 1%. Values from the probit models are marginal effects estimates and those from the ordinary least squares regression are coefficient estimates. All models control for age, sex, residence (urban or rural), education, measures of household wealth, survey year indicators, and country indicators. In Panel A, we defined an older adult to be 70 years of age or older and a working-age adult between the ages of 18 and 69. In Panel B, we defined an older adult to be 50 years of age or older and a working-age adult between the ages of 18 and 49. Countries are categorized based on adult HIV prevalence (ages 15-49) in 2015 (UNAIDS). \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Source: Demographic and Health Surveys, AIDS Indicator Surveys, and Malaria Indicator Surveys for 28 countries in sub-Saharan Africa, between 1991 – 2015.