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Prevalence of HIV among those 15 and older in rural South Africa

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A greater knowledge of the burden of HIV in rural areas of Southern Africa is needed, especially among older adults. We conducted a cross-sectional biomarker survey in the rural South African Agincourt Health and Socio-demographic Surveillance site in 2010–2011 and estimated HIV prevalence and risk factors. Using an age–sex stratified random sample of ages 15+, a total of 5037 (65.7%) of a possible 7662 individuals were located and 4362 (86.6%) consented to HIV testing. HIV prevalence was high (19.4%) and characterized by a large gender gap (10.6% for men and 23.9% for women). Rates peaked at 45.3% among men and 46.1% among women – both at ages 35–39. Compared with a similar study in the rural KwaZulu-Natal Province, South Africa, peak prevalence occurred at later ages, and HIV prevalence was higher among older adults – with rates above 15% for men and 10% for women through to age 70. High prevalence continues to characterize Southern Africa, and recent evidence confirms that older adults cannot be excluded from policy considerations. The high prevalence among older adults suggests likely HIV infection at older ages. Prevention activities need to expand to older adults to reduce new infections. Treatment will be complicated by increased risk of noncommunicable diseases and by increasing numbers of older people living with HIV.

Keywords: HIV; South Africa; rural health

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Introduction

Among world regions, sub-Saharan Africa continues to have the highest burden of HIV/AIDS (UN Joint Programme on HIV/AIDS, 2010). Within sub-Saharan Africa, the epidemic in South Africa remains one of the largest in the world (Shisana et al., 2009). Evidence from 2002 to 2008 suggests that in South Africa HIV prevalence has stabilized, with a reduction among adolescents from 2005 to 2008. However, national estimates mask regional heterogeneity, with KwaZulu-Natal having the highest estimated regional prevalence of 21.5% (Welz et al., 2007).

Gaps remain in understanding the HIV epidemic in South Africa, and detailed information from rural areas remains scarce (Welz et al., 2007). Surveys often ignore HIV burden among those older than 50 (Mills, Rammohan, & Awofeso, 2010). A study at the Africa Centre health and demographic surveillance system (HDSS) site in KwaZulu-Natal in 2007 expanded HIV surveillance to include all eligible individuals aged 15+. It found high HIV prevalence among older adults and indicated the need for greater understanding of the burden, treatment, and prevention needs of this population (Wallrauch, Barnighausen, & Newell, 2010).

To address these gaps, we estimated HIV prevalence and its association with several sociodemographic factors in a rural population in South Africa near the Mozambique border. We compare our results with two studies from the Africa Centre HDSS (Wallrauch et al., 2010; Welz et al., 2007) and the 2006–2007 Swaziland Demographic and Health Survey.

Method

The rural study site is situated in northeast South Africa in the Bushbuckridge subdistrict of Ehlanseni district, Mpumalanga Province (Figures 1 and 2). By mid-2011, the population under surveillance comprised some 90,000 people in 27 villages. The MRC/Wits Rural Public Health and Health Transitions Research Unit (Agincourt) annually monitors deaths, births, and migration in this population since 1992 (Kahn et al., 2012). For this cross-sectional study, we randomly selected 7662 individuals, stratified by age and sex, from an eligible population of 34,413 using the 2009 HDSS census round as the sampling frame. Inclusion criteria were men and women aged 15+ who were permanent residents prior to the 2009

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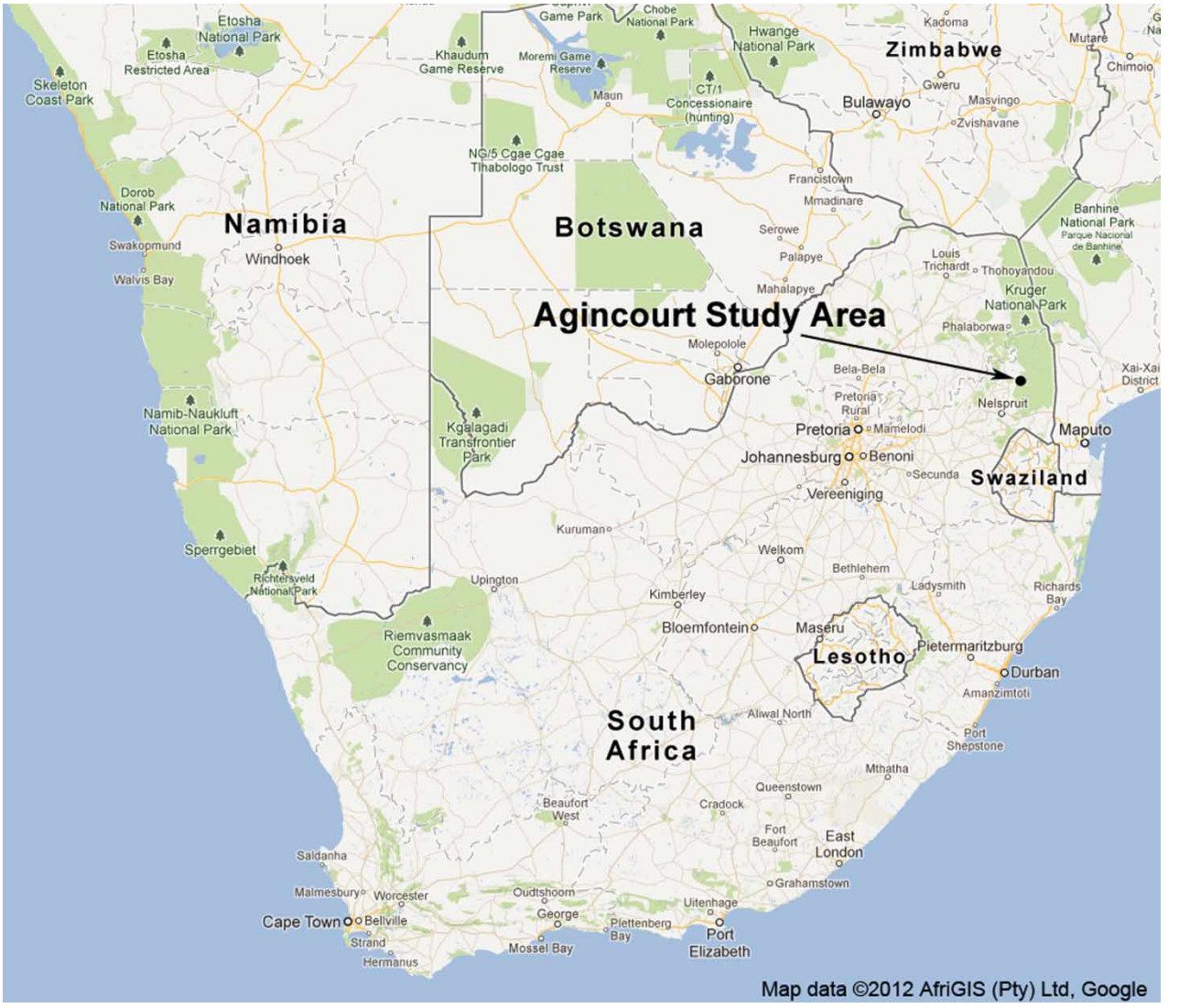


Figure 1. Location of the Agincourt HDSS in Southern Africa.

census round. We incorporated an oversample of 284 adults over age 50 from a prior study of older people (The 2006 Study on Global Ageing and Adult Health (SAGE) studied the health and well-being of a sample of 425 adults aged 50 +). Recruitment occurred during August 2010–May 2011.

All sampled persons were visited in their homes up to three times. The field team included 10 fieldworkers, 1 field supervisor, and 1 project site manager, all trained in the field research protocol, HIV counseling, and collection of dried blood spots. The interview (approximately 45 minutes) included the following: informed consent (assent for minors); sexual behavior and chronic disease risk factors questionnaires; anthropometric measurements; and collection of biomarkers for diabetes, cholesterol, and dried blood spots for HIV. No material incentives were provided to participate in the study. Test results were made available to participants one month after enrollment at the two health facilities in the area offering antiretroviral treatment. Blood spots were tested using screening assay Vironostika Uniform 11 (Biomerieux, France), and positives were confirmed by the SD Bioline HIV ELISA test (Standard Diagnostics Inc., Korea). If screening and confirmatory assays did not agree, a third assay was done. Following WHO criteria, this third assay determined the final result. We used a probit regression to model sociodemographic risk factors for HIV status among those who were tested. Predictors included sex, five-year age group, quintiles using 2009 household socioeconomic status, previous migration status,

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Figure 2. Boundary of the Agincourt HDSS study site in the subdistrict.

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village, gender of household head, nationality, education in years, and union status.

We performed all analyses using Stata 11.2 (StataCorp, 2009). Models incorporated probability weights to produce population estimates.

The study received ethical approvals from the University of the Witwatersrand Human Research Ethics Committee and the Mpumalanga Provincial Research and Ethics Committee.

Results

Figure 3 shows the recruitment flowchart. Of the 7662 randomly selected participants, 469 (6%) were found ineligible. Of the remaining 7193 eligible participants, 5037 (70%) were located. Of these, 353 refused to participate (7%), 322 consented to interview, but not HIV testing (6%), and 4362 consented to both interview and HIV testing (87%). Table 1 presents sociodemographic characteristics of males and females from the eligible sample.

Table 2 presents sex- and age-specific HIV prevalence rates estimated from those who were tested.

A probit regression estimated HIV sociodemographic risk factors for the tested sample (Table 3). An interaction between sex and age improved model fit ($p < 0.001$). Those in the high SES quintile had lower probability of being HIV + relative to those in the low quintile ($p < 0.001$). Men aged 15–19 ($p = 0.001$), 20–24 ($p < 0.001$) and 25–29 ($p < 0.001$) had lower probabilities of being HIV + relative to same-age women. Men aged 55–59 ($p = 0.020$), 60–64 ($p = 0.110$), and 65–69 ($p = 0.013$) had higher probabilities of being HIV + relative to same-age women. Those in a male-headed household had lower probability of being HIV + ($p = 0.010$), while South Africans had higher probability of being HIV + relative to non-South Africans (i.e., those not of South African origin, namely former Mozambican refugees) ($p = 0.031$). Those with the most education had lower probability of being HIV + relative to those with no education ($p = 0.028$). Those in union currently had a

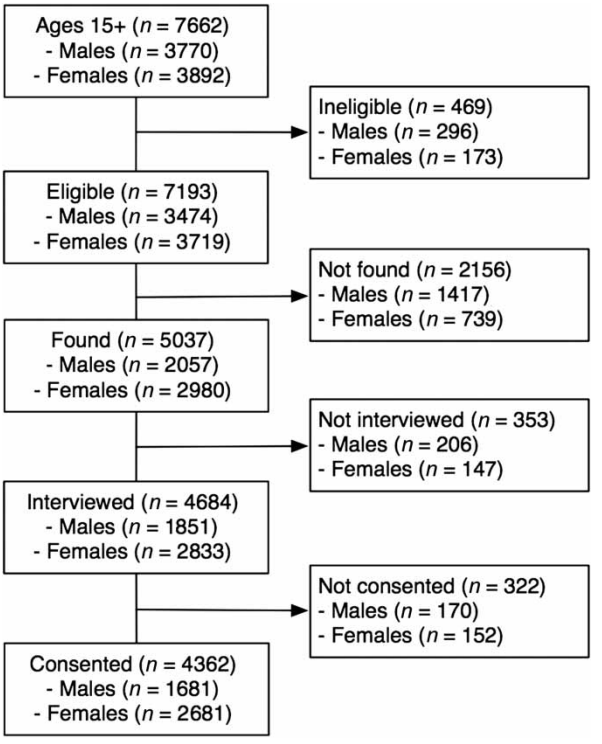


Figure 3. Flowchart of age–sex stratified random sample of 2009 Agincourt population, based on eligibility, being located for potential interview, consenting to interview, and consenting to HIV testing.

lower probability of being HIV+($p = 0.001$), while those who were in union previously had a higher probability of being HIV+($p = 0.049$) relative to those who had never been in union.

Figure 4(A) presents Agincourt HIV prevalence estimates by sex and age. The estimate for all ages was 19.4% (23.9% for females and 10.6% for males). Males had peak prevalence of 45.3% at ages 35–39 and prevalence remained over 15% until age 70. Females had peak prevalence of 46.1%, also at ages 35–39, with prevalence remaining over 10% until age 70. HIV prevalence among those 50 + was 16.5% (16.1% females and 17.7% males).

Figure 4(B) presents sex- and age-specific prevalence estimates based on two studies from KwaZulu-Natal Province (Wallrauch et al., 2010; Welz et al., 2007), and Figure 4(C) contains results from the 2006–2007 Swaziland DHS survey (Central Statistical Office (CSO) [Swaziland] and Macro International, 2008). Geographically, Swaziland sits between the Agincourt and KwaZulu-Natal study sites. HIV prevalence estimates are comparable between studies but age patterns somewhat differ. In KwaZulu-Natal and Swaziland, prevalence is skewed to the left, with high prevalence among younger ages that steadily declines with age. In Agincourt, HIV prevalence peaks at slightly older ages, with slower decline with age. Similar to its geography, the Swaziland results are intermediate between KwaZulu-Natal and Agincourt.

Table 1. Sociodemographic characteristics by sex: age–sex stratified random sample of ages 15+ from the 2009 Agincourt population ($N = 34{,}413$).

	Female (%) $n = 3892$	Male (%) $n = 3770$	Total (%) $n = 7662$
Sex			
Female	100	0	52
Male	0	100	48
Age group			
15–19	8	8	8
20–24	12	13	12
25–29	12	13	13
30–34	12	13	12
35–39	12	13	12
40–44	9	8	9
45–49	8	8	8
50–54	4	5	5
55–59	5	4	5
60–64	5	5	5
65–69	4	4	4
70–74	3	3	3
75–79	3	1	2
80–84	3	2	2
SES quintile			
Low	15	15	15
Middle-low	19	19	19
Middle	21	20	21
Middle-high	21	21	21
High	24	26	25
Previous migration history			
No	35	45	40
Yes	65	55	60
Male-headed household	54	73	63
South African	69	71	70
Education			
0	23	15	19
1–11	56	61	58
12	15	17	16
13 +	6	7	7
Union status			
None	36	45	40
Current	37	42	40
Previous	27	13	20

Discussion

Using a cross-sectional biomarker survey, we estimated HIV prevalence in rural South Africa for adults aged 15 + in 2010–2011. We found high prevalence comparable with KwaZulu-Natal, the

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Table 2. Measured Agincourt HIV prevalence (%) by sex and age.

	Measured (95% CI)			
Age	Female		Male	
15–19	5.5	(2.6–8.4)	0.4	(0.0–1.3)
20–24	27.0	(21.9–32.2)	6.1	(2.9–9.4)
25–29	37.8	(32.1–43.4)	21.7	(15.2–28.3)
30–34	41.8	(36.2–47.3)	41.8	(33.7–50.0)
35–39	46.1	(40.7–51.6)	45.3	(38.1–52.6)
40–44	34.4	(28.1–40.8)	41.0	(31.4–50.6)
45–49	34.2	(28.0–40.4)	28.8	(20.9–36.7)
50–54	26.9	(19.4–34.4)	30.6	(19.9–41.2)
55–59	26.8	(19.5–34.0)	34.6	(24.2–44.9)
60–64	13.1	(7.6–18.6)	19.8	(12.4–27.2)
65–69	10.3	(5.2–15.4)	16.5	(8.9–24.1)
70–74	11.0	(4.6–17.4)	5.7	(0.8–10.5)
75–79	6.2	(0.9–11.4)	5.3	(0.0–12.4)
80–84	1.3	(0.0–3.8)	1.8	(0.0–5.3)
15–84	23.9	(22.2–25.6)	10.6	(9.3–12.0)

Table 3. Probit regression of HIV status on sociodemographic characteristics: respondents tested for HIV ($n = 4197$).

	Beta	Lower 95% CI	Upper 95% CI
Male	−1.085	−1.774	−0.396
Age			
15–19	–	–	–
20–24	1.060	0.748	1.373
25–29	1.454	1.135	1.774
30–34	1.541	1.219	1.862
35–39	1.694	1.368	2.02
40–44	1.345	0.999	1.691
45–49	1.336	0.981	1.692
50–54	1.120	0.725	1.515
55–59	0.994	0.596	1.392
60–64	0.447	0.027	0.868
65–69	0.261	−0.19	0.712
70–74	0.242	−0.243	0.727
75–79	−0.097	−0.657	0.464
80–84	−0.773	−1.637	0.092
Sex × Age			
Male × 20–24	0.049	−0.704	0.802
Male × 25–29	0.575	−0.162	1.312
Male × 30–34	1.048	0.325	1.772
Male × 35–39	1.030	0.311	1.75
Male × 40–44	1.226	0.484	1.968
Male × 45–49	1.047	0.296	1.799
Male × 50–54	1.306	0.521	2.092
Male × 55–59	1.554	0.783	2.326
Male × 60–64	1.623	0.841	2.405
Male × 65–69	1.669	0.857	2.481
Male × 70–74	1.094	0.21	1.977
Male × 75–79	1.331	0.275	2.387
Male × 80–84	1.503	0.187	2.819
Village			
1	–	–	–
2	0.123	−0.267	0.513
3	0.059	−0.185	0.303
4	−0.087	−0.397	0.223
5	−0.131	−0.407	0.145
6	−0.003	−0.292	0.285
7	−0.064	−0.375	0.248
8	−0.076	−0.337	0.184
9	−0.113	−0.368	0.142
10	−0.188	−0.445	0.069
11	0.023	−0.209	0.256
12	0.179	−0.131	0.489
13	−0.098	−0.388	0.193
14	−0.038	−0.404	0.327
15	0.128	−0.157	0.414
16	−0.473	−0.768	−0.178
17	0.263	−0.071	0.597
18	0.348	−0.063	0.76
19	0.318	−0.137	0.772
20	−0.069	−0.513	0.375
21	0.566	0.165	0.967
Prior migration history	0.004	−0.118	0.125
SES quintiles			
Low	–	–	–
Middle-low	−0.160	−0.328	0.009
Middle	−0.048	−0.223	0.127
Middle-high	−0.052	−0.237	0.134
High	−0.332	−0.515	−0.15
Male-headed household	−0.170	−0.301	−0.04
South African	0.158	0.015	0.301
Education (years)			
0	–	–	–
1–11	0.013	−0.148	0.174
12	−0.077	−0.299	0.145
13 +	−0.323	−0.611	−0.035
Union status			
None	–	–	–
Current	−0.263	−0.42	−0.106
Previous	0.170	0	0.34
Constant	−1.505	−1.914	−1.097

region recognized to have highest prevalence in South Africa (Wallrauch et al., 2010; Welz et al., 2007) and nearby Swaziland. As in the South-African sites, prevalence for those aged 50–54, 55–59, and 60–64 from the 2006–2007 DHS of Swaziland are relatively high and show no sign of quickly approaching 0 as age increases; prevalence among the oldest age group

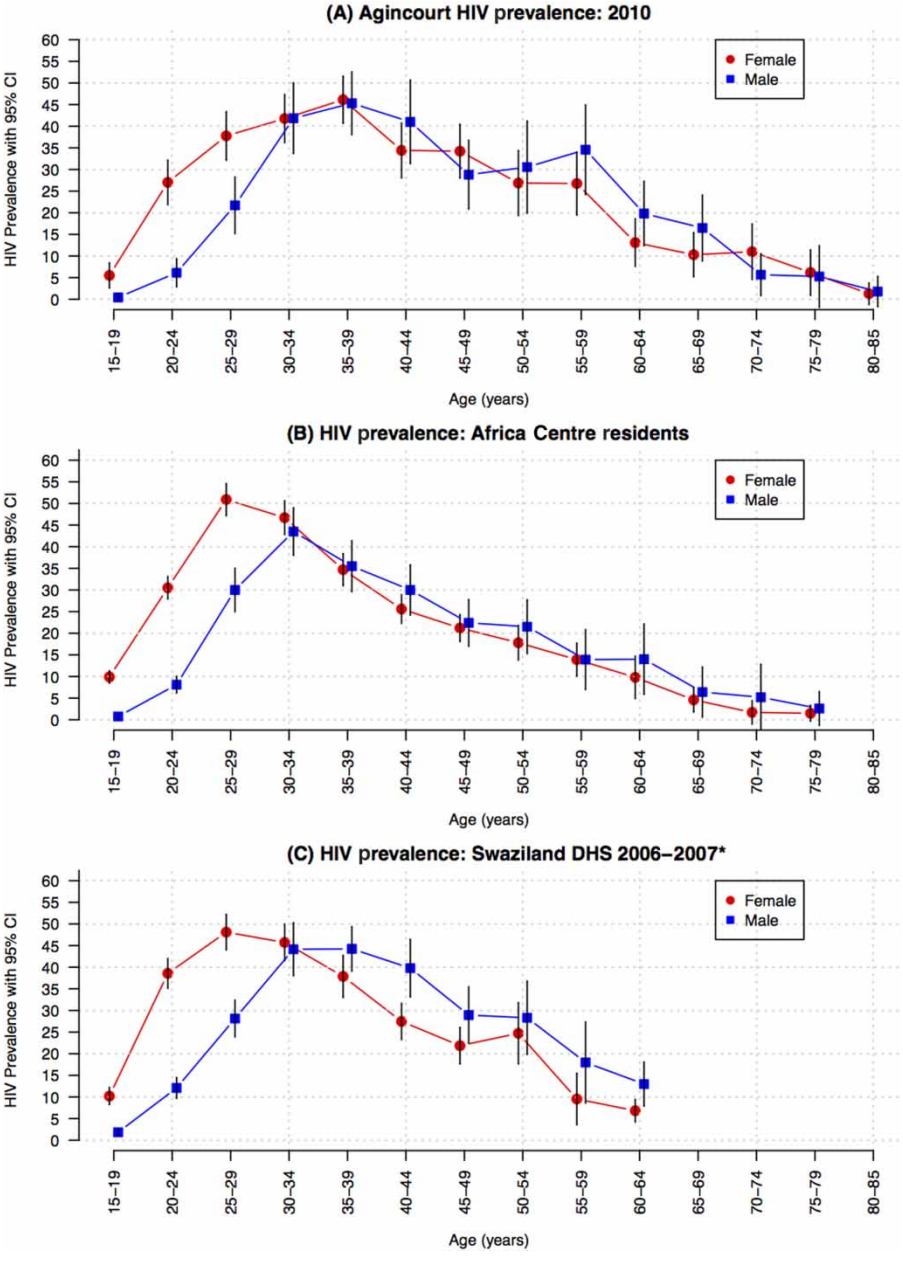


Figure 4. HIV prevalence by sex and age of: (A) Agincourt 2010 estimates; (B) KwaZulu-Natal estimates; and (C) Swaziland DHS estimates from 2006 to 2007. *Age group 60–64 includes everyone aged 60+.

in that survey, 60–64, is 13% for males and 6.8% for females. Compared with both KwaZulu-Natal and Swaziland, Agincourt HIV prevalence peaks over 35% in the fifties for males and over 25% in females. Agincourt is the highest of the three at ages 35+.

A relatively large HIV burden among those who were 50 + raises several questions. First, it is unknown whether older individuals contracted HIV at earlier ages and survived for long periods, or whether they acquired HIV at older ages; additional analyses of sexual risk behavior among older adults are needed. Antiretroviral therapy rollout in the study site only began in 2007 – future studies are needed to determine uptake and coverage. Second, high prevalence among older people may affect their capacity to care for grandchildren, creating an epidemic that affects both older people themselves and those under their care (Kautz, Bendavid, Bhattacharya, & Miller, 2010). Third, older people who also suffer from chronic noncommunicable diseases (NCDs) will need to use health facilities more frequently, seeking chronic care for both NCDs and HIV.

The Agincourt and Africa Centre HDSS sites are widely separated, with Swaziland in between. The

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similarity of HIV prevalence estimates in all three areas and the gradient they form suggest that HIV prevalence of this general sex–age-specific magnitude (through to older ages well beyond 50) is typical in rural South Africa.

Two conclusions are clear: (1) consideration must be given to expanding prevention activities to older adults and (2) health care systems need to include HIV + older adults in treatment plans. Effective treatment will be complicated by increased prevalence of NCD in older people, requiring coordination of care and follow-up, and by increasing numbers of older people living with HIV (Levitt, Steyn, Dave, & Bradshaw, 2011).

We contemplate two longitudinal follow-up studies of HIV – participants to estimate incidence and of HIV + participants to investigate entry into treatment, adherence, resistance, and other outcomes important to people living with HIV.

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