Sexual Behaviors and HIV Status: A Population-Based Study Among Older Adults in Rural South Africa

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Objective: To identify the unmet needs for HIV prevention among older adults in rural South Africa.

Methods: We analyzed data from a population-based sample of 5059 men and women aged 40 years and older from the study Health and Aging in Africa: Longitudinal Studies of INDEPTH Communities (HAALSI), which was carried out in the Agincourt health and sociodemographic surveillance system in the Mpumalanga province of South Africa. We estimated the prevalence of HIV (laboratory-confirmed and self-reported) and key sexual behaviors by age and sex. We compared sexual behavior profiles across HIV status categories with and without age–sex standardization.

Results: HIV prevalence was very high among HAALSI participants (23%, 95% confidence interval [CI]: 21 to 24), with no sex differences. Recent sexual activity was common (56%, 95% CI: 55 to 58) across all HIV status categories. Condom use was low among HIV-negative adults (15%, 95% CI: 14 to 17), higher among HIV-positive adults who were unaware of their HIV status (27%, 95% CI: 22 to 33), and dramatically higher among HIV-positive adults who were aware of their status (75%, 95% CI: 70 to 80). Casual sex and multiple partnerships were reported at moderate levels, with slightly higher estimates among HIV-positive compared to HIV-negative adults. Differences by HIV status remained after age–sex standardization.

Conclusions: Older HIV-positive adults in an HIV hyperendemic community of rural South Africa report sexual behaviors consistent with high HIV transmission risk. Older HIV-negative adults report sexual behaviors consistent with high HIV acquisition risk. Prevention initiatives tailored to the particular prevention needs of older adults are urgently needed to reduce HIV risk in this and similar communities in sub-Saharan Africa.

Key Words: aging population, older adults, sexual behavior, South Africa, HIV acquisition risk, HIV transmission risk

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INTRODUCTION

Older adults have received relatively little attention in the context of HIV prevention research and interventions.[1–4] Mathematical models and growing empirical evidence

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suggest that older adults make up a fast-increasing proportion of people living with HIV because of the impacts of large-scale HIV treatment on HIV mortality.[5–9] It is likely that the future of the HIV response will be determined to a large extent by our ability to design HIV interventions that are targeted at and appropriate for older adults. However, the evidence on sexual HIV transmission and acquisition risks in older adults remains scarce, in particular in sub-Saharan Africa where most of the worldwide 37 million HIV-infected people live.[10–15] In fact, HIV prevention policy and funding are largely focused on younger adults: most HIV prevention interventions have been developed and designed to fit the specific needs of this age group, and very few prevention interventions specifically targeted at older adults are available worldwide.[16] With this study in rural South Africa, we aim to contribute to filling this persistent knowledge gap.

Risky sexual activity places an HIV-negative individual at higher risk of acquiring HIV infection from an infected partner, whereas risky sexual activity by an HIV-positive individual places them at higher risk of transmitting HIV to an uninfected partner. Evaluating both the potential for HIV acquisition *and* the potential for HIV transmission in HIV-vulnerable populations is important because the intervention toolbox to prevent HIV acquisition is only partially overlapping with the intervention toolbox to prevent HIV transmission. As a biomedical example, antiretroviral therapy is an important approach to prevent HIV transmission,[17] whereas preexposure prophylaxis is used to prevent HIV acquisition.[18]

As observed in younger adults, sexual behavior patterns in older adults likely differ by HIV status, and documenting these differences will help provide insight into the potential drivers of the sexual transmission and acquisition of HIV in this age range. Certain sexual behaviors, like unprotected sex and multiple partnerships, clearly increase the risk of acquiring HIV,[19–21] and are likely to be observed more frequently in HIV-positive compared to HIV-negative populations, but whether or not these behaviors confer the same risk in older adults as in younger adults is underexplored. HIV status and sexual behaviors may also be linked because knowledge of HIV status could promote protective behavior change to avoid transmitting HIV to partners or to maintain HIV-negative status. Again, this relationship is observed in younger adults,[22,23] but is not yet explored in older adults.

In this article, we aim to add to the emerging body of literature on HIV risk in older adults. First, we report on the HIV prevalence in a population of men and women aged 40 years and older in rural South Africa. Second, we characterize this cohort with respect to their sexual behaviors. Finally, we compare sexual behavior profiles across HIV status categories, using both self-reported and laboratory-confirmed HIV status data.

METHODS

Study Population

We analyzed data from the Health and Aging in Africa: Longitudinal Studies of INDEPTH Communities (HAALSI) study. The HAALSI study is a population-based survey that aims to characterize a population of older men and women with respect to health, physical, and cognitive function, aging, and well-being. In 2015, 5059 men and women aged 40 years and older were enrolled in the study, which was carried out in the Agincourt health and socio-demographic surveillance system (AHDSS) in the rural Agincourt subdistrict of Mpumalanga province, South Africa.[24] Extensive survey and laboratory data were collected to assess (1) physical and cognitive functioning, (2) cardiometabolic health, (3) economic well-being, and (4) HIV status and HIV risk. In this study, we analyzed baseline data on HIV prevalence and sexual behaviors. Although most literature on the sexual health of older adults uses 50 years as the lower age cutoff, there is not a clearly established definition of "older age."[25] Our study population of older adults included men and women aged 40 years and older because life expectancy in southern African communities with high HIV prevalence, like our study community, is substantially lower than in most other world regions.[24,26–28] To assist in making valid comparisons with previous studies using different age cutoffs, we provide, where possible, sexual behavior and HIV prevalence data stratified by decade of life. Ethical approval for HAALSI was obtained from the University of the Witwatersrand Human Research Ethics Committee (#M141159), the Harvard T.H. Chan School of Public Health Office of Human Research Administration (#13-1608), and the Mpumalanga Provincial Research and Ethics Committee.

Data Collection

All variables in this analysis were collected in HAALSI baseline surveys and biological testing. Trained, local fieldworkers collected survey data electronically using a Computer Assisted Personal Interview system. Surveys were conducted in the local Shangaan language, with instruments translated from English and back-translated to ensure reliability. In addition to the survey data, trained fieldworkers also collected blood through finger prick and prepared dried bloodspots from each participant who consented to blood collection.

Key Measures

Laboratory-confirmed HIV status was determined through screening and confirmatory HIV enzyme-linked immunosorbent assays using standard laboratory practices on the prepared dried bloodspots.[29] Participants also self-reported their HIV status in the baseline survey. We defined *self-reported HIV status* based on participant responses to 2 questions: "Have you ever been tested for HIV? (yes/no)" and "Have you ever tested positive for HIV? (yes/no)." We categorized participants into 3 self-reported HIV status categories: (1) Those who reported testing positive for HIV; (2) Those who reported testing negative for HIV, and (3) Those who reported never testing for HIV, or testing with unknown status. Cross-referencing laboratory-confirmed with self-reported HIV status, we also calculated whether or not HIV-positive participants were aware of their positive status (under the

assumption that self-reported data reliably reflected this information[30]), separating those who self-reported being HIV-positive from those who self-reported being HIV-negative or not knowing their status.

We also present data on sexual activity and key sexual behaviors self-reported by participants at baseline. Participants were asked to report the *number of lifetime sex partners* and *number of recent sex partners* (past 24 months). Each participant reporting at least 1 recent partner was asked to report on specific characteristics of up to 3 recent sex partners. We examined whether or not the most recent partner was categorized as *casual* or *anonymous,* as opposed to *regular*. The *frequency of condom use* with most recent partner was originally elicited with the response categories of "always", "most of the time", "sometimes", and "never", but dichotomized for this analysis into the two categories "at least some of the time" and "never".

Analysis

We calculated the prevalence of key sociodemographic characteristics, HIV status (laboratory-confirmed status, self-reported status, and laboratory-confirmed status broken down by self-reported status), and each sexual behavior. Log-binomial regression models were used to calculate the age-specific and sex-specific prevalence of HIV and recent sexual behaviors (past 24 months) with their associated 95% confidence intervals (CIs).

We also used log-binomial regression models to estimate the prevalence of each recent sexual behavior (past 24 months) within each HIV status category and to assess whether the relative prevalence of certain sexual behaviors differed across the status categories. These analyses were conducted with the intention to separately characterize the potential for HIV acquisition and the potential for HIV transmission, with HIV-negative adults at potential risk for HIV acquisition and HIV-positive adults at potential risk for HIV transmission. Further comparing sexual behavior profiles between HIV-positive adults who were and were not aware of their positive status allowed us to investigate whether the observed patterns were compatible with the hypothesis that sexual behavior may change as a result of status knowledge. To examine whether any observed differences in sexual behavior across HIV status categories were attributable to age and sex composition differences, we used marginal structural binomial regression models to age- and sex-standardize prevalence and prevalence ratio estimates to the age and sex distribution of the overall study population.[31] We coded age in 10-year intervals. All analyses were conducted using SAS statistical software, version 9.4.[32]

RESULTS

Of the 5059 older adults enrolled in the study, 46% were men, 51% were currently married, and 46% had no formal education (Table 1). The median age was 61 years with an interquartile range (IQR) between the ages of 52 and 71 years. Compared with men, women were less likely to be married, live alone, report any formal education, and be employed.

TABLE 1. Socio-Demographic Characteristics, Sexual Behavior, Sexual History Characteristics, and HIV Status, by Sex, Among HAALSI Participants in Rural South Africa, 2014–2015 (n = 5059)

Variable	Total (n = 5059)	Men (n = 2345)	Women (n = 2714)
Sociodemographic characteristics			
Age, yrs			
40–49	918 (18.2)	418 (17.8)	500 (18.4)
50–59	1410 (27.9)	624 (26.6)	786 (29.0)
60–69	1304 (25.8)	643 (27.4)	661 (24.4)
70–79	878 (17.4)	446 (19.0)	432 (15.9)
80+	549 (10.9)	214 (9.1)	335 (12.3)
Educational attainment			
No formal education	2306 (45.7)	957 (40.9)	1349 (49.9)
Some primary (1–7 yrs)	1614 (32.0)	819 (35.0)	795 (29.4)
Some secondary (8–11 yrs)	537 (10.7)	303 (13.0)	234 (8.7)
Secondary or more (12+ yrs)	585 (11.6)	259 (11.1)	326 (12.1)
Missing	17	7	10
Country of origin			
South Africa	3528 (69.8)	1663 (70.9)	1865 (68.8)
Mozambique/other	1526 (30.2)	682 (29.1)	844 (31.2)
Marital status			
Never married	290 (5.7)	166 (7.1)	124 (4.6)
Separated/divorced	650 (12.9)	300 (12.8)	350 (12.9)
Widowed	1540 (30.5)	276 (11.8)	1264 (46.6)
Currently married/ cohabitating	2575 (50.9)	1602 (68.3)	973 (35.9)
Missing	4	1	3
Household composition			
Living alone	534 (10.6)	330 (14.1)	204 (7.5)
Living with 1 other person	538 (10.6)	257 (11.0)	281 (10.4)
Living in 3–6 person household	2438 (48.2)	1055 (45.0)	1383 (51.0)
Living in 7+ person household	1549 (30.6)	703 (30.0)	846 (31.2)
Employment status			
Employed (part or full time)	805 (16.0)	443 (19.0)	362 (13.4)
Not working	3719 (73.7)	1709 (73.1)	2010 (74.3)
Homemaker	521 (10.3)	186 (8.0)	335 (12.4)
Missing	14	7	7
Sexual behaviors			
No. lifetime partners			
0–1	1489 (33.1)	215 (10.8)	1274 (51.1)
2–4	1725 (38.4)	658 (32.9)	1067 (42.8)
5+	1280 (28.5)	1126 (56.3)	154 (6.2)
Missing	565	346	219
No. Partners past 2 yrs			
0	2118 (43.4)	522 (23.3)	1596 (60.4)
1	2537 (52.0)	1502 (67.0)	1035 (39.2)
2+	228 (4.7)	217 (9.7)	11 (0.4)
Missing	176	104	72
Most recent partner casual or anonymous*			

(*continued on next page*)

TABLE 1. (*Continued*) Socio-Demographic Characteristics, Sexual Behavior, Sexual History Characteristics, and HIV Status, by Sex, Among HAALSI Participants in Rural South Africa, 2014–2015 (n = 5059)

Variable	Total (n = 5059)	Men (n = 2345)	Women (n = 2714)
Yes	340 (12.3)	225 (13.1)	115 (11.0)
No	2419 (87.7)	1491 (86.9)	928 (89.0)
Missing	6	3	3
Condom use with most recent partner*			
Never	2054 (75.0)	1267 (74.4)	787 (76.0)
At least sometimes	686 (25.0)	437 (25.7)	249 (24.0)
Missing	25	15	10
HIV prevalence			
HIV status, laboratory-confirmed			
Positive	1048 (23.0)	483 (23.0)	565 (22.9)
Negative	3512 (77.0)	1614 (77.0)	1898 (77.1)
Missing	499	248	251
HIV status, self-reported			
Positive	616 (12.3)	287 (12.3)	329 (12.2)
Negative	2587 (51.5)	1163 (49.9)	1424 (52.9)
Unknown	1821 (36.3)	881 (37.8)	940 (34.9)
Missing	35	14	21
Self-reported HIV status among HIV+†			
Positive	537 (51.5)	249 (51.9)	288 (51.2)
Negative/unknown	506 (48.5)	231 (48.1)	275 (48.9)
Missing	5	3	2

*Among those who report at least 1 sex partner in the past 24 months (n = 2765).
†Among those with laboratory-confirmed HIV infection (n = 1048).

HIV Prevalence and Trends by Age and Sex

Overall, laboratory-confirmed HIV prevalence was high (23%, 95% CI: 22 to 24) and did not differ between men and women. Among those aged 50 years and older, HIV prevalence was 20% (95% CI: 19 to 21). Fewer respondents self-reported being HIV-positive (12% in full sample). About one-third of respondents (36%) reported never having been tested for HIV, and among those with laboratory-confirmed infections, nearly half (49%) self-reported a negative or unknown HIV status. Laboratory-confirmed HIV prevalence was highest in the youngest age categories (as high as 39% among 40–45-year-olds), and generally decreased with age in both men and women (Fig. 1A). Put another way: median age among those who tested HIV-positive [median age (IQR): 54 (47–62)] was considerably younger than among those who tested HIV-negative [median age (IQR): 63 (53–73)]. The age distribution of prevalent HIV infections by sex is reported in Supplemental Digital Content, Table 1, http://links.lww.com/QAI/A913.

Although the true duration of each HIV infection is unknown, we calculated a crude estimate of the duration of HIV status knowledge by examining the timing of the most recent HIV test. Among those who tested HIV-positive and self-reported being positive, 38% reported their most recent test less than 6 months ago, 21% between 6 months and 1 year ago, and 41% more than 1 year ago.

Prevalence of Sexual Activity and Sexual Behaviors by Sex

Sexual activity and sexual risk behaviors were prevalent in this population (Table 1). Two-thirds of the population reported multiple lifetime sex partners (67%), and more than half reported at least 1 recent sex partner, defined as within the last 2 years (57%). Among those with at least 1 recent partner, three-quarters reported never using condoms with their most recent partner (75%). More than 1 in 10 reported their most recent sex partner was casual or anonymous (12%). Women reported fewer lifetime partners and fewer partners in the past 2 years, compared with men. However, condom use and casual sex were observed at similar rates in women and men with at least 1 recent partner.

Age Trends in Sexual Activity and Sexual Behaviors by Sex

Men maintained sexual partnerships at relatively high rates across older ages, only dropping to 52% at age 80 and older (Fig. 1B). However, the proportion of women with recent sex partners decreased more steeply with age, dropping steadily from 78% at age 40–44 years, to 30% at age 60–64 years, to 6% at age 80 years and older. Multiple recent partnerships were represented in small numbers across men of all ages, and only represented in the youngest age categories for women (Fig. 2). The proportion of those reporting any condom use with their most recent partner decreased with age in both men and women (Fig. 1C), as did the proportion of recent partnerships categorized as casual or anonymous (Fig. 1D). However, low levels of casual sex persisted even at high ages with 10% of men 80 years and older and 17% of women 80 years and older reporting this outcome, among those with at least 1 recent partner.

Sexual Behaviors Across HIV Status Categories

The distribution of some sexual behaviors differed between HIV-negative adults, HIV-positive adults aware of their status, and HIV-positive adults unaware of their status (Fig. 3). Recent sexual partnerships were reported at similar rates across all 3 categories; 57% (95% CI: 55 to 59) of HIV-negative adults, 58% (95% CI: 54 to 62) of HIV-positive adults aware of their status, and 55% (95% CI: 51 to 60) of HIV-positive adults unaware of their status reported recent sex partners. However, among those with at least 1 recent partner, condom use was very low among HIV-negative adults [15% (95% CI: 14 to 17)], higher among HIV-positive adults unaware of their status [27% (95% CI: 22 to 33)], and dramatically higher among HIV-positive adults aware of their status [75% (95% CI: 70 to 80)]. Among those with at least 1 recent partner, casual sex was reported at the lowest level in HIV-negative adults [9% (95% CI: 8 to 10)] with higher levels reported in both HIV-positive categories: among those with status knowledge, casual sex prevalence was 29%

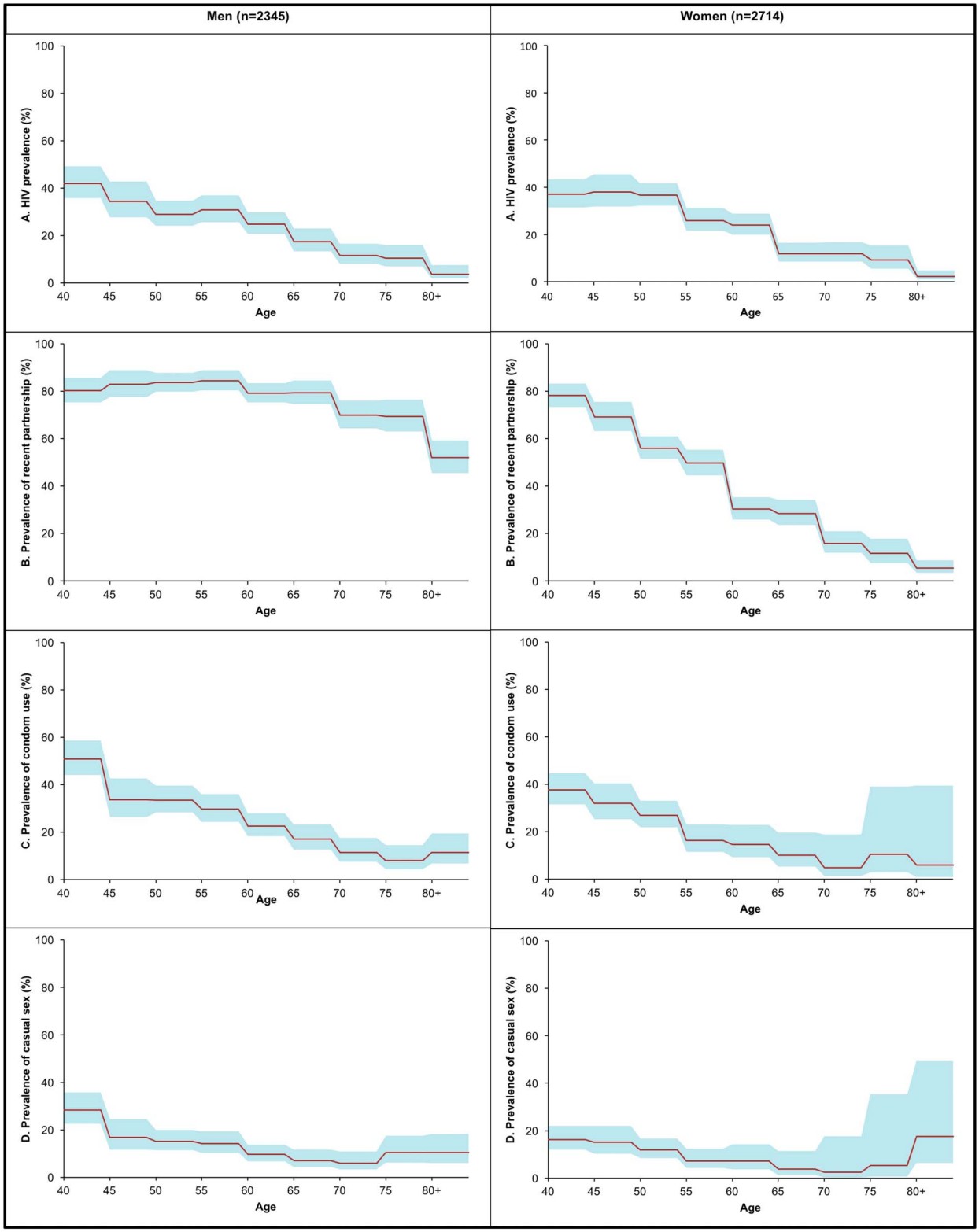

FIGURE 1. Prevalence of (A) HIV, (B) recent partnerships, (C) condom use, and (D) casual sex, by age and sex. Study population is HAALSI participants (men and women aged 40 years and above) in rural South Africa, 2014–2015 (n = 5059). Prevalence estimates and 95% confidence intervals were calculated using log-binomial regression models. HIV prevalence estimates are based on laboratory-confirmed testing. Condom use and casual sex outcomes were calculated among those reporting at least 1 sex partner in the past 24 months (n = 2765).

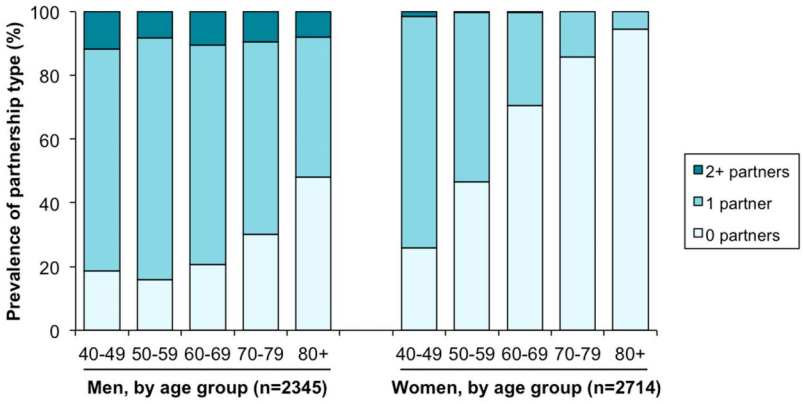

FIGURE 2. Number of sex partners in the past 24 months, by age and sex. Study population is HAALSI participants (men and women aged 40 years and above) in rural South Africa, 2014–2015 (n = 5059). Number of sex partners in the past 24 months is categorized into 0, 1, and more than 1 partner.

(95% CI: 24 to 34) and among those without status knowledge, casual sex prevalence was 18% (95% CI: 14 to 23). Multiple partnerships followed a similar pattern: this outcome was reported in 8% (95% CI: 6 to 9) of HIV-negative adults, 13% (95% CI: 10 to 17) of HIV-positive adults with status knowledge and 9% (95% CI: 6 to 13) of HIV-positive adults without status knowledge. The differences in sexual behaviors remained but tended to attenuate modestly after age and sex standardization. The unstandardized frequency of each sexual behavior, by HIV status, and stratified by sex, is presented in Supplemental Digital Content, Table 2, http://links.lww.com/QAI/A914. Unstandardized and age- and sex-standardized prevalence ratios comparing the relative frequency of each sexual behavior across HIV status categories are presented in Supplemental Digital Content, Table 3, http://links.lww.com/QAI/A915.

DISCUSSION

Overall, our results suggest that older adults in rural South Africa are at high risk for both HIV acquisition and HIV transmission. We found that HIV prevalence was high among both men and women, and that many of those who tested HIV-positive were unaware of their status. In contrast to stereotypes that older people are not sexually active, and in

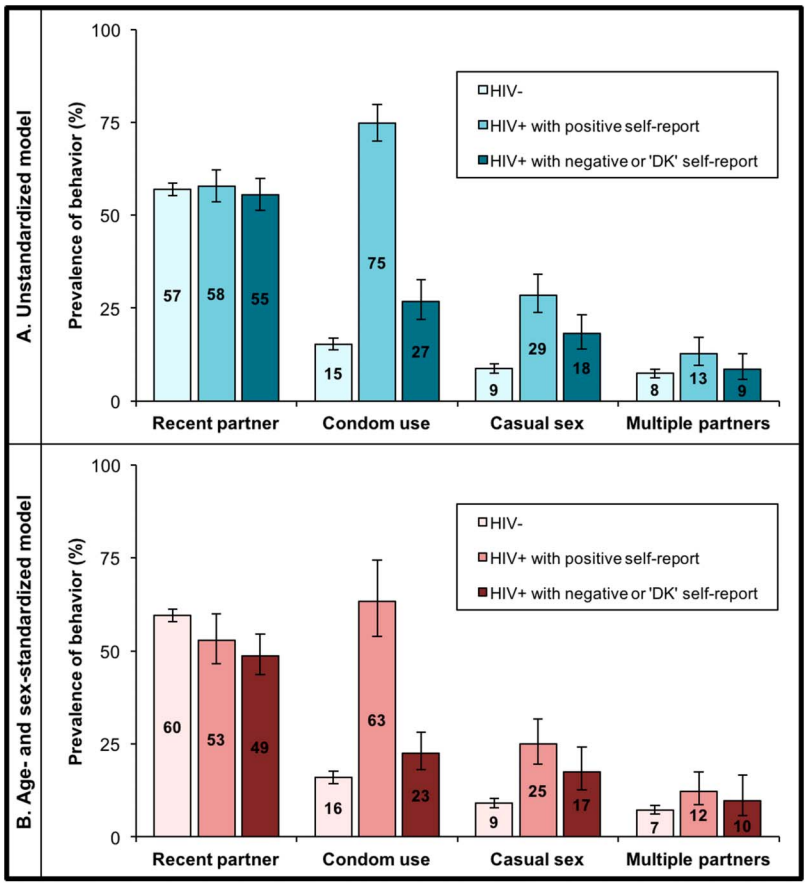

FIGURE 3. Sexual behavior profiles by HIV status based on self-report and laboratory testing. Study population is HAALSI participants (men and women aged 40 years and older) in rural South Africa, 2014–2015 (n = 5059). A, Prevalence estimates and 95% CIs were calculated using log-binomial regression models. B, Estimates standardized to the age and sex composition of the full study population were calculated using marginal structural log-binomial models. Condom use, casual sex, and multiple partners outcomes were calculated among those reporting at least 1 sex partner in the past 24 months (n = 2765). The HIV-negative category consists of all participants with HIV-negative laboratory test. The category "HIV-positive with positive self-report" consists of all participants with an HIV-positive laboratory test and HIV-positive self-report. The category "HIV-positive with negative or "DK" self-report" consists of all participants with HIV-positive laboratory test and HIV-negative or "don't know" self-report.

line with the few previous studies of sexual behavior in older adults in other settings,[10–13,15] this population reported recent sexual partnerships even into very old ages and sexual risk behaviors were reported that are consistent with the sexual transmission of disease—low condom use, casual sex, and multiple recent partnerships. The high rates of risky sexual behavior across HIV status categories points to the potential for older HIV-positive adults to transmit HIV to their sex partners and for older HIV-negative adults to acquire HIV from their sex partners.

Our study is one of the first to report sexual risk-taking among older adults in sub-Saharan Africa. Sexual activity was prevalent in this study population, although women tended to report fewer partners compared with men, and sexual activity tended to decrease with age. Although casual sex and multiple partnerships tended to decrease with age, condom use also became less likely with age. Notably, even in the oldest age categories, sexual activity and sexual risk behaviors were reported at rates implying substantial risk among both men and women. The observed continued sexual activity into older ages, low levels of condom use, and associated trends by sex and age are consistent with the 3 previous studies of older adult sexual behavior in sub-Saharan Africa, from Malawi in 1998–2008,[10] from the same Agincourt study site in 2010–2011,[13] and from Uganda in 2013.[15] Even globally, the evidence base on sex in older adults is scarce. However, the few previous studies on this topic (in the United States[11,33] and Thailand[34]) have also shown behavioral trends similar to the ones we observed here.

Important comparisons can also be made between the sexual behavior profiles of older adults and adolescents, a population considered to be at critically high HIV risk.[35–37] Compared with both a nationally representative sample of South African adolescents, and a population-based sample of adolescent young women in the same Agincourt study site, this cohort of older adults in rural South Africa was much less likely to use condoms, and among women, more likely to report casual sex.[38,39] Thus, older adults in South Africa are likely to differ in their exposure or response to HIV prevention messages.

The HIV prevalence estimates we observed in this study were higher than the estimates from previous studies of HIV prevalence in older adults in South Africa. The overall national HIV prevalence among adults aged 50 years and older was 6.4% in 2007–2008[40] and 7.6% in 2012.[41] The 2008 HIV prevalence among adults aged 50 years and older living in the Africa Centre surveillance site in rural KwaZulu-Natal was 9.5%.[42] The 2010–2011 HIV prevalence among adults aged 50 years and older within the same Agincourt study site from which the HAALSI study population was drawn was 16.5%.[43] Our HIV prevalence estimate for this same age range was 19.7%, more than 10 percentage points higher than the national and Africa Centre estimates. The prevalence differences over time suggests that HIV prevalence in older adults is currently increasing, a phenomenon likely largely explained by the HIV-positive population living longer because of antiretroviral therapy. Consistent with our results, the previous South African studies of HIV prevalence in older adults showed decreasing HIV prevalence with increasing age and similar trends in both men and women. It is important to note that these findings were primarily observed in older populations in rural South Africa. Extending the generalizability of these findings to other older populations in sub-Saharan Africa should be a priority for future work.

We also found that sexual behavior profiles differed by HIV status. Notably, more condom use was observed among those who tested HIV-positive compared with HIV-negative, but the magnitude of the protective effect was much stronger among those who reported knowledge of their positive status. This finding points to the important influence that HIV testing and counseling may have in changing the behavior of HIV-positive older people to avoid HIV transmission to uninfected partners. However, the very low condom use among sexually active HIV-negative older adults (15%) highlights the potential for incident HIV infections to occur in this high prevalence setting. At the same time, recent casual sex and recent multiple partnerships were also more common among those who tested HIV positive. These findings provide preliminary evidence that the same types of sexual behaviors established as risk factors for HIV among adolescents and younger adults are also risk factors for the sexual transmission of HIV among older adults.[19–21] Further examination of whether the magnitudes and patterns of these risks may change in older age is warranted.

The associations we observe here generate hypotheses about causal relationships between HIV status and sexual behavior, but they cannot serve as a test of such hypotheses. For those who tested HIV-positive, the duration of infection is unknown—transmission may have occurred relatively recently for some, whereas infections may be much older in others. The sexual behaviors we evaluated were collected with reference to the most recent 2-year time period, although behaviors reported for this period could have been established much earlier and may be representative of behaviors that also occurred at younger ages. In theory, the association between HIV status and sexual behavior is bidirectional. Older adults may plausibly change their behavior in response to knowledge of their HIV status to avoid transmission to their partners or acquisition from their partners. Conversely, risky sexual behaviors among older people could lead to subsequent HIV infection. Data on the timing of the most recent HIV test among those who test positive suggest a range in the length of time participants have known about their positive status from relatively recent (less than 6 months) to relatively long (more than 1 year). The fact that we observe short lengths of positive status knowledge is compatible with the hypothesis that sexual behaviors influence HIV risk. The fact that we also observe longer lengths of positive status knowledge is compatible with the hypothesis that older people modify their behaviors in response to their HIV status. Future analyses of longitudinal data on sexual behavior and HIV status could provide insights into the relative contributions of each hypothesized association.

Many of the outcomes we present in this article were self-reported by the participants in face-to-face interviews and may thus have been subject to social desirability bias. Sensitive questions about personal sexual behaviors were

likely underreported in this sample. Although we found that a large proportion of participants were willing to report on "undesirable" outcomes such as sexual activity, condom use, and casual sex, the prevalence values we report may underestimate the true values of these sexual behaviors.[44] Likewise, HIV status is also a sensitive outcome to self-report and those who tested HIV-positive but reported a negative or unknown status may have, in fact, known they were positive, or avoided previous HIV testing because of suspicions about being HIV-positive. It is thus possible that the true prevalence of HIV infection by self-report among those with laboratory-confirmed HIV-positive status is higher than we observed. However, the laboratory-identified infections among those who tested are objective measures and not subject to the same biases as self-reported status.

Our findings add to the growing body of evidence suggesting older adults urgently require HIV interventions that are tailored to their particular prevention needs. Among HIV-positive older adults, "positive prevention" campaigns with intensified counseling and motivation about sexual transmission risks should be considered,[45,46] with attention to HIV-related stigma that may be experienced by older adults.[47,48] Specific programs ensuring universal HIV testing, rapid linkage of HIV-positive people to care, and supported HIV treatment retention and adherence should also be considered.[17,49] Among HIV-negative older adults, it will be important to consider how established interventions, such as medical male circumcision[50] and condom promotion, and novel interventions, such as preexposure prophylaxis,[18] can be designed and delivered in ways that best meet the needs of older adults.[46,49] In general, it is likely that to reach older adults with HIV prevention messages, interventions will need to explore disseminating messages through different channels than have been successfully used for younger age groups (ie, social media and social venues). Older adults may also face different physical and cognitive barriers to interventions access than found in younger populations. HIV intervention research is urgently required to intensify and improve HIV prevention in the important but neglected vulnerable group of older adults.

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