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Associations with HIV testing in Uganda: an analysis of the Lot Quality Assurance Sampling database 2003–2012

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ABSTRACT

Beginning in 2003, Uganda used Lot Quality Assurance Sampling (LQAS) to assist district managers collect and use data to improve their human immunodeficiency virus (HIV)/AIDS program. Uganda's LQAS-database (2003–2012) covers up to 73 of 112 districts. Our multidistrict analysis of the LQAS data-set at 2003–2004 and 2012 examined gender variation among adults who ever tested for HIV over time, and attributes associated with testing. Conditional logistic regression matched men and women by community with seven model effect variables. HIV testing prevalence rose from 14% (men) and 12% (women) in 2003–2004 to 62% (men) and 80% (women) in 2012. In 2003–2004, knowing the benefits of testing (Odds Ratio [OR] = 6.09, 95% CI = 3.01–12.35), knowing where to get tested (OR = 2.83, 95% CI = 1.44–5.56), and secondary education (OR = 3.04, 95% CI = 1.19–7.77) were significantly associated with HIV testing. By 2012, knowing the benefits of testing (OR = 3.63, 95% CI = 2.25–5.83), where to get tested (OR = 5.15, 95% CI = 3.26–8.14), primary education (OR = 2.01, 95% CI = 1.39–2.91), being female (OR = 3.03, 95% CI = 2.53–3.62), and being married (OR = 1.81, 95% CI = 1.17–2.8) were significantly associated with HIV testing. HIV testing prevalence in Uganda has increased dramatically, more for women than men. Our results concurred with other authors that education, knowledge of HIV, and marriage (women only) are associated with testing for HIV and suggest that couples testing is more prevalent than other authors.

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LQAS, Lot Quality Assurance Sampling; HIV testing; Uganda; logistic regression; VCT, voluntary counseling and testing

Introduction

As of 2013 Uganda had 1,600,000 people living with human immunodeficiency virus (HIV) and a prevalence of 7.3% among adults aged 15–49 years (UNAIDS, 2015). In 2013, just under two-thirds of Ugandan adults (15–49 years) underwent an HIV test in the preceding 12 months (UAC, 2015). The Uganda AIDS Commission (UAC) intends to increase the proportion of Ugandan adults who have tested in the past 12 months to 80% by 2020 (UAC, 2015). The Strengthening TB and AIDS Response–Eastern Region (STAR E) project has worked with the UAC and Ugandan Ministry of Health (UAC, 2014) to use Lot Quality Assurance Sampling (LQAS) to collect data annually at the district level. STAR E-LQAS has built an LQAS-database starting with 19 districts in 2003, increasing to 73 by 2012. It includes data on HIV testing. While this information has been used for management purposes, it has not been analyzed to gain insights into HIV testing across time and districts. We performed a multidistrict analysis of the LQAS data-set at two time points to examine whether the percentage of adults who ever tested for HIV in Uganda varied between men and women over time, and which attributes were associated with testing and not testing for HIV.

Methods

The data are a collection of Lot Quality Assurance Samples (Robertson et al., 1997; Valadez, 1991) collected in 13 districts of Uganda in 2003–2004 that were subdivided into 24 districts by 2012. Taken together these samples are representative of the populations of these districts. In this study, we consider independent samples of men aged 15–54 years and women aged 15–49 years. These surveys are described elsewhere (Crossland, Hadden, Vargas, Valadez, & Jeffery, 2015; Olanrewaju, Jeffery, Crossland, & Valadez, 2015; Valadez et al., 2014); they are a secondary data source and we obtained permission of the Uganda Ministry of Local Government to perform these analyses.

In the early period respondents were asked if they had taken an HIV test using the questions "Have you ever voluntarily requested an HIV Test (Yes/No)?" and

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"Did you actually take the test (Yes/No)?", and in the late period with "Have you ever been tested for HIV (Yes/No)?" Each survey also included questions on respondents' sociodemographic characteristics, knowledge of benefits of HIV Counseling and Testing (HCT), and knowing where to get tested (Table 1).

To model "ever testing for HIV", we use conditional logistic regression to control for any unmeasured contextual effects in study areas (Kleinbaum and Klein, 2010). The samples include one man and one woman from each community; these are paired in the analysis. There are 1321 pairs for the early period and 2555 for the late period. Variables included as model effects are: sex, age, education level, marital status, knowing the benefits of HCT, and knowing where to get tested for HIV. All statistical analyses were conducted using the software R version 3.1.0 and the clogit function of the R survival package (R Core Team, 2014; Therneau, 2014; Therneau & Grambsch, 2000).

Results

Table 2 presents the demographic characteristics of respondents and their knowledge about HCT.

During the early period the percentage of respondents who ever tested for HIV is below 15% for both men and women. Results from model 1 (Table 3) show the odds of women ever testing are not significantly different from men even after controlling for other factors (Odds Ratio [OR] = 1.09; 95% CI = 0.74–1.60). However, having some level of secondary (OR = 3.04; 95% CI = 1.19–7.77) or post-secondary (OR = 6.25; 95% CI = 1.49–26.23) education compared to none significantly increases the odds of ever testing. So too does respondents knowing the benefits of HCT (OR = 6.09; 95% CI = 3.01–12.35) and where to get a test (OR = 2.83; 95% CI = 1.44–5.56).

During the late period, the percentage of respondents who have ever tested for HIV increases dramatically to 80% for women, and 62% for men. However, unlike

Table 1. Question wording in early (2003–2004) and late (2012) period LQAS surveys in Uganda and definition of positive response for analysis.

	Early		Late		
	Question	Answer categories	Question	Answer categories	Positive response
Age	When were you born? How old are you?	Day, month, year; years	When were you born? How old are you?	Day, month, year; years	Age reconciled with age calculated from birth date
Education level	What is the highest level of school you attained?	Never attended; primary; secondary; post-secondary	What is your highest level of education?	Never attended; function adult literacy; incomplete primary; complete primary; O-level; A-level; post-secondary; vocational training	None: never attended. Primary: primary, function adult literacy; incomplete primary; complete primary. Secondary: O-level; A-level; vocational training. Post-secondary: post-secondary
Marital status	Are you single, married, widowed, divorced or separated?	Single, no partner; single, non-regular partner; single with regular partner; married; living together; widowed; divorced/separated	What is your current marital status?	Single, no partner; single, non-regular partner; single with regular partner; married; cohabiting; widowed; divorced/separated	No partner: single, no partner. Not married has partner: single, non-regular partner; single with regular partner. Married or living together: Married; living together; cohabiting. Widowed, divorced, separated: widowed; divorced/separated
Knows the benefits of HCT	Do you know any benefits of having voluntary counseling and testing for HIV? Which benefits do you know?	Plan future; avoid infection; learn to live positively; do not know; other	What are the benefits of HIV counseling and testing?	Plan future; avoid infection; protect unborn; go for art; learn to live positively; food support; material support; HIV care; do not know; other	Naming one or more of the first 5 benefits listed for 2012, HIV care, or "Know status" specified under "Other"
Knows a place where to get tested for HIV	Do you know where you can be tested for HIV in this county?	Yes, no	Do you know the nearest place where you can be tested for HIV?	Yes, no	"Yes"
Tested for HIV with partner and received results in the last year			Have you ever taken an HIV test and received the test results together with your partner within the past 12 months?	Yes, no; yes, no	"Yes" to both questions
Ever tested for HIV	Have you ever voluntarily requested an HIV Test? Did you actually take the test?	Yes, no	Have you ever been tested for HIV?	Yes, no	"Yes" to both questions in the early period; "yes" in the later period

the early period, women are significantly more likely to have ever tested (OR = 3.03; 95% CI = 2.53–3.62). In the late period, both primary (OR = 2.01; 95% CI = 1.39–2.91) and secondary (OR = 3.12; 95% CI = 1.97–4.94) education are positively associated with testing compared to no education. As in the early period, respondents reporting knowing the benefits of HCT (OR = 3.63; 95% CI = 2.25–5.83) and where to get a test (OR = 5.15; 95% CI = 3.26–8.14) are significantly more likely to have ever tested. However, unlike the early period, respondents who are married or living with their partner are significantly more likely to have ever tested (OR = 1.81; 95% CI = 1.17–2.80).

Model 2 (Table 3) tests the above associations for differences between men and women. The increase in the odds of testing with education is significant for both men and women in the late period, but for women only in the early period (except women with tertiary-level education). Conversely, marital status is not associated with HIV testing for men or women during the early period, but by the late period it becomes significantly associated with testing for women (OR = 2.6; 95% CI = 1.4–4.82). The association with "Knows the benefits of having a test" and "knows where to get tested" is significantly stronger for women than men in the late period ($p = .018$). Except for tertiary-level education in the late period ($p = .014$), none of the other associations differ between men and women significantly (Table 3, last column).

Table 2. Characteristics of adult men and women participating in LQAS surveys in 2003–2004 (early period) and 2012 (late period).

	Men		Women	
Variable	Early (n = 1327)	Late (n = 2567)	Early (n = 1324)	Late (n = 2556)
Age				
15–25 years	172 (13%)	395 (15%)	293 (22%)	627 (25%)
25–35 years	500 (38%)	875 (34%)	544 (41%)	949 (37%)
35–55 years	655 (49%)	1297 (51%)	NA	NA
35–50 years	NA	NA	486 (37%)	967 (38%)
Missing	0 (0%)	0 (0%)	1 (0%)	13 (1%)
Education level				
None	102 (8%)	162 (6%)	264 (20%)	344 (13%)
Primary	789 (59%)	1751 (68%)	776 (59%)	1798 (70%)
Secondary	321 (24%)	551 (21%)	209 (16%)	357 (14%)
Post-secondary	80 (6%)	96 (4%)	35 (3%)	56 (2%)
Missing	35 (3%)	7 (0%)	40 (3%)	1 (0%)
Marital status				
No partner	99 (7%)	308 (12%)	71 (5%)	179 (7%)
Not married has partner	88 (7%)	162 (6%)	91 (7%)	156 (6%)
Married or living together	1109 (84%)	2002 (78%)	972 (73%)	1976 (77%)
Widowed, divorced, separated	31 (2%)	93 (4%)	189 (14%)	244 (10%)
Missing	0 (0%)	2 (0%)	1 (0%)	1 (0%)
Knows the benefits of HCT				
Yes	989 (75%)	2397 (93%)	803 (61%)	2411 (94%)
No	338 (25%)	170 (7%)	521 (39%)	145 (6%)
Knows a place where to get tested for HIV				
Yes	626 (47%)	2392 (93%)	533 (40%)	2361 (92%)
No	696 (53%)	175 (7%)	790 (60%)	194 (8%)
Tested for HIV with partner and received results in the last year[a]				
Yes		605 (64%)		517 (50%)
No		347 (36%)		507 (50%)
Ever tested for HIV				
Yes	182 (14%)	1599 (62%)	164 (12%)	2034 (80%)
No	1141 (86%)	961 (37%)	1155 (87%)	517 (20%)
Missing	4 (0%)	7 (0%)	5 (0%)	5 (0%)

[a]Measured in 2012 only.

Discussion

Our results detect a large increase in the proportion of men and women who ever tested between the early and late periods. Knowing the benefits and where to get a test were significantly associated with testing for both sexes in both periods; in the late period levels of education became significantly associated with testing for both sexes, as did being female, and for women only, being married or living with a partner.

The marked increase in HIV testing is also found in the Uganda Demographic and Health Survey (DHS) (Uganda Bureau of Statistics (UBOS) and ICF International Inc, 2012; Uganda Bureau of Statistics (UBOS) and ORC Macro, 2001). One possible explanation for this is the adoption of Provider Initiated Counseling and Testing (PICT) as national policy between the early and late periods (UAC, 2011). Under PICT, an HIV test is routinely offered to all patients attending a health facility and patients must specifically decline if they do not want the test (WHO, 2007). Byamugisha et al. (2010) credit PICT with dramatically increased testing rates among antenatal attendees in Eastern Uganda, and the WHO now recommends PICT in all generalized epidemics (WHO, 2007). Nationally, nearly all women attended at least one antenatal care visit according to DHS (Uganda Bureau of Statistics (UBOS) and ICF International Inc, 2012), which may explain why being a married female was associated with testing. A 2011 study (Ziraba et al., 2011) in Nairobi's informal settlements also found that being female and being married was positively associated with testing, although it did not attempt to examine the effect of marital status separately for men and women.

Our results find couples testing has greater success than other authors suggest: Larsson et al. (2012) found that only 4% of women tested with their partner. At 27.8%, Matovu et al. (2013) found greater uptake of couples testing in Rakai district in 2008–2009. By contrast our results find that for the late period, half of women and 64% of men tested with their partner in the last year, suggesting that couples testing is a viable strategy for increasing the uptake of testing among men. Other authors explored ways of increasing testing

Table 3. Odds ratios of the effects of sociodemographic and behavioral characteristics on ever testing for HIV, with 95% Wald confidence intervals.

	Variable	Model 1[a]	Model 2[b] (men)	Model 2[b] (women)	*p*-value[b]
Early period	Female (ref: male)	1.09 (0.74–1.60)		0.39 (0.02–6.61)	
	Age	0.99 (0.96–1.02)	0.97 (0.93–1.01)	1.01 (0.97–1.06)	.095
	Education level (ref: none)				
	Primary	1.32 (0.56–3.08)	0.48 (0.09–2.52)	2.07 (0.69–6.21)	.149
	Secondary	3.04 (1.19–7.77)*	1.44 (0.26–7.94)	4.03 (1.18–13.76)*	.337
	Post-secondary	6.25 (1.49–26.23)*	2.26 (0.32–15.96)	37.23 (2.75–504.82)**	.058
	Marital status (ref: single, no partner)				
	Not married has partner	0.74 (0.21–2.61)	0.30 (0.06–1.57)	1.05 (0.15–7.19)	.283
	Married or living together	1.06 (0.36–3.1)	1.05 (0.25–4.35)	0.93 (0.16–5.2)	.908
	Widowed, divorced, separated	2.07 (0.53–8.08)	1.27 (0.1–15.5)	1.89 (0.28–12.61)	.780
	Knows the benefits of HCT (ref: no)	6.09 (3.01–12.35)*	8.72 (2.96–25.68)***	3.74 (1.45–9.67)**	.240
	Knows a place where to get tested (ref: no)	2.83 (1.44–5.56)*	2.57 (1.13–5.84)*	4.06 (1.75–9.42)**	.270
Late period	Female (ref: male)	3.03 (2.53–3.62)***		1.51 (0.33–6.8)	.592
	Age	1 (0.99–1.02)	1.01 (0.99–1.03)	0.99 (0.98–1.01)	.122
	Education level (ref: none)				
	Primary	2.01 (1.39–2.91)***	2.65 (1.18–5.95)*	1.95 (1.27–2.99)*	.501
	Secondary	3.12 (1.97–4.94)***	4.42 (1.88–10.41)***	2.87 (1.54–5.36)***	.411
	Post-secondary	1.12 (0.52–2.4)	3.41 (1.04–11.14)***	0.53 (0.21–1.37)	.014*
	Marital status (ref: single, no partner)				
	Not married has regular partner	1.67 (0.93–2.98)	1.32 (0.64–2.73)	2.59 (1.1–6.13)*	.507
	Married or living together	1.81 (1.17–2.8)**	1.38 (0.79–2.41)	2.6 (1.4–4.82)**	.114
	Widowed, divorced, separated	1.40 (0.74–2.63)	0.91 (0.31–2.64)	2.02 (0.91–4.5)	.215
	Knows the benefits of HCT (ref: no)	3.63 (2.25–5.83)***	4.53 (2.07–9.9)***	2.98 (1.6–5.54)***	.406
	Knows a place where to get tested (ref: no)	5.15 (3.26–8.14)***	2.57 (1.3–5.07)**	6.95 (4.03–11.99)***	.018*

*$p < .05$.
**$p < .01$.
***$p < .001$.
[a]Model 1 includes as main effects: sex, education level, marital status, knowledge of HCT, and knowledge of place where to get an HIV test.
[b]Model 2 includes an interaction term between sex and all the other variables.

among men: Sekandi et al. (2011) assessed home-based testing in Kampala, and found that 69% of participants accepted it when offered. Moreover, men were significantly more likely to accept it than women. This led the authors of the study and others to call for home-based therapy as a way to increase the amount of men testing for HIV (Bwambale, Ssali, Byaruhanga, Kalyango, & Karamagi, 2008).

Limitations of our study are that it is a secondary analysis of a previously collected data-set, and contains information deemed pertinent by others. We recommend that future surveys include questions on the source of HIV testing to identify successful strategies. There were slight changes in the wording of questions from the early to the late period. However, we believe that this should have limited effect on our results; our findings are similar to other surveys conducted during that time (Health & Macro, 2006).

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