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Acceptability and feasibility of serial HIV antibody testing during pregnancy/postpartum and male partner testing in Tororo, Uganda

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Our objective was to determine whether serial HIV testing during pregnancy and the postpartum period as well as male partner testing are acceptable and feasible in Tororo, Uganda. This was a prospective study of pregnant women at the Tororo District Hospital (TDH) Antenatal Clinic. Patients presenting for routine antenatal care were asked to participate in a serial HIV testing integrated into standard antenatal and postpartum/child immunization visits, and to invite their male partners for HIV testing. Serial testing was defined as ≥2 tests during pregnancy and ≥2 tests within 24 weeks postpartum. Of the 214 enrolled women, 80 (37%) completed serial testing, 176 (82%) had ≥2 tests, and 147 (69%) had ≥3 tests during the study period. One hundred eighty-two women (85%) accepted male partner testing, but only 19 men (10%) participated. One woman seroconverted during the study, for a cumulative HIV incidence of 0.5% (1/214). In multivariable logistic regression analysis, longer distance between home and clinic (aOR 0.87 [95% CI 0.79–0.97]) and not knowing household income (aOR 0.30 [95% CI 0.11–0.84]) were predictive of not completing serial testing. Higher level of education was associated with completing serial testing (linear trend p value = 0.05). In conclusion, partial serial HIV testing was highly acceptable and feasible, but completion of serial testing and male partner testing had poor uptake.

Keywords: serial HIV testing; pregnancy; postpartum; partner testing; Uganda

Introduction

In response to the public health crisis of perinatal HIV transmission, UNAIDS called for the elimination of perinatal HIV infections by 2015 (UNAIDS, 2010). HIV-infected women on antiretroviral treatment have significantly reduced rates of perinatal HIV transmission including during lactation, which is especially important in sub-Saharan Africa where breastfeeding is the safest form of infant feeding even for HIV-infected mothers (Chasela et al., 2010; Connor et al., 1994; "Eighteen-month follow-up of HIV-1-infected mothers and their children enrolled in the Kesho Bora study observational cohorts," 2010; Musa, 2011; Shapiro et al., 2009). Unfortunately, less than 50% of pregnant women in sub-Saharan Africa underwent HIV testing in 2010, and HIV testing during breastfeeding is not routinely offered (UNICEF, 2012).

Current guidelines for HIV testing during pregnancy in Uganda recommend a repeat HIV test in the third trimester between 28 and 36 weeks (or if missed, in labor or immediately postpartum) (Esiru, 2010). Adopting serial HIV testing during both pregnancy and the postpartum period to detect incident HIV infection coupled with male partner testing could be a critical step forward to eliminate perinatal HIV transmission. The acceptability and feasibility of serial HIV testing during pregnancy and postpartum integrated with antenatal care and postpartum child immunization clinic visits, coupled with male partner testing, have not previously been studied. The primary aim of our study was to determine the proportion of women who successfully completed ≥2 HIV tests antenatally and ≥2 tests postpartum in a prospective cohort of HIV-uninfected women in Uganda.

Materials and methods

We conducted a prospective study of HIV-uninfected pregnant women presenting for routine care at the Tororo District Hospital (TDH) Antenatal Clinic, located in rural eastern Uganda. Our hypothesis was that >80% of women would complete serial HIV testing, defined as having ≥2 tests antenatally and ≥2 tests during the first 24 weeks postpartum. Pregnant women were eligible if

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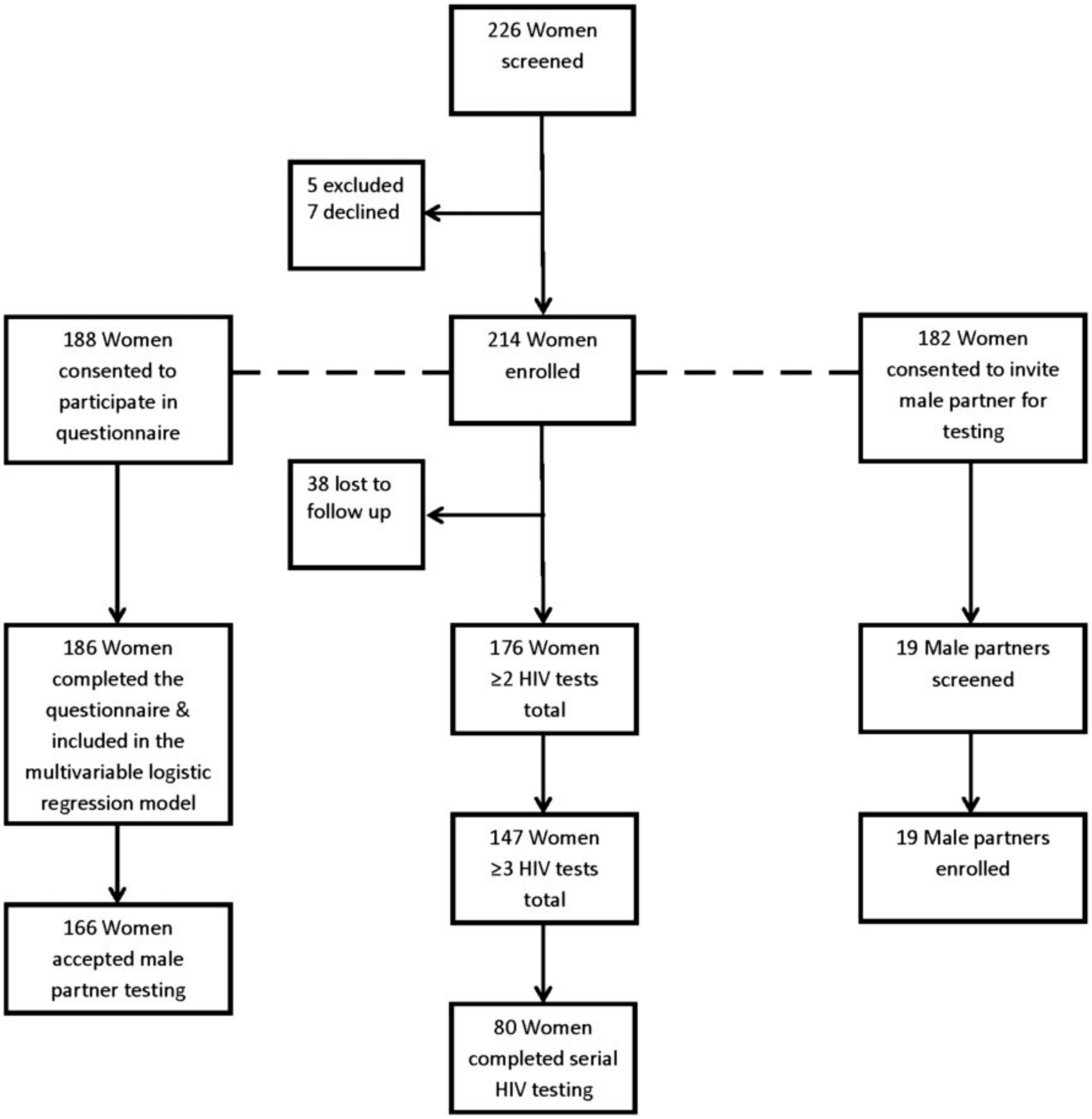

Figure 1. Study schema.

they were HIV-uninfected, aged ≥16 years, had a gestational age of ≤32 weeks, and lived ≤30 kilometers from TDH. Women were excluded if they were enrolled in an antiretroviral HIV prevention trial. Study staff enrolled eligible pregnant women by convenience sampling over a 3-month period. The study had the Institutional Review Board approval, and all study participants provided informed consent.

The primary study intervention was to provide HIV testing at every antenatal clinic visit, at the time of labor and delivery if they delivered at TDH, and postpartum at the 6-, 14-, and 24-week child immunization visits. There were two optional study activities for enrolled women: (1) completion of a questionnaire of attitudes toward HIV testing and (2) inviting their male partner for HIV voluntary counseling and testing (VCT). Enrolled male partners underwent one-time HIV VCT and were offered an optional questionnaire as well.

All HIV tests were performed onsite using Determine rapid HIV antibody tests (Abbott Diagnostics). Testing was done in accordance with the TDH laboratory protocol with subsequent confirmatory testing using Stat-Pak (Inverness Medical Professional Diagnostics) for any positive Determine results, and Uni-Gold (Trinity BioTech) rapid HIV antibody "tie-breaker" tests done for any discordant Determine/Stat-Pak results.

We calculated the proportion of women who completed serial HIV testing and performed multivariate logistic regression to identify predictors of completing serial HIV testing. We also calculated the proportion of pregnant women who accepted male partner testing and performed multivariate logistic regression to identify predictors of accepting male partner testing. In the logistic regression models, we included variables that we hypothesized to be predictors of who would complete serial HIV testing and of who would accept male partner testing: maternal age, distance of home from TDH, marital status, education level, household income, reported condom use, history of pre-pregnancy HIV testing, perception of HIV infection risk, active verbal abuse, and active physical abuse. We used Stata version 9.0 (StataCorp, College Station, TX, USA) for all analyses.

Table 1. Baseline characteristics of women enrolled in the study[a].

Demographics	$N = 204$[b]
Age, years	24 (20–29)
Distance to clinic, km	4 (2–7)
Marital status	
Not Married	13 (6.4%)
Married in a monogamous union	155 (76.0%)
Married in a polygamous	35 (17.2%)
Widowed	1 (0.5%)
Education level	
No education	14 (6.9%)
Some primary school	115 (56.4%)
Primary 1–2	6 (2.9%)
Primary 3–4	25 (12.3%)
Primary 5–7	84 (41.2%)
Secondary 1–2	23 (11.3%)
Secondary 3–4	27 (13.2%)
>Secondary 4	25 (12.3%)
Occupation	
Housewife	124 (60.8%)
Sales/trade	36 (18.0%)
Agriculture	10 (4.9%)
Education	8 (3.9%)
Student	6 (2.9%)
Unemployed	5 (2.5%)
Other	15 (7.4%)
Household income, Uganda Schillings[c]	
≤50,000	131 (64.2%)
None	13 (6.4%)
<10,000	56 (27.5%)
10,000–50,000	62 (30.4%)
50,001–100,000	17 (8.3%)
100,001–200,000	15 (7.4%)
>200,000	7 (3.4%)
Don't know	34 (16.7%)

Notes: [a]Values are reported as medians (interquartile range) or *n* (%).
[b]Demographic data were unavailable on 10 (5%) of 214 enrolled women.
[c]At the time of the study, 2000 Uganda Schillings = 1 USD.

Results

Of the 226 women screened, 214 (95%) enrolled in the study for serial HIV testing (Figure 1). Demographic information (Table 1) was collected from 204 women (95%), and 188 women (88%) agreed to the voluntary questionnaire. Overall, 37% (n=80) of women underwent 2 antenatal and 2 postpartum HIV tests. Partial serial HIV testing was common with 82% of women (176) having 2 and 69% (147) having 3 HIV tests. Although 182 women (85%) consented to male partner HIV testing, only 19 (10.4%) male partners enrolled (all were HIV negative). We detected HIV seroconversion in one postpartum woman during the study period for a cumulative HIV incidence of 0.5% (1/214).

In multivariate logistic regression, only longer distance between home and clinic (aOR 0.87 [95% CI 0.79–0.97]) and not knowing household income (aOR 0.30 [95% CI 0.11–0.84]) were associated with a decreased odds of completing serial HIV testing (Table 2). Conversely, higher level of education was associated with completing serial HIV testing (linear trend p value = 0.05). For predictors of accepting male partner HIV testing, not being married was associated with a decreased odds (aOR 0.03 [95% CI 0.00–0.16) while uncertainty about the risk of becoming HIV infected increased the odds (aOR 7.44 [95% CI 1.32–42.07]) of a woman accepting male partner testing (Table 3).

Discussion

We studied the acceptability and feasibility of serial HIV testing during pregnancy/postpartum, coupled with male partner testing in Uganda. Only 37% of women completed the serial HIV testing protocol, though 82% of women underwent at least two HIV tests. While 85% of women agreed to invite their male partner for HIV testing, only 10% of their male partners had HIV testing. These results underscore that although pregnant women in Uganda may be willing to have repeat HIV testing and partner testing, successful completion of serial HIV testing and uptake of male partner testing may not be feasible unless the barriers to HIV testing are identified and addressed.

Our study showed that longer distance from a woman's home to the clinic was a barrier to completing serial HIV testing, which is consistent with another Ugandan study (Larsson et al., 2012). Innovative alternatives to clinic-based HIV VCT, such as HIV self-testing at home and mobile HIV testing units, may surmount this barrier but face additional challenges of quality control and linkage to clinical care (Fonner, Denison, Kennedy, O'Reilly, & Sweat, 2012; Truong et al., 2011; Wachira, Kimaiyo, Ndege, Mamlin, & Braitstein, 2012). Not knowing the amount of their

Table 2. Predictors of completing serial HIV testing[a].

	Completers[b] (*n* = 70)	Non-completers (*n* = 116)	Total cohort (*N* = 186)	Univariate LR: OR (95% CI)	Multivariable LR: aOR (95% CI)
Age: Mean years (±SD)	24.0 (±5.9)	25.2 (±5.9)	24.8 (±5.9)	0.96 (0.91–1.01)	0.98 (0.92–1.05)
Distance to clinic: Mean km (±SD)	4.3 (±2.3)	6.0 (±5.1)	5.3 (±4.4)	0.89 (0.81–0.98)	0.87 (0.79–0.97)
Marital status: *n* (%)					
Married, monogamous	54 (38.3)	87 (61.7)	141 (75.8)	Reference	Reference
Married, polygamous	12 (35.3)	22 (64.7)	34 (18.3)	0.88 (0.40–1.92)	1.60 (0.64–4.00)
Other	4 (36.4)	7 (63.6)	11 (5.9)	0.92 (0.26–3.29)	0.67 (0.16–2.88)
Education level: *n* (%)					
≤Primary 4	12 (28.6)	30 (71.4)	42 (22.6)	Reference	Reference
Primary 5–7	31 (39.2)	48 (60.8)	79 (42.5)	1.75 (0.72–4.26)	1.71 (0.74–3.92)
≥Secondary 1	27 (41.5)	38 (58.5)	65 (34.9)	2.40 (0.88–6.53)	2.40 (0.95–6.05)
Household income: Uganda schillings[c]					
<10,000	28 (45.2)	34 (54.8)	62 (33.3)	Reference	Reference
10,000–50,000	22 (37.3)	37 (62.7)	59 (31.7)	0.59 (0.26–1.37)	0.60 (0.27–1.32)
50,001–100,000	11 (33.3)	22 (66.7)	33 (17.7)	0.61 (0.25–1.46)	0.48 (0.17–1.34)
Don't know	9 (28.1)	23 (71.9)	32 (17.2)	0.30 (0.11–0.84)	0.34 (0.13–0.93)
Condom use	15 (33.3)	30 (66.7)	45 (24.2)	0.78 (0.39–1.58)	0.71 (0.33–1.53)
Verbal abuse	20 (36.4)	35 (63.6)	55 (29.6)	0.93 (0.48–1.78)	1.34 (0.58–3.13)
Physical abuse	9 (34.6)	17 (65.4)	26 (14.0)	0.86 (0.36–2.05)	0.57 (0.19–1.75)
Prior HIV test	50 (37.3)	84 (62.7)	134 (72.0)	0.95 (0.49–1.84)	0.87 (0.42–1.82)
Perceived risk of HIV acquisition					
No	26 (39.4)	40 (60.6)	66 (35.5)	Reference	Reference
Yes	26 (40.6)	38 (59.4)	64 (34.4)	1.05 (0.52–2.12)	1.08 (0.46–2.51)
Don't know	18 (32.1)	38 (67.9)	56 (30.1)	0.73 (0.35–1.54)	0.66 (0.29–1.53)

Notes: [a]Complete data for the logistic regression (LR) model available on 186 (87%) of 214 enrollees.
[b]Completion of serial HIV testing defined as having had at least 2 HIV tests in pregnancy and at least 2 HIV tests up to 24 weeks postpartum.
[c]At the time of the study, 1 USD = 2000 Uganda Schillings.

Table 3. Predictors of accepting male partner testing[a].

	Acceptors (*n* = 161)	Non-acceptors (*n* = 25)	Total cohort (*N* = 186)	Univariate LR: OR (95% CI)	Multivariable LR: aOR (95% CI)
Age: Mean years (±SD)	25.0 (±5.9)	22.9 (±5.6)	24.8 (±5.9)	1.08 (0.99–1.17)	1.01 (0.89–1.14)
Distance to clinic: Mean km (±SD)	5.4 (±4.3)	4.8 (±4.8)	5.3 (±4.4)	1.04 (0.93–1.16)	1.03 (0.91–1.17)
Marital status: *n* (%)					
Married, monogamous	128 (90.8)	13 (9.2)	141 (75.8)	Reference	Reference
Married, polygamous	30 (88.2)	4 (11.8)	34 (18.3)	0.76 (0.23–2.50)	0.67 (0.17–2.66)
Other	3 (27.3)	8 (72.7)	11 (5.9)	0.03 (0.00–0.19)	0.03 (0.00–0.16)
Education level: *n* (%)					
≤Primary 4	40 (95.2)	2 (4.8)	42 (22.6)	Reference	Reference
Primary 5–7	68 (86.1)	11 (13.9)	79 (42.5)	0.31 (0.07–1.47)	0.32 (0.05–1.83)
≥Secondary 1	53 (81.5)	12 (18.5)	65 (34.9)	0.22 (0.05–1.04)	0.40 (0.06–2.55)
Household income: Uganda schillings[b]					
<10,000	55 (88.7)	7 (11.3)	62 (33.3)	Reference	Reference
10,000–50,000	55 (93.2)	4 (6.8)	59 (31.7)	1.75 (0.48–6.32)	3.23 (0.57–18.37)
50,001–100,000	25 (75.8)	8 (24.2)	33 (17.7)	0.40 (0.13–1.22)	0.48 (0.10–2.33)
Don't know	26 (81.3)	6 (18.8)	32 (17.2)	0.55 (0.17–1.81)	1.42 (0.30–6.80)
Condom use	40 (88.9)	5 (11.1)	45 (24.2)	1.32 (0.47–3.75)	3.42 (0.77–15.10)
Verbal abuse	48 (87.3)	7 (12.7)	55 (29.6)	1.09 (0.43–2.79)	0.29 (0.07–1.14)
Physical abuse	23 (88.5)	3 (11.5)	26 (14.0)	1.22 (0.34–4.42)	1.99 (0.33–11.96)
Prior HIV test	117 (87.3)	17 (12.7)	134 (72.0)	1.25 (0.50–3.11)	0.85 (0.24–2.99)
At risk of HIV					
No	50 (75.8)	16 (24.2)	66 (35.5)	Reference	Reference
Yes	57 (89.1)	7 (10.9)	64 (34.4)	2.61 (0.99–6.85)	2.39 (0.62–9.22)
Don't know	54 (96.4)	2 (3.6)	56 (30.1)	8.64 (1.89–39.48)	7.44 (1.32–42.07)

Notes: [a]Complete data for the logistic regression (LR) model available on only 186 of 214 enrollees.
[b]At the time of the study, 1 USD = 2000 Uganda Schillings.

household income was also a predictor of not completing serial HIV testing. This lack of domestic financial knowledge may represent a group of women who may not feel empowered to seek repeat HIV VCT. Community education campaigns have increased HIV testing uptake in resource-poor settings and may improve testing uptake during pregnancy and lactation despite these barriers (Khumalo-Sakutukwa et al., 2008; Mall, Middelkoop, Mark, Wood, & Bekker, 2013; Sweat et al., 2011). Higher education has been associated with numerous beneficial health outcomes, and thus it is not surprising that we found an association between higher education and increased odds of completing serial HIV testing (Adler et al., 1994; Rettenmaier & Wang, 2012; Zajacova & Hummer, 2009).

Although being single has been associated with protective behaviors such as uptake of HIV testing, we found that not being married was predictive of not accepting male partner testing, which highlights the need for additional qualitative studies (Simpson et al., 1998; Thior et al., 2007; Wringe et al., 2008). While the majority of women accepted male partner testing, very few men got tested, consistent with other studies that had low male partner testing rates (Byamugisha et al., 2011; Ditekemena et al., 2011; Koo, Makin, & Forsyth, 2012). Although other studies have shown that older maternal age and higher income are associated with increased uptake of HIV testing by pregnant women and their male partners, these were not significant predictors in our cohort (Ditekemena et al., 2011; Kowalczyk et al., 2002; Msuya et al., 2008). This may be due to our small cohort size that had a young median age of 24 and few high income households.

The 0.5% incidence of HIV during pregnancy and the postpartum period in our study was similar to HIV incidence in the general Ugandan population (Shafer et al., 2008). In contrast, other studies have found that pregnant women are more susceptible to HIV infection compared to nonpregnant women (De Schacht et al., 2009; Gray et al., 2005; Morrison et al., 2007; Taha et al., 1998). The low incidence of HIV may reflect the particular epidemiology of HIV in the area of Uganda where the study was conducted; Tororo has hosted other HIV research studies that may have increased community awareness of HIV and affected HIV incidence (Moore et al., 2008; Sandison et al., 2011). Furthermore, the low incidence of HIV in our study may be due to protective behavior changes adopted by participants in a research study. Also, our study sample may have been too small to adequately address the incidence of HIV.

A major strength of our study is that we included postpartum women, whereas other HIV testing uptake studies have not (Bello et al., 2011; Ekouevi et al., 2012; Kieffer et al., 2011). Also, we specifically studied HIV testing integrated into child immunization visits compared to other studies of postpartum HIV testing that did not integrate testing with routine health care visits (Gray et al., 2005; Kinuthia et al., 2010; Mbizvo, Kasule, Mahomed, & Nathoo, 2001; Morrison et al., 2007). Furthermore, our study was conducted in a resource-limited country in sub-Saharan Africa, the epicenter of the HIV epidemic, making the results generalizable to the population that will benefit the most from HIV testing, though our study was limited by sample size.

In summary, the integration of a serial HIV testing program into routine antenatal and postnatal health care visits was highly acceptable to pregnant women in this low-resource, sub-Saharan African setting. However, the majority of women only partially completed the serial testing protocol, and there was low uptake of testing by their male partners. Thus, further qualitative exploration of barriers to HIV testing among pregnant/postpartum women and their male partners is needed. A less intensive serial HIV testing protocol (such as one repeat test in the third trimester of pregnancy and one repeat test at 6 months postpartum) may be more feasible, and innovative strategies to improve partner testing uptake need to be studied.

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