HIV Risk Perception and Prevalence in a Program for Prevention of Mother-to-Child HIV Transmission

Comparison of Women Who Accept Voluntary Counseling and Testing and Those Tested Anonymously

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Objective: To determine whether data from voluntary counseling and testing (VCT)/prevention of mother-to-child transmission (PMTCT) programs can be used for HIV surveillance.

Methods: Women attending an antenatal clinic at the district hospital in Entebbe, Uganda, from May 2002 to April 2003 were offered counseling and HIV testing with same-day results (VCT) and nevirapine for PMTCT was provided for HIV-positive women and their babies. Those who declined VCT were tested for HIV anonymously.

Results: Overall, 2635 women accepted VCT; 883 were tested anonymously. HIV prevalence was higher in VCT than in anonymously tested women in the first month of the program (20% vs. 11%, $P = 0.05$) and in months with <70% VCT uptake (17% vs. 8%, $P < 0.001$) but was similar in months with high uptake. Uptake of VCT was higher in women who had risk factors for HIV, especially those who believed themselves to have been exposed (84% vs. 73%, $P < 0.001$).

Conclusion: There was a bias to accepting VCT in women with HIV, or risk factors for HIV infection, the former most apparent when there was low coverage. Data from VCT/PMTCT programs cannot replace anonymous surveillance for monitoring of HIV epidemic trends where coverage is incomplete within clinics or communities.

Key Words: prevention of perinatal transmission, risk factors, seroprevalence, surveillance, women, Africa

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In most countries in sub-Saharan Africa, sentinel surveillance at antenatal clinics (ANC) is the most widely used method by which the HIV epidemic is monitored.[1] Antenatal surveillance data are likely to be reasonably representative of HIV prevalence in pregnant women (>94% of pregnant women in Uganda receive some antenatal care[2]) and, despite reservations, are used to assess progress of the epidemic in the community.

Following evidence that single-dose nevirapine significantly lowered mother-to-child HIV-1 transmission,[3] Uganda implemented a policy for prevention of mother-to-child transmission of HIV (PMTCT) with voluntary counseling and testing (VCT) as the entry point. Entebbe Hospital ANC is one of 20 sentinel surveillance sites in Uganda, but a program offering VCT and PMTCT was started in May 2002. It was not known how HIV prevalence among women accepting VCT and PMTCT would compare with that among anonymously tested women. To determine whether the introduction of VCT/PMTCT would lead to a bias in surveillance results, anonymous HIV testing was continued for women who declined VCT and prevalence in VCT/PMTCT mothers was compared with anonymously tested mothers. This important information would help policy makers and program managers decide whether VCT/PMTCT data could replace the anonymous sentinel surveillance for purposes of monitoring the epidemic.

Initial results in May 2002 showed that HIV prevalence in women accepting VCT was very high (20%). By contrast, the antenatal prevalence in Uganda for urban sites in 2001 was reported as 9%[4] (and 11% for Entebbe) (unpublished data from the Uganda National Laboratory for Reference and Quality Assurance). These initial results suggested a strong bias in VCT uptake and we wondered whether women who considered themselves at high risk for HIV infection were more likely to seek VCT/PMTCT services than those who did not, as noted for VCT services in other settings.[5–8] If this was true, the numbers attending VCT/PMTCT sites might increase at the start of the PMTCT program and the overall HIV prevalence might increase at sentinel surveillance sites with VCT/PMTCT activities and decrease in neighboring clinics, while implementation of PMTCT is incomplete; HIV prevalence would be higher in VCT than in anonymously

tested women, and women with risk factors for HIV would choose VCT.

METHODS

Participants and Setting

Entebbe General Hospital is the only government hospital in Wakiso district, Uganda. Since May 2002, PMTCT procedures have been integrated into the ANC routine. All new clients have a Ministry of Health questionnaire completed, giving demographic information and HIV risk factors. All are offered group pretest counseling by trained staff, followed by individual counseling.

Voluntary Counseling and Testing

Women who consent to the HIV test have blood drawn for syphilis serology, hemoglobin estimation, and HIV testing. Results are given out on the same day after individual posttest counseling.

Anonymous Testing

Women who decline VCT have blood drawn for syphilis serology and hemoglobin estimation, and an aliquot is sent to the Uganda Virus Research Institute for anonymous HIV testing.

Laboratory Tests

HIV testing for VCT women is performed using 2 different rapid tests in parallel (according to availability). In all cases included here, Determine HIV1/2 (Abbott Laboratories, Abbott Park, IL) or Unigold (Trinity Biotech PLC, Bray, Ireland) rapid test kit was used, with one of several second tests. Participants with positive results on both tests were regarded as seropositive and those with negative results on both tests as seronegative. Samples with discordant results were reexamined using 2 enzyme-linked immunosorbent assay (ELISA) tests, Murex HIV-1.2.0 (Murex Biotech, Ltd., Dartford, UK) and Recombigen HIV-1/HIV-2 EIA (Cambridge Diagnostics, Galway, Ireland) or Anilabsystems HIV EIA (Anilabsystems, Ltd., Museokatu, Finland) at the National Reference Laboratory at Uganda Virus Research Institute. Anonymous HIV testing was done at the National Reference Laboratory using Murex HIV-1.2.0 ELISA, with positive results confirmed using Recombigen HIV-1/HIV-2 EIA. Quality control was done by Medical Research Council (MRC) Program on AIDS in Uganda laboratories with good results.

Statistical Analysis

The primary outcome measured was the HIV prevalence among VCT compared with anonymously tested women during the first year (May 2002–April 2003) of the PMTCT program in Entebbe. Data were entered using Microsoft Access 97 (Microsoft Corp., Redmond, WA) and exported to STATA version 6 for analysis (STATA Corp., College Station, TX). Simple comparisons were made using χ^2 tests and odds ratios. Analyses adjusted for age were performed using logistic regression and likelihood ratio tests.

RESULTS

There was a steady increase in the registration of new clients at the Entebbe General Hospital ANC from 3087 in the year May 2000–April 2001, to 4248 in May 2001–April 2002, to 4867 in May 2002 (the start of the PMTCT program)–April 2003.

Of the 4867 new clients registered between May 2002 and April 2003, 3628 (75%) were counseled and had a blood sample drawn. The remainder were generally women who attended the clinic late in the day, attended only once, or who failed to comply with procedures; differences between these clients and those who were pretest counseled could not be evaluated. Of those counseled, 2635 (73%) accepted VCT. The remainder, 993 (27%), gave samples for syphilis testing and hemoglobin estimation; of these 883 samples had results available from anonymous HIV testing.

The overall HIV-1 prevalence at the ANC, combining results for VCT and anonymously tested women, was 53/309 (17%) in May 2002 and 465/3518 (13%) for the full first year of the PMTCT program (May 2002–April 2003). These results were compared with findings in a sample of women from the same clinic who were tested for sentinel surveillance between January and June 2001. In the sentinel surveillance sample, 53/501 (11%) were seropositive (unpublished data, Uganda Virus Research Institute); thus results at the ANC during the PMTCT program were higher than in the preceding period, significantly so for the first month ($P = 0.01$) but not for the full year ($P = 0.21$).

The prevalence of HIV-1 in VCT women in the 1st month of the program (May 2002) was 42/209 (20%), significantly higher than the prevalence in anonymously tested women (11/100; 11%, $P = 0.05$). However, when the full year was considered, the difference in HIV prevalence among VCT women (358/2635; 14%) and anonymously tested women (107/883; 12%) was not statistically significant ($P = 0.26$).

On examining the data, we noted that the difference in prevalence between VCT and anonymously tested women appeared greater in the months of May, June, and December 2002, when uptake was low (Fig. 1). To examine this further, the relationship was examined for months when uptake was $<70\%$ or $>70\%$, the approximate level of uptake at many sites in Uganda. This analysis showed that the prevalence of HIV-1 was statistically significantly higher in women accepting VCT in months with uptake $<70\%$, but not in months with higher uptake (P value for interaction, 0.001) (Table 1).

To determine whether women at higher risk for HIV, or considering themselves to be at higher risk, were more likely to choose VCT, an analysis was performed to identify factors associated with HIV infection in this population and to determine the association of these factors with choosing VCT. Questionnaires were missing or incomplete for 171/2635 women (6%) with results from VCT and 66/883 women (7%) who were tested anonymously; there was no difference in HIV prevalence for women who did, or did not, have complete questionnaires. Thus 2464 VCT women and 817 anonymously tested women were included in this analysis (Table 2). We found a higher HIV prevalence with increasing age, with the peak of 22% in the 30–34 age groups; increase in age was also

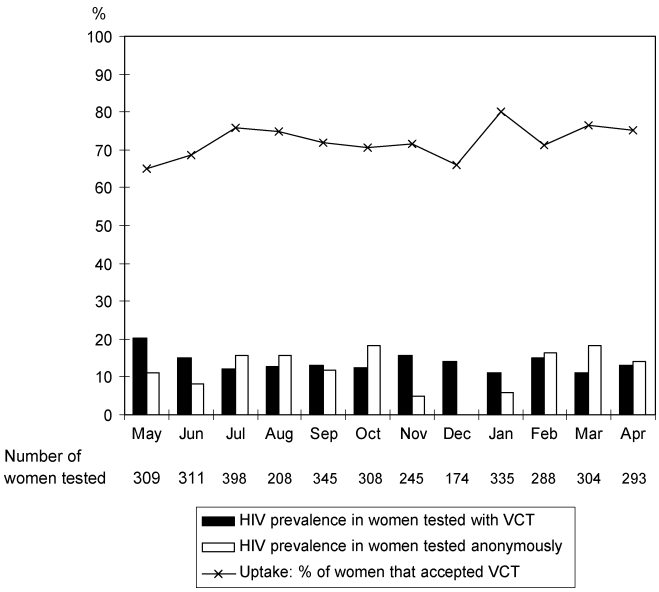

FIGURE 1. HIV prevalence in women tested by VCT or anonymously and uptake of VCT. Columns show the % prevalence of HIV in women tested by VCT (*black*) or anonymously (*clear*). The line shows % uptake of VCT by month from May 2002–April 2003.

associated with higher acceptance of VCT, except for teenagers (who had a high uptake). Women with no education, or only primary education, were more likely to be HIV positive than those with secondary or tertiary education; these women were also more likely to accept VCT than the more educated women. The widowed, divorced, and separated were found to have a higher HIV prevalence than the single or married; there was no statistically significant difference in VCT uptake between the 2 groups, but almost all widowed women accepted VCT.

As expected, women who had had a partner who died or was known to be HIV positive, or who believed that they had been exposed to HIV infection or had had a sexually transmitted disease, were more likely to be HIV positive. Those more likely to accept VCT were the women whose partner was known to be HIV positive and women who believed they had been exposed to HIV. Having had a sexually transmitted disease did not increase the likelihood of choosing VCT. A history of blood transfusion was not associated with HIV and did not influence the mother to choose VCT. With the exception of marital status, which showed some confounding with age, all these effects remained statistically significant after adjusting for age.

DISCUSSION

In this analysis, we found that the prevalence of HIV was higher among women accepting VCT than those tested anonymously, but this effect was only seen in months when VCT uptake was <70%, and early on in the program. In addition, women who perceived themselves to be at risk for HIV infection were more likely to choose VCT. This means that VCT-generated data alone may be unsuitable for monitoring the HIV epidemic, especially if VCT uptake is low.

One of the limitations of this analysis was that a proportion of women who declined VCT did not have results by anonymous testing and differences between these women and the women who gave blood samples could not be assessed; however, this group of women would also have been omitted by sentinel surveillance procedures. A further point is that the anonymous group we used to compare with VCT was taken as those women who declined VCT, whereas in sentinel surveillance, the women are sampled systematically.[4] Thus the difference between our 2 groups was more extreme than would be seen comparing VCT mothers with a sentinel surveillance sample.

Data from antenatal surveillance have limitations as to how well they represent the HIV prevalence in the general population. These data are thought to underestimate population prevalence for women and to overestimate it for men, and they probably overestimate the overall population prevalence.[9–11] Our results show that the introduction of VCT/PMTCT programs may complicate this relationship further. First, there may be a special bias at the start of PMTCT programs: the overall HIV prevalence in the 1st month of our program was significantly higher (17%) than the previous year (11%), but this difference was not sustained when the whole year was considered. This may have followed an influx of HIV-positive women who had been waiting for the PMTCT program to start, given that the prevalence among those who accepted VCT was 20% in the 1st month, yet it was 11% (hence similar to the previous year) for those tested anonymously. Second, we found that VCT results did not reflect HIV prevalence among all clients when VCT was <70%. This implies that when the VCT uptake is low, the few women who accept to be tested are more likely to have risk factors for HIV infection and to be HIV positive. One solution to this 2nd problem might be to continue with standard surveillance sampling procedures after introduction of VCT/PMTCT; but this might not completely resolve the issue when services are restricted to a few clinics in a given area, because women at high risk of HIV infection might choose to attend VCT/PMTCT clinics, giving artificially high surveillance results at these clinics. Our overall prevalence in the first year of

TABLE 1. HIV-1 Prevalence, Comparing Voluntary Counseling and Testing (VCT) and Anonymously Tested Women, According to VCT Uptake

Uptake of VCT	Testing Method	Prevalence of HIV	Odds Ratio (95% CI)	*P* Value
<70%	Anonymous	19/249 (8%)	1	<0.001
	VCT	91/545 (17%)	2.43 (1.44–4.08)	
≥70%	Anonymous	88/634 (14%)	1	0.47
	VCT	267/2090 (13%)	0.91 (0.70–1.18)	

TABLE 2. General and Specific Risk Factors for HIV and Their Association With Uptake of Voluntary Counseling and Testing (VCT)

		HIV Status			Choice for VCT		
	Number of Women	% HIV Positive	Adjusted OR*	*P* Value	% Choose VCT	Adjusted OR*	*P* Value
Age							
13–19	824	7%		<0.001†	79%		<0.001
20–24	1333	13%			71%		
25–29	719	16%			75%		
30–34	254	22%			81%		
35+	151	17%			81%		
Education							
None	193	20%	1	<0.001†	80%	1	0.03†
Primary	1767	14%	0.74		76%	0.78	
Secondary	1093	10%	0.54		73%	0.66	
Tertiary	228	12%	0.53		74%	0.70	
Marital Status							
Single	509	13%	1	0.06	77%	1	0.28
Married	2632	13%	0.83		74%	0.90	
Widowed	11	27%	1.78		91%	2.98	
Divorced/separated	129	24%	1.41		81%	1.19	
Partner Died							
No	3214	13%	1	<0.001	75%	1	0.28
Yes	67	40%	3.56		82%	1.41	
Partner Known HIV+							
No	3221	12%	1	<0.001	75%	1	0.005
Yes	60	52%	6.21		90%	2.88	
Believe Exposed to HIV							
No	2771	12%	1	<0.001	73%	1	<0.001
Yes	510	21%	1.80		84%	1.92	
Ever had an STD							
No	1701	10%	1	<0.001	74%	1	0.13
Yes	1580	17%	1.69		76%	1.13	
Blood Transfusion							
No	3197	13%	1	0.28	75%	1	0.80
Yes	84	18%	1.38		76%	1.07	

*Adjusted for age. *P* values (likelihood ratio test) given for adjusted analyses, except in the case of age.
†Test for trend.
OR, odds ratio; STD, sexually transmitted disease.

VCT/PMTCT rose from 11% to 13%; although not statistically significant, this rise occurred in the context of declining HIV prevalence elsewhere in Uganda. A biased effect of this magnitude would be very misleading if it occurred on a wider scale.

Our results gave strong evidence that women who perceive themselves to be at risk for HIV were indeed more likely to be HIV positive, in keeping with earlier work from Uganda.[12] These same women were also more likely to accept VCT in the context of the PMTCT program. Other studies have shown that VCT services attract higher-risk individuals than those found in the general population[5–7] and that there is high demand for these services in less-developed countries,[5] especially when VCT services are linked to care, such as the provision of antiretroviral drugs.[8] In our study, associations with both HIV prevalence and acceptance of VCT/PMTCT were particularly strong for women who believed they had been exposed to HIV, or who had had a known HIV-positive partner.

Educational status has a complex association with HIV prevalence but, in this study, low education was associated with both higher HIV prevalence and higher VCT uptake. Sexually transmitted infections (STIs) have long been shown to be associated with HIV infection, as seen in our analysis.[13,14] However, this was not associated with choosing VCT, implying that women may not consider STIs to be associated with an increased risk of HIV infection. Indeed, we discovered that the women's definition of STI included vaginal candidiasis, which is not always sexually transmitted, especially in pregnancy. Having had a blood transfusion was not associated with increased HIV prevalence and did not increase the women's likelihood to choose VCT, and it is possible that women did not perceive it as a risk.

In keeping with other studies,[15,16] women with a known HIV-positive partner had the highest prevalence of HIV infection (53%) and were also very likely to accept VCT. However, the observation that 47% of pregnant women with known

HIV-positive partners were actually HIV negative, and thus in a serodiscordant relationship, emphasizes the importance of providing an opportunity for them to learn their own HIV status.

Taken together, we found that women who believed they had been exposed to HIV infection, or who had other important risk factors for HIV, had a high prevalence of HIV and were the most likely to accept VCT/PMTCT. These results indicate that data from VCT/PMTCT programs are unsuitable for surveillance where coverage in clinics or communities is incomplete. The significance of VCT uptake <70% was of particular interest and should now be investigated at other sites. "Opt-out" strategies for HIV testing, where all clients are tested unless they actively decline, might lead to more complete "uptake" with results closer to the true prevalence within a given clinic, but differences between PMTCT and non-PMTCT clinics might still persist. It may be necessary to include representative ANC clinics both with and without VCT/PMTCT activities in the surveillance system, until complete PMTCT coverage is attained.

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