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Personal Risk Perception, HIV Knowledge and Risk Avoidance Behavior, and Their Relationships to Actual HIV Serostatus in an Urban African Obstetric Population

Elizabeth M. Stringer, MD^{*,†,‡}, Moses Sinkala, MD, MPH^{‡,§}, Rosemary Kumwenda, MD^{||}, Victoria Chapman, MPH^{*}, Alexandrina Mwale[§], Sten H. Vermund, MD, PhD^{*,‡}, Robert L. Goldenberg, MD^{*,‡}, and Jeffrey S.A. Stringer, MD^{*,†,‡}

^{*} Schools of Medicine and Public Health, University of Alabama at Birmingham, Birmingham, AL

[†] University of Zambia School of Medicine

[‡] Centre for Infectious Disease Research in Zambia

[§] Lusaka Urban District Health Management Board

^{||} Central Board of Health, Zambian Ministry of Health, Lusaka, Zambia

Abstract

One quarter of pregnant women in Zambia are infected with HIV. Understanding how knowledge of HIV relates to personal risk perception and avoidance of risky behaviors is critical to devising effective HIV prevention strategies. In conjunction with a large clinical trial in Lusaka, Zambia, we surveyed postpartum women who had been tested for HIV but did not know their status before undergoing the questionnaire. Of 858 women for whom complete data were available, 248 (29%) were HIV infected. Women 22 years of age or older (adjusted odds ratio [AOR], 1.7; 95% confidence interval [CI], 1.1–2.5), women reporting ≥ 2 sexual partners in their lifetime (AOR, 1.8; 95% CI, 1.3–2.5), and women reporting a history of a sexually transmitted infection (AOR, 2.7; 95% CI, 1.7–4.3) were more likely to be HIV infected. Having had ≥ 2 lifetime sexual partners was a marker for perception of high personal risk for HIV infection (AOR, 1.5; 95% CI, 1.1–2.1). However, there was no relationship between perceived risk of HIV infection and actual HIV status. In fact, 127 (52%) of 245 women who stated that they were at no or low risk for HIV infection were HIV infected. Living in an area of high HIV seroprevalence like Zambia seems to be the greatest risk factor for infection in unselected pregnant women. Before significant inroads can be made in decreasing the incidence of HIV infection among pregnant women, population-based strategies that involve men must be implemented.

Keywords

HIV; AIDS; knowledge; behavior; risk perception; perinatal HIV transmission

Zambia is a highly urbanized sub-Saharan African country with a population of 10.2 million.

¹ One million people live in Zambia's capital Lusaka, where $>40,000$ babies are born yearly.

Although the national seroprevalence of HIV infection among the general population is $\sim 16\%$,

² it exceeds 30% in some maternity centers in Lusaka.³ Because of this high rate of HIV infection among pregnant populations and the increasing availability of interventions to block

mother-to-child transmission, much emphasis has recently been placed on perinatal HIV prevention programs.^{4,5} An important but sometimes overlooked component of these programs is risk reduction education for women with seronegative test results.

Since the early 1990s, various programs have been ongoing to educate Zambians about HIV infection with the hope that increased knowledge of the disease and its transmission would lead to behavior change and, ultimately, fewer new infections. However, sentinel surveillance data from Zambia during this same period suggest that rates of HIV infection among urban obstetric populations remain high (in fact, unchanged) despite widespread educational and prevention messages.^{6–8} Similarly, data collected between 1992 and 1998 from the Zambian Sexual Behavior Survey show that there has been little change in women's sexual behavior.⁹

Traditionally, HIV messages have been targeted to “high-risk” groups; however, in areas with high prevalence, it may be that everyone who is sexually active is at “high risk” and that prevention messages need to target everyone. A major challenge for Zambia lies in translating its anti-HIV messages and outreach activities into behavior changes that reach across populations and ultimately result in a decline in the incidence of HIV infection.

METHODS

We sought to understand more about the complex relationships among risky sexual behavior, knowledge about HIV and its transmission, HIV risk perception, and actual HIV serostatus in an obstetric population in Lusaka, Zambia. This study was conducted between September 2000 and May 2001 as part of a larger clinical trial assessing ways of administering nevirapine to antenatal attendees in 2 busy Lusaka District maternity clinics.¹⁰ In the parent clinical trial, each clinic was assigned to either a targeted strategy of giving nevirapine (provision of the drug to seropositive patients identified through voluntary counseling and testing) or a universal strategy (provision of the drug without HIV testing). Halfway through the study period, the approach offered at each clinic was crossed over to the complimentary strategy. There was also a third labor ward arm, where women at both participating clinics who had not been offered enrollment in either the targeted arm or the universal arm were eligible for nevirapine without testing upon presentation in labor. Women in the targeted and universal arms were enrolled between 34 and 36 weeks' gestation; women in the labor ward arm were enrolled in early labor. All participants were administered a detailed questionnaire after giving birth just before discharge from the study facility (typically 8 to 24 hours after delivery).

Questionnaires were administered by study personnel and available in the patient's choice of English, Bemba, or Nyanja, the three most widely spoken languages in Lusaka. Bemba and Nyanja versions were translated by native speakers and then back translated by different native speakers to ensure their validity. In addition to sociodemographic characteristics, 9 true/false questions, predominantly about HIV transmission, were used to create a composite HIV knowledge score. A series of questions about behaviors that may be related to HIV transmission were also asked. A post hoc composite behavior score was created using all behaviors that were deemed “risky.” In addition, women were asked to quantify their perceived risk for HIV as none, low, medium, or high. Both the University of Zambia Research Ethics Committee and the Institutional Review Board at the University of Alabama at Birmingham approved this study. All women provided written informed consent at enrollment.

The patients in this substudy ($n = 976$) were selected by excluding those enrolled in the targeted arm (since, by definition, these women already knew their HIV status at the time of questionnaire administration). We chose to analyze this subgroup because HIV risk perception was a key research question and women who already knew their status would not be able to make a meaningful assessment of this risk. All participants in the larger clinical trial had the

option of learning their serostatus after giving birth. Statistical analysis included the calculation of means and SDs and comparisons between groups using the Student *t* test; where appropriate, correlation coefficients were calculated. Proportional data were compared by the χ^2 or Fisher exact test. Logistic regression analyses were performed to understand the effects of multiple variables on outcomes of interest. Data were analyzed with SAS version 8.0 (SAS Institute, Cary, NC). Statistical significance was set at a rate of false-positive results of $\leq 5\%$.

RESULTS

One thousand one hundred twenty-eight women participated in the overall clinical trial from which the substudy was derived. One hundred fifty-two women enrolled in the targeted arm were omitted from the analysis because they knew their HIV status before the questionnaire was administered. Of the remaining 976 women, 858 had complete serologic and questionnaire data available. Two hundred forty-eight women (29%) were infected with HIV.

Correlates of HIV Seropositivity

HIV-infected women were more likely than HIV-uninfected women to be the same age or older than the median cohort age of 22 years (69% vs. 53%, respectively; $P < 0.0001$) and were more likely to have had more children than the cohort median of 1 child (82% vs. 70%, respectively; $P = 0.0004$) (Table 1). Other demographic factors including tribe, spoken language, ability to understand English, level of education, average weekly income, and marital status did not differ between HIV-infected and -uninfected women.

Univariate analysis revealed that the following behavioral factors were associated with HIV infection in respondents: having had ≥ 2 lifetime sexual partners (68% vs. 55%; $P = 0.0002$), having received previous treatment of a sexually transmitted disease (25% vs. 10%; $P < 0.0001$), and having had a positive syphilis serology in the index pregnancy (12% vs. 6%; $P = 0.002$) (Table 2). Women who reported having unwanted sex with their partners were less likely to be HIV infected than were women who did not (53% vs. 64%, respectively; $P = 0.002$) (Table 2).

Logistic regression analysis (which included all variables found by univariate analysis to be associated with HIV seropositivity at $P \leq 0.1$) demonstrated that women who were at least 22 years of age (adjusted odds ratio [AOR], 1.7; 95% confidence interval [CI], 1.1–2.5), women with ≥ 2 lifetime sexual partners (AOR, 1.8; 95% CI, 1.3–2.5), and women reporting a history of a sexually transmitted infection (AOR, 2.7; 95% CI, 1.7–4.3) were more likely to be HIV infected.

Risk Perception and Actual HIV serostatus

Two hundred sixty-one women (31%) perceived themselves to be at no risk for HIV infection; 207 (25%), at low risk; 168 (20%), at moderate risk; and 213 (26%), at high risk (Table 3). HIV-infected women were not more likely than HIV-uninfected women to view themselves as being at moderate or high risk for HIV infection (48% vs. 43%, respectively; $P = 0.22$). One hundred twenty-seven (52%) of 245 women who stated that they were at no or low risk for HIV infection were in fact HIV positive. Women who had ≥ 2 lifetime sexual partners (64% vs. 54%, respectively; $P = 0.002$) and those who reported engaging in dry sex practices (26% vs. 19%, respectively; $P = 0.03$) were more likely than those who did not to view themselves at moderate to high risk for HIV infection (Table 3). By contrast, women who reported having unwanted sex with their partners were more likely than those who did not to view themselves at lower risk for HIV infection (66% vs. 56%, respectively; $P = 0.003$). Age, parity, language, tribal origin, education level, income, and marital status did not differ significantly between

those women who perceived themselves at no or low risk and those who perceived themselves at moderate or high risk (Table 3).

Logistic regression analysis (which included all variables found by univariate analysis to be associated with a self-perception of moderate to high risk for infection at $P \leq 0.1$) showed that only having had ≥ 2 lifetime sexual partners remained a marker of individuals who perceived themselves to be at moderate to high risk for HIV infection (AOR, 1.5; 95% CI, 1.1–2.1).

HIV-Related Knowledge

Women who were HIV infected were slightly more likely to have said that they know what HIV is than were HIV-uninfected women (92% vs. 87%, respectively; $P = 0.045$); however, there were no significant differences between infected and uninfected women in response to the other transmission-related questions. Composite HIV transmission knowledge scores (reported here as the number of correct responses of 9) were the same for both HIV-infected and HIV-uninfected women (7.8 ± 1.0 vs. 7.8 ± 0.9 , respectively; $P = 0.76$) (Table 4).

Relationship Between Knowledge and Behavior

A composite behavior score was created that included the following variables: alcohol use, lifetime number of sexual partners, number of sexual partners in the past 2 years, condom use with partner, history of a sexually transmitted infection, history of syphilis in most recent pregnancy, history of dry sex, and unwanted sex with partner. Overall, there were few differences in answers to specific knowledge questions among women who practiced “less risky” versus “more risky” behavior. When we compared the composite knowledge score with a composite behavior score (where women received 1 point for each risky behavior), there was a statistically significant, but relatively small, correlation between knowledge and behavior ($R = 0.0953$; $P = 0.0007$). Contrary to what we expected, women with more knowledge appeared to participate more in risky behavior. When the correlation between knowledge and behavior was stratified by HIV status, there was no difference between the 2 (HIV positive: $R = 0.08$ and $P = 0.22$; HIV negative: $R = 0.10$ and $P = 0.016$).

HIV Knowledge and Risk Perception

Having more knowledge about HIV did not correlate significantly with risk perception for HIV. Women who perceived themselves to be at no or low risk for HIV infection answered 7.8 of 9 questions correctly versus 7.7 of 9 correct responses for women who perceived themselves to be at moderate or high risk for HIV infection ($P > 0.05$).

DISCUSSION

Twenty nine percent of women in our study were infected with HIV. Infected women were more likely to be older, to have been previously treated for a sexually transmitted infection, and to have had >2 sexual partners in their lifetime. Women reporting >2 lifetime sexual partners were more likely to perceive themselves to be at risk for HIV infection, although overall perceived risk did not correlate with actual serostatus. Indeed, one half of the infected women in our cohort believed that they were at no or low risk for HIV infection. Knowledge of HIV did not correlate with actual HIV status. Furthermore, risk perception did not correlate with behavior. Interestingly, women who had greater HIV-related knowledge had riskier behaviors.

The lack of a relationship between HIV risk perception and actual HIV status is surprising, but it suggests that one reason over one half of the infected women could not predict their HIV status may be that many of them did not practice what they would consider “risky” behaviors. In fact, only 17 of 253 HIV-infected women had all 3 behavior markers identified as significant:

syphilis in current pregnancy, history of being treated for a sexually transmitted infection, and ≥ 2 lifetime sexual partners. These data seem to suggest that the greatest HIV risk factor for pregnant women in Lusaka, Zambia, is simply living in a society with a high HIV seroprevalence. Almost any unprotected sexual activity in this setting is risky. Increasing age and parity—correlates of HIV seropositivity in our cohort—probably are simple markers for increased number of sexual exposures.

Another interesting observation is that women who reported having unwanted sex with their partners were less likely to be HIV positive and were more likely to correctly assess their risk for HIV infection. One possible explanation for this finding is that this characteristic could be a marker for a monogamous relationship. Although we did not administer questionnaires to husbands or partners, other data showed that men have more premarital and extramarital sexual partners than women in this setting.⁷

A 3-step AIDS risk reduction model has been described by which a person gains knowledge about HIV and is able to label his or her behaviors as risky, makes a commitment to changing these behaviors, and then seeks outside support to maintain the commitment.¹¹ Our data suggest that many women may not be able to assess their own risk because it may be directly related to the risk of their partner. Perhaps the definition of high risk needs to change in high prevalence settings where every sexually active individual is at risk. Campaigns for everyone to be tested for HIV may need to be implemented because personal risk-based assessments seem to be of limited utility. These data show a definite correlation between age and HIV status; thus, targeting preadolescents and adolescents with risk reduction messages would seem of the utmost importance.

Our study's unusual strength is that it involved an unselected group of women who answered questions about knowledge and risk perception without having to learn their HIV status. In fact, most women (70%) elected not to learn their HIV status after answering the questions; this may have allowed us to obtain more candid responses and to have sampled a more representative population of pregnant women—not only those willing to learn their serostatus. A weakness of our study is that the 9 questions we asked about HIV transmission were fairly simple and may not have allowed detection of more subtle differences in HIV-related knowledge among the women. In addition, we did not include knowledge questions about preventive methods. Another potential weakness is that women acquired knowledge about HIV during their counseling sessions and used that newly acquired knowledge to correctly answer the questions about HIV transmission. This would make the women appear more knowledgeable than the general population. However, other studies suggest that general knowledge about HIV and its transmission is high in urban Zambia.^{2,6,12}

In summary, the major findings of our study were that pregnant women in Lusaka, Zambia, are fairly knowledgeable about HIV and most do not appear to practice particularly risky behaviors. On the basis of these data, we believe that the definition of a high-risk woman or individual in a high prevalence setting needs to be reconsidered. Simply, every sexually active individual should be considered as being at risk for HIV infection until both members of the partner dyad are confirmed HIV negative and assured that they are in a monogamous sexual relationship. Implementation of programs that focus on serostatus knowledge, as well as male behavior change including during pregnancy and the immediate postpartum period, must begin to involve men and convey the message that everyone is at risk for HIV infection.

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TABLE 1
Demographic Correlates of HIV Status

	HIV Negative n = 610 (71%)	HIV Positive n = 248 (29%)	P
Age (y) *			
<22	275 (47.2)	74 (31.1)	<0.0001
≥22	308 (52.8)	164 (68.9)	
Parity [†]			
≤1	180 (29.6)	44 (17.7)	0.0003
>1	429 (70.4)	204 (82.3)	
Language			
Nyanja	261 (43.0)	93 (38.7)	0.05
Bemba	159 (26.2)	85 (34.4)	
Other	187 (30.8)	69 (27.9)	
Tribe			
Bemba	150 (24.7)	80 (32.3)	0.05
Nyanja	159 (26.2)	66 (26.6)	
Other	298 (49.1)	102 (41.1)	
Understands English			
A bit/not at all	371 (61.2)	163 (66.0)	0.19
Well/very well	235 (38.8)	84 (34.1)	
Education (y)			
<7	220 (36.3)	87 (35.2)	0.77
≥7	386 (63.7)	160 (64.8)	
Weekly income in US \$			
<5	362 (63.2)	159 (66.3)	0.40
≥5	211 (36.8)	81 (33.8)	
Marital status			
Married	571 (93.8)	231 (93.2)	0.74
Not married	38 (6.2)	17 (6.9)	

Data are no. (%) of women.

* Cohort median, 22.

[†] Cohort median, 1.

TABLE 2
Risk Factors for Women by HIV Status

	HIV Negative n = 610 (71%)	HIV Positive n = 248 (29%)	P
Alcohol use			
Yes	166 (27.4)	71 (28.7)	0.68
No	441 (72.7)	176 (71.3)	
Lifetime sexual partners			
<2	275 (45.4)	78 (31.6)	<0.0002
≥2	331 (54.6)	169 (68.4)	
Sexual partners in past 2 y			
≤1	554 (91.6)	221 (89.5)	0.33
>1	51 (8.4)	26 (10.5)	
Unprotected sex with partner (no condoms)			
Yes	433 (71.3)	169 (68.4)	0.40
No	174 (28.7)	78 (31.6)	
Unwanted sex with partner			
Yes	390 (64.3)	131 (53.0)	0.002
No	217 (35.8)	116 (47.0)	
Treated for STD			
Yes	61 (10.1)	61 (24.7)	<0.0001
No	546 (90.0)	186 (75.3)	
Dry sex			
Yes	124 (20.6)	62 (25.4)	0.13
No	478 (79.4)	182 (74.6)	
History of syphilis in most recent pregnancy			
Yes	35 (6.0)	30 (12.4)	0.002
No	550 (94.0)	212 (87.6)	
Mean composite behavior score ± SD	2.6 ± 1.2	2.9 ± 1.3	0.007

Unless stated otherwise, data are no. (%) of women. STD indicates sexually transmitted disease.

TABLE 3
Relationship of Demographics to Risk Perception

	None–Low Risk n = 468 (55%)	Medium–High Risk n = 381 (45%)	P
Age			
<22	196 (43.5)	147 (40.6)	0.41
≥22	255 (56.5)	215 (59.4)	
Parity			
≤1	133 (28.5)	87 (22.8)	0.06
<1	334 (71.5)	294 (77.2)	
Language			
Nyanja	195 (41.7)	158 (41.5)	0.64
Bemba	139 (29.7)	104 (27.3)	
Other	134 (28.6)	119 (31.2)	
Tribe			
Bemba	117 (25.0)	108 (28.5)	0.41
Nyanja	131 (28.0)	94 (24.8)	
Other	220 (47.0)	177 (46.7)	
Understands English			
A bit/not at all	288 (61.7)	242 (63.5)	0.58
Well/very well	179 (38.3)	139 (36.5)	
Education (y)			
<7	175 (37.4)	129 (34.0)	0.30
≥7	293 (67.6)	251 (66.1)	
Weekly income in US \$			
<5	291 (65.3)	225 (62.2)	0.36
≥5	155 (34.8)	137 (37.9)	
Marital status			
Married	435 (93.2)	359 (94.2)	0.52
Not married	32 (6.9)	22 (5.8)	
Alcohol use			
Yes	126 (26.9)	111 (29.1)	0.48
No	342 (73.1)	270 (70.9)	
Lifetime sexual partners			
<2	215 (46.0)	136 (35.7)	0.002
≥2	252 (54.0)	245 (64.3)	
Sexual partners in past 2 y			
≤1	421 (90.2)	351 (92.4)	0.26
>1	49 (9.9)	29 (7.6)	
Unprotected sex with partner (no condoms)			
Yes	329 (70.3)	271 (71.1)	0.80
No	139 (29.7)	110 (28.9)	
Unwanted sex with partner			
Yes	307 (65.6)	212 (55.6)	0.003

	None–Low Risk n = 468 (55%)	Medium–High Risk n = 381 (45%)	P
No	161 (34.4)	169 (44.4)	
Treated for STD			
Yes	58 (12.4)	63 (16.5)	0.09
No	410 (87.6)	318 (83.5)	
Dry sex			
Yes	89 (19.3)	96 (25.5)	0.03
No	372 (80.7)	280 (74.5)	
History of syphilis			
Yes	31 (6.9)	34 (9.2)	0.21
No	420 (93.1)	334 (90.8)	

Data are no. (%) of women.

STD indicates sexually transmitted disease.

TABLE 4
HIV Knowledge by HIV Status

Question	HIV Negative n = 610 (71%)	HIV Positive n = 248 (29%)	P
Know what HIV is?			
Yes	527 (86.8)	227 (91.9)	0.036
No	80 (13.2)	20 (8.1)	
Can you tell someone has HIV by looking?			
Yes	139 (22.9)	58 (23.5)	0.85
No	468 (77.1)	189 (76.5)	
Transmit by hand-holding?			
Yes	26 (4.3)	11 (4.4)	0.91
No	581 (95.7)	223 (95.6)	
Transmit by needles?			
Yes	578 (95.2)	232 (93.9)	0.44
No	29 (4.8)	15 (6.0)	
Transmit by kissing?			
Yes	356 (58.7)	140 (56.7)	0.60
No	251 (41.4)	107 (43.3)	
Transmit by sex?			
Yes	597 (98.4)	244 (98.8)	0.77
No	10 (1.7)	3 (1.2)	
Mother give it to her baby?			
Yes	562 (92.6)	219 (88.7)	0.06
No	45 (7.4)	28 (11.3)	
Mother give it by breast-feeding?			
Yes	555 (91.4)	227 (91.9)	0.91
No	52 (8.6)	20 (8.1)	
Mother give it by holding baby?			
Yes	18 (3.0)	6 (2.4)	0.67
No	589 (97.0)	241 (97.6)	
Mean composite knowledge score $\pm$ SD	7.8 $\pm$ 0.9	7.8 $\pm$ 1.0	0.72

Unless stated otherwise, data are no. (%) of women.