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Modeling Covariates of Self-Perceived and Epidemiologic Notions of Risk for Acquiring STIs/HIV among Military Personnel: A Comparative Analysis

Osaro Mgbere[1,3], **Emmanuel Monjok**[1], **Susan Abughosh**[1], **Ernest Ekong**[4], **Marcia M. Holstad**[5], and **E. James Essien**[1,2]

[1]Institute of Community Health, University of Houston, Texas Medical Center, 1441 Moursund Street, Houston, Texas 77030, USA

[2]The University of Texas School of Public Health, 7000 Fannin Street, Houston, Texas 77030, USA

[3]Houston Department of Health and Human Services, 8000 N. Stadium Drive, Houston, Texas 77054, USA

[4]Institute for Health Research and Development, Yaba, Lagos, Nigeria

[5]Nell Hodgson School of Nursing, Emory University, 1520 Clifton Road, Atlanta, GA 30322, USA

Abstract

This study examined the socio-demographic and selected behavioral characteristics associated with self-perceived and epidemiologic notions of risk for acquiring STIs/HIV infection using data from a cross-sectional survey involving 346 consenting female military personnel from two cantonments in Southwestern Nigeria. Findings revealed significant discordance in participants' risk status based on the two assessment methods, with Kappa coefficients ranging from −0.021 to 0.115. Using epidemiologic assessment as the "*gold standard*", 45.4% of the study population were able to accurately assessed their risk levels through self-perception with significant ($p \leq .01$) socio-demographic variations. Multivariate logistic regression analyses indicate that STIs/HIV risk models using both self-perceived and epidemiologic notions of risk were significantly determined by different set of covariates. It is recommended that STIs/HIV prevention intervention should integrate the identified covariates and be targeted at changing individual risk behaviors and perceptions, as well as the social contexts in which risky behaviors occur in the military population.

Keywords

STIs/HIV; self-perceived risk; epidemiologic risk; sexual behavior; military personnel; Nigeria

Introduction

Sexually Transmitted Infections (STIs)/Human immunodeficiency virus (HIV) is not only a serious public health or social problem affecting the Nigerian military, but also a national security problem that requires a concerted effort to control the disease [1]. With a population of approximately 149.2 million people, Nigeria is said to be the second most affected

Corresponding Author: Dr. E. James Essien Institute of Community Health, University of Houston, Texas Medical Center, 1441 Moursund Street, Houston, Texas 77030, USA. Tel: 713-795-8393; Fax: 713-795-8383; Ejessien@uh.edu.

country in sub-Saharan Africa (SSA) with the HIV disease [2]. The adult HIV prevalence increased from 1.8% in 1991 to 5.8% in 2001, before dropping to 5.0% in 2003 and 4.4% in 2005 [3]. However, the national prevalence seemed to stabilize between 2005 and 2010 with a reported prevalence of 4.6% in 2008 and 4.1% in 2010 [4]. Based on the overall national prevalence of 4.1%, it is estimated that 3.1 million people in Nigeria are living with HIV/AIDS in 2010. The vast majority of HIV transmission in the country is through heterosexual activity, and women are disproportionately affected [3]. Like many other countries in Africa, HIV is most prevalent among the most productive members of society (age 25-29), with young women particularly affected. The epidemic also had a disproportionate impact on women and girls in their reproductive years, with 4.9% of pregnant women age 25-29 infected followed by women age 20-24 with 4.7%. A more alarming situation is the fact that about 3.6% of women age 15-19 were reported to have been infected as well suggesting early sexual debut [5]. While awareness of HIV is relatively high especially among urban populations in Nigeria, it appears that the high level of knowledge of HIV/AIDS has little impact on the myths and misconceptions about HIV transmission [6], and the attendant risk-taking behaviors [7, 8]. Evidence indicates that vast majority of Nigerian women still indulge in risky sexual practices such as having multiple sexual partners, unprotected sex, alcohol and drug abuse, with elevated rates of STIs [7-9].

The impact of HIV among African militaries have assumed alarming dimensions with prevalence rates of between 5.8% and 26.7% reported in selected countries [10]. Nigerian military personnel, like other militaries in the world indulge in high-risk sexual behaviors, which put them at high risk of contracting STIs, including HIV, when compared to the general population. The prevalence rates in the Nigerian military have been estimated at 10-20% [11]. The military is a high-risk population because of its demographic constitution, social norms, and occupational exposures. Apart from the fact that danger and risk taking are integral parts of most field operations in the military profession, there are a number of other risk factors that increases the military personnel vulnerability to STIs/HIV infection. They are generally young, mostly single and sexually active, stay away from their families and home communities for extended periods of time, and are more likely to be influenced by peer pressure rather than social convention. Freed from the strictures of their normal social environments many engage in high risk behaviors such as anonymous, purchased or even coercive sex as a means of relieving the tension of loneliness [12, 13], including alcohol consumption, use of drugs and unprotected sex with multiple partners and commercial sex workers [11,12,14].

The relationship between perception of risk and sexual behavior is complex and poorly understood. Studies conducted in different cultures, countries and subpopulations have associated HIV risk perception with a wide range of variables including choice of partner, choice of sex act, and condom use [7, 15-17]. According to the AIDS risk reduction model, knowledge of AIDS is a prerequisite to recognizing risky behavior and taking action to change it [18], but findings regarding the relationship between knowledge and behavior have so far been inconsistent. In our earlier study [7], we noted that despite having a high degree of HIV/AIDS knowledge, majority of the study participants were engaged in risk-taking behaviors including having unprotected sex. On the contrary, accurate assessment of risk perception has been associated with increased condom use [15].

Many young people do not consider their behavior or that of their sexual partner to be risky, and this lack of risk perception is more challenging when the negative outcomes are not immediately obvious. For instance, it has been reported that 36% of Nigerian uniformed service personnel did not think of using condoms during sexual encounters with their casual partners [19]. Also, in our recent study [7], we noted that female military personnel who were not consistent condom users were 65% less likely to encourage their casual partners to

use condom, thus, suggesting that this group would be at elevated risk of STIs/HIV infection. While the trends in risky behaviors are likely to persist in the coming years, in spite of a high level of public awareness about HIV/AIDS, military women would be particularly susceptible to STIs/HIV infection and its consequences. This is because the existing sexual norms place them at a disadvantage in that they are unable to control the sexually risky behaviors of their spouses and/or partners or take action that would limit their risk of exposure [20]. The increasing participation of women in the military in Nigeria also underscores the special vulnerability of this group to STIs/HIV transmission. It is also important to note that the walls of military bases constitute no barriers to the bi-directional transmission of STIs/HIV between military and civilian populations. These health risks apart from contributing to the HIV epidemic, may serve a significant threat to the preparedness of the military to carry out its functions [1, 14]. Already, AIDS is now the leading cause of death in military and police forces in some African countries, accounting for more than half of in-service mortality [21].

Therefore, individual level risks for STIs/HIV infection are at the core of these epidemics, and are powerfully impacted by social, structural, and population level risks and protections [22]. These observations suggest that HIV risk assessment should be based both on personal perceptions of risk and on the epidemiologic notions of risk [7]. But Weinstein [23] posit that perception of risk goes beyond the individual, and that it is a social and cultural construct reflecting values, symbols, history, and ideology. Although behavior changes may be indicative of one's perception of risk, but recognizing one's current behaviors as risky is the first step toward behavior changes such as adopting condom use. Also, an individual's risk perception could have direct influence on the reception of STIs/HIV prevention messages; especially as the choice of personal HIV-infection prevention strategy has been associated with different risks and benefits [24]. Ideally, effective choices are based on an accurate perception of the risks from different combinations of behaviors. Often, however, the perceived hierarchy of risks from different activities may not match the data from epidemiologic standpoint [25]. Accurate information on the magnitude of risks and benefits of each of these choices could substantially improve efforts to prevent STIs/HIV infection among venerable population such as the military.

The main objective of this study therefore was to compare the correlates of self-perceived and epidemiologic notions of risk for acquiring STIs/HIV infection among female military personnel in Nigeria. In addition, we determined the measure of agreement between both risk assessment methods, and the socio-demographic characteristics associated with accurate assessment of STIs/HIV risk in the study population. Finally, we modeled the predictors of participants risk levels based on self-perception and Epidemiologic notions of risk for acquiring STIs/HIV infection.

Methods

Study Participants and procedures

Using a cross-sectional design, 346 female military personnel were recruited from two military cantonments in the Southwestern part of Nigeria to participate in the study. The number represented 90% of the initial sample population of 386 screened. The two cantonments were chosen because they served as camps for recruitment, training and entry points for returning military personnel deployed on peacekeeping operations and foreign missions; and therefore, offered an ideal environment for our study. The participants formed the baseline population of an intervention study [26]. In order to consider the participants at risk of potential STIs/HIV infection, this study required them to be sexually active and to meet certain criteria, which include: aged 18 years or older, self-reported unprotected vaginal intercourse and having two or more different partners in the past six months, or

having been diagnosed and treated for a sexually transmitted disease in the last year, residence at the study sites, ability to communicate in English language, and willingness to sign a consent form for study participation. The study was conducted between 2006 and 2008.

Measures and Operationalization

The questionnaire used captured participants' socio-demographic characteristics such as age, marital status, number of children, race/ethnicity, religion, level of education, employment status, annual income, sexual relationships, and personally knowing someone with HIV/AIDS. Other measures assessed include HIV/AIDS-related knowledge, sexual behaviors, STIs/HIV-related risks, and alcohol and drug-related risks using several items. Participants provided self-report based on these measures. Self-Perceived risk was measured on a 4-point scale with the following questions: Based on your behavior in the past 3 months; "what do you think is your risk of getting sexually transmitted infections like herpes, syphilis, Chlamydia or gonorrhea?" and "what do you think is your risk of getting the AIDS virus (HIV)?" Participants who responded (1) No risk at all or (2) Somewhat at risk were defined as perceiving themselves at no/low risk, and participants who responded (3) Good deal at risk or (4) Extremely at risk were defined as perceiving themselves at moderate/high risk. A composite mean score for both items was used to represent participants' STIs/HIV risk levels, which is herein operationalized as "*Self-Perceived STIs/HIV risk*". The assessed STIs/HIV risk of participants referred to as "*Epidemiologic notions of STIs/HIV risk*" in the current study was determined using selected risk indicators for STIs/HIV infection such as: having not used a condom at last sex, having had a causal partner at last sex, having had two or more cumulative partners in the last 6 months, having a history of STIs and, having received money, drug or gifts in exchange for sex, having ever been tested for HIV, duration since last HIV test, drinking or using drug before last sexual encounter, not knowing someone with HIV/AIDS, sharing needle and having sex with a partner who used needle to inject drugs and not knowing the HIV status of last sex partner. This measure assessed participants' risks on a scale ranging from 0-5, depending on the number of answer options for each question, with "0" representing "no risk" and "5" representing the "highest risk" level. Three investigators independently evaluated and scored each participant's responses to variables of interest depending on the risk level. The risk assessments were valid only when at least two of the investigators gave the same weight or score to a response. A composite score that summarized the status of each participant response score was then created (range: 18-34; Mean (SD) = 24.2 (2.73)). The average score was used to categorize the study participants into two main risk groups as follows: "little or no risk" (below average) and "moderate/high risk" (average score and above). This assessed measure of risk (epidemiologic risk), which was used as proxies for "*confirmed risk status*" in the circumstance of the cross-sectional design study, also served as the "*gold standard*" for comparing the respondents' perceived risk statuses.

Human Subjects Protection and Ethical Considerations

Appropriate steps were taken to ensure the protection of participants given the possibility of coercion in a military establishment. The research protocol was reviewed and approved by Institutional Review Board (IRB) of both the University of Houston in the United States and Institute for Health Research and Development in Nigeria. The women were informed verbally and in writing that their participation was voluntary, and that failure to complete the study questionnaire or refusal to participate would not jeopardize their eligibility for benefits, to which they were otherwise eligible at the Armed Forces Program on AIDS Control or the collaborating community-based organization.

Statistical Analysis

Chi-square statistic was used to assess the independent associations between socio-demographic characteristics, HIV/AIDS-related knowledge, sexual behaviors, STIs/HIV-related and Alcohol/Drug-related factors and the risk assessment methods (self-perceived vs. Assessed). Furthermore, we used chi-square to test for differences in the proportional distribution of participants who were able to accurately assess their risk levels by socio-demographic characteristics using the epidemiologic notion of risk (assessed risk) as the "*gold standard*". The Fisher's exact test was used where applicable to correct for small cell counts. The measure of agreement between the two independent risk assessment methods - self-perceived risk and assessed risk by socio-demographic characteristics were measured using the Cohen's Kappa statistics (*K*), where 1 represents perfect agreement, 0 represents no agreement beyond chance, and negative values indicate agreement less than chance, i.e., potential systematic disagreement between the two ratings. The general formula for calculating Cohen's kappa is: Kappa (K) = $(A_{obs} - A_{ch})/(N - A_{ch})$; where A_{obs} is observed agreement between perceived and assessed risk levels, A_{ch} is total agreement expected by chance, and N is the total sample size. Using the socio-demographic characteristics as independent factors, we conducted a multivariate logistic regression analysis to determine the adjusted odds of accurate STIs/HIV risk assessments by the study participants through self-perception, based on epidemiologic notions of risk (assessed risk).

Based on the outcome of the initial bivariate analyses, the predictor variables were selected a priori, to model the covariates of STIs/HIV risks, if they were significant at $p \leq 0.10$ or, if they were epidemiologically important. HIV/AIDS knowledge and educational level were considered epidemiologically important and therefore were forced into the models irrespective of their probability values. A total of 14 and 17 variables met the criteria for self-perceived and assessed risk categories, and were included in the multivariate logistic regression models to assess the independent contribution of each covariate in predicting participants' risk based on self-perceived and epidemiologic assessment, and to simultaneously adjust for the covariates and potential confounders in the models. We applied the stepwise procedure with forward selection in the multivariate analyses because we were interested in the most parsimonious models with the minimum number of variables that will predict the outcome variables. Adjusted odds ratio (AOR) with 95% confidence interval was computed for each association. Finally, we conducted a model likelihood ratio test to determine the goodness of fit of the models. The regression diagnostics yielded no evidence of multi-colinearity or overly influential outliers in any of the models. All tests were two-tailed, with probability value of 0.05 used as the statistical significance level. Data management and statistical analyses were performed using SPSS software version 16.0 (SPSS Inc., Chicago, IL, USA).

Study Limitations

This study has several limitations that should be considered when interpreting and generalizing the findings. First, because the study was based on a cross sectional design, we were unable to examine the direction of causality between risk context and associated sexual behaviors. This makes it difficult to interpret the reported relationship status in the models, as concurrency is unknown. Due to the sensitive nature of the survey, findings are subject to social desirability bias where individuals may not wish to report behaviors that may be deemed undesirable. Additionally, retrospective recall of the number and nature of sexual activities may be less accurate after a long period and may have resulted in underreporting. In developing epidemiologic risk scale, we assigned weight or score to each participant's response depending on the level of risk for which such response was assessed. It is possible that the risk levels associated with certain sexual practices and behaviors may have been underestimated or overestimated, and therefore, given higher or lower weights, leading to

risk level misclassifications and selection bias. However, while potentially correlated response may have been anticipated between risk categorizations and behaviors, further analysis indicated that each construct represented a distinct and measurable dimension that varies independently from each other. Given that the study used military cantonments from one of the six geopolitical zones in Nigeria, the findings may not be generalizable or representative of the female military personnel in Nigeria. Each of the zones has different socio-cultural characteristics and environmental settings that may have some influence on the type of sexual risk behaviors and practices that personnel serving in such areas engage in. In spite of these limitations, the findings from our study have several implications for the design and implementation of STIs/HIV prevention interventions for female military population in Nigeria, in addition to providing an important extension to previous researches on STIs/HIV risk assessment.

Results

Socio-demographic Characteristics

The socio-demographic characteristics of the study population comprising of 346 participants, and their association with STIs/HIV risk assessment methods are presented in Table 1. There were clear indications that participants generally tend to underrate their risks level based on self-perception. Overall, majority of the participants (75.1%) significantly perceived themselves to be at no risk/low risk than those who claimed to be at moderate/high risk (24.9%) of contracting STIs/HIV infection (χ^2=87.5; p<.001). With self-perceived STIs/HIV risk assessment, except for employment status; all the factors considered were significantly associated (p≤.05) with the participants' risk levels.

However, when their epidemiologic STIs/HIV risk levels were determined, we noted a significant (p<.05) shift in the proportions, with 19.3% of the participants who perceived themselves to be at no risk/low risk actually being determined to be at moderate/high risk of contracting STIs/HIV infection (χ^2=4.62; p<.05). Based on actual risk assessment, we noted the existence of significant independent associations in the risk levels by marital status (χ^2=12.52; p<.01), number of children (χ^2=22.06; p<.001), race/ethnicity (χ^2=14.91; p<.01), and annual income (χ^2=8.67; p<.05) of the participants. Of interest was a significant increase observed in the proportion of legally married individuals who perceived themselves to be at little or no risk/low risk (94.7%), becoming 61.8% at moderate/high risk of contracting STIs/HIV infections after epidemiologic assessment. Similarly, following epidemiologic assessment, more women of Hausa (13.5%), Yoruba (17.5%) and other (36%) tribes were at moderate/high risk levels compared to their initial self-perceived assessment (Table 1).

Bivariate Associations of Risk Indicators

Table 2 shows the bivariate association between HIV/AIDS knowledge, Sexual Behavior, STIs/HIV-related and Alcohol/Drug-related risks, and Risk Assessment Methods. Findings indicate that self-perception of risk by participants were significantly (p<.05) associated with the following risk factors: cumulative number of partners (χ^2=12.05; p<.01), type of partner at last sexual encounter (χ^2=6.48; p<.01), condom use at last sexual encounter (χ^2=9.92; p<.01), duration since last HIV test (χ^2=40.49; p<.001), drinking before the last sexual encounter (χ^2=9.83; p<.05) and drug use before last sexual encounter (χ^2=14.58; p<.01). Within these factors, the proportion of participants that rated themselves as being at no/low risk ranged from 50.0-100%, while those that rated their risk levels as moderate/high ranged from 0.0-50.0%. In addition to the aforementioned variables, six more risk factors were significantly associated with epidemiologic risk assessment method. These include receiving money, drugs or gift for sex (p<.001); HIV status of the last partner (χ^2=10.42;

$p<.05$); personally knowing someone with HIV/AIDS ($\chi^2=27.97$; $p<.001$); number of persons known with HIV/AIDS ($\chi^2=28.58$; $p<.001$); ever sharing needles to inject drugs ($p<.01$); and having sex partners who used needles to inject drugs ($p<.05$). The proportional distribution of participants' assessed risk levels ranged from 0.0-88.2% for no/low risk and from 11.8-100% for moderate/high risk category. In general, with self-perception, majority of the participants tend to underrate their levels of risk for contracting STIs/HIV infections by claiming to be at no/low risk. But when assessed epidemiologically, we noted a significant increase in the proportions of those at moderate/high risk and a reduction in participants classified as being at no/low risk (Table 2).

Measure of Agreement

The measures of agreement between self-perceived and assessed STIs/HIV risk by socio-demographic characteristics of participants are presented in Table 3. The results indicate that majority of the Kappa coefficients (K) obtained were negative; except for a few low positive values, and ranged from −0.021 to 0.115. These figures generally denote very low agreement between both assessment methods, and confirmed that majority of the women tended to underrate their STIs/HIV risk levels through self-perceptions compared to the epidemiologically assessed risk levels. Consequently, participants were more at risk of acquiring the diseases than they actually perceived themselves to be.

Accurate Assessment of STIs/HIV Risk

Percentage distribution and adjusted odds ratios of accurate assessment of STIs/HIV risk levels of the study population by socio-demographic characteristics are shown in Table 4. Using the epidemiologic notions of risk as the *gold standard*, we observed that overall, 45.4% (n=157) of the study participants were able to accurately perceive their risk levels. However, the proportions of accurate assessment of risk by participants differed significantly ($p\leq0.01$) across and within the socio-demographic characteristics. For example, correct assessment of risk increased significantly with increase in age group ($\chi^2=38.57$; $p<.001$), educational level ($\chi^2=132.71$; $p<.001$), and annual income ($\chi^2=69.90$; $p<.001$), but showed no clear pattern based on number of children. Participants who were Christians had 11.5% more accurate perception of their risk levels than Muslims (48% vs. 36.5%). The highest accurate risk perception came from participants with annual salary of ₦501,000 and above (70%) [1 US $ = ₦150], followed by those who had four or more children (68.4%) and then, those who were divorced, widowed or separated from their partners (62.5%).

Risk estimates based on accurate assessment indicated that women who were 40 years and older were 5 times (AOR=5.09; 95% CI: 1.32-9.64; $p<.05$) more likely than those in age group, 18-29 years to accurately assess their risk levels. Employment status and annual income of the participants were also associated with participants' ability to accurately assess their risk of contracting STIs/HIV. Women who earned ₦361,000 - ₦500,000 were approximately 4 times (AOR=3.56; 95% CI: 1.38-9.16; $p<.01$) more likely than those in the lowest income bracket to accurately perceive their risk levels. Active service female personnel were about 12 times (AOR: 12.46; 95% CI: 2.03-26.42; $p<.01$) more likely than trainees to accurately perceive their risk levels. While our final model indicated that only 19.3% of actual STIs/HIV risk could be predicted by the identified covariates, the slightly wide confidence intervals associated with the AORs, may indicate a reduced precision of the estimates, and call for caution in interpreting the results. In attempt to determine, if accurate risk assessment was associated with condom use at last sexual encounter, we noted that among participants who accurately assessed their risk levels, 72.7% of them used condom at their last sexual encounter compared to 27.3% who did not. Using multivariate analysis, we further noted that only race/ethnicity and number of children were significant predictors of condom use at last sexual encounter, with participants from Ibo and Yoruba tribes being 10

and 7 times more likely than the Hausas, respectively, to have used condom at their last sexual encounters (results not shown).

Covariates of Self-Perceived and Epidemiologic Notions of STIs/HIV Risk

Multivariable models analysis indicate that self-perceived risk by participants could be significantly predicted by educational level, religion, condom use at last sex and duration since last HIV test (R^2=0.267; p<.001) (Table 5). The adjusted odds ratios (AORs) were generally protective, except for religion where Muslims were reported to be three times more likely than Christians to be at moderate/high risk of contracting STIs/HIV (AOR: 3.32; 95% CI: 1.29-8.51, p<.01). Results showed that the epidemiologic risk for acquiring STIs/HIV, unlike self-perceived risk, was significantly determined by the following covariates: type of partner at last sex, condom used at last sexual encounter, cumulative number of partners, duration since last HIV test, drinking before last sexual encounter and personally knowing someone with HIV/AIDS, with a model coefficient of determination of 70% (R^2=0.700; p<.001). Women who did not use condom during their last sexual encounter were 4 times (AOR=4.19; 95% CI: 1.39-12.66, p<.01) more likely than those who used condom, to be at moderate/high risk of contracting STIs/HIV. Furthermore, epidemiologic assessment of the participants' risk showed that increased duration of last negative HIV test was significantly associated with moderate/high risk of STIs/HIV infection. Participants whose recent HIV tests were carried out during the last 4-12 months, and more than 12 months were 8 times (AOR:7.85; 95% CI=1.53-15.35, p<.01) and 14 times (AOR:14.19; 95% CI=7.76-23.42, p<.001), respectively, more likely than the reference group (past three months) to be at moderate/high risk of contracting the diseases. Similarly, participants' risk levels tend to increase with increasing cumulative number of partners with those having 3 or more partners being about 14 times (AOR=13.58; 95% CI: 3.20-27.62, p<.001) more at moderate/high risk of contracting STIs/HIV infection than those with single partner.

Women whose last sex partner or both of them were drinking before last sexual encounter were 4 times (AOR=4.28; 95% CI: 1.01-8.03, p<.05) and 12 times (AOR=12.00; 95% CI: 6.14-19.81, p<.05) more likely than those whose male partners and them were both drinking, to be at moderate/high risk of acquiring STIs/HIV. Not personally knowing someone with HIV/AIDS was also significantly (p<.001) associated with increased risk for acquiring STIs/HIV. Participants in this group were 8 times (AOR=8.33; 95% CI: 2.95-23.52, p<.001) more at risk than those who personally knew someone with HIV/AIDS disease. Comparatively, only two of the covariates namely condom use at last sexual encounter and duration since last HIV test, were significant and common predictors of the risk level of the study participants based on both assessment methods (self-perceived vs. epidemiologic risk). However, the slightly wide confidence intervals associated with some AORs, may indicate a reduced precision of the estimates and call for caution in interpreting the results.

Discussion

Accurate assessment of personal risk and making the connection between behavior and susceptibility to STIs/HIV infection are important first steps in preventing the diseases. In the current study, we noted with significant socio-demographic variations that majority of the participants who perceived themselves to be at little or no risks were actually at moderate/high risk of contracting STIs/HIV infection following epidemiologic assessment. This demonstrated systematic tendency of the participants to be overly optimistic about the outcome of planned actions, which has been termed "optimism bias" [27] was similarly observed among college students in Nigeria [28] and by other researchers elsewhere [15, 25, 29, 30]. In Nigerian culture, individuals with STIs/HIV disease are highly stigmatized (it is considered shameful to acquire these diseases), and often mistakenly believed to be associated only with certain individuals or high-risk groups such as commercial sex workers

(CSW), homosexuals, intravenous drug users and immoral 'others'. Therefore, the fear of "subjectification" may be responsible for this unrealistic optimism, which may make the women less likely to take protective action or be more likely to engage in high risk behaviors. In addition, the common patterns of risk perception shared by the women may be linked to the military community membership's shared experience, culture, norms or other forms of group self-identity that in turn shape their risk behaviors. Consequently, the choice of safe sex or abstinence may involve weighing the sexual fulfillment expected from a given behavior against the perceived health risks of that behavior. This implies that sexual behavior and safer sex has a complex relationship that is determined by several factors such as context, time and settings.

We noted that 45.4% of our study participants accurately assessed their actual risk levels based on self-perception. This figure raises some concern about higher likelihood of STIs/HIV transmission among those who are less likely to correctly perceive their risk levels or aware of any recent changes in their serostatus. While this observation may be implicated in the current epidemic dynamics in the Nigerian military, effective health education campaign among this population will depend to a large extent on getting participants to acknowledge the link between their behavior and actual risk level. Thus, self-perception of risk may be the first step toward behavioral changes and adoption of protective actions such as condom use, and has been reported to be powerfully influenced by social, structural, and population-level risks and protections [22]. A typical Nigerian military environment, which tends to put the female military personnel at high risk of contracting and transmitting STIs/HIV have been described in previous studies [6-9]. Analyzing the risk environment in which these women operate would help in developing prevention and coping strategies that emphasize both individual behavioral and environmental change.

The relationship between perception of risk and sexual behavior is complex and some studies in sub-Saharan Africa have shown mixed results [16, 20, 29, 30, 31, 35, 39, 40]. We recorded no significant association between HIV/AIDS knowledge and the risk assessment methods, despite a high prevalence of HIV risk indicators in the population. Although the adult literacy rate in Nigeria is considered high, this observation corroborates with our earlier findings [6-7], and that of other researchers [31-32], where despite high degree of HIV/AIDS knowledge, armed forces personnel were reported to have engaged in risk-taking behaviors. For instance, approximately, 60.4% of our study participants who did not use condom during their last sexual encounter were at moderate/high risk of contracting STIs/HIV, despite widespread knowledge that condoms offer protection against the diseases when used correctly and consistently.

As expected, more of the behavioral variables were associated with epidemiologic risk than the self-perceived risk outcome. However, we noted significant independent associations between cumulative number of partners, type of sex partner at last sex, condom use at last sexual encounter, duration since last HIV test, drinking before last sexual encounter and the two risk assessment methods. Studies conducted in different cultures have similarly associated HIV risk with a wide range of variables [15-17]. In Sub-Saharan Africa, socio-cultural norms and practices were identified as major determinants of sexual risk-taking behavior [33].

Based on epidemiologic assessment, personally knowing someone with HIV/AIDS significantly ($p<.001$) reduced the risk of contracting STIs/HIV by 32.3% when compared to those who do not know someone with the diseases. If participants are able to relate with those impacted by the disease, it could help to create awareness about the consequences of HIV/AIDS disease, thereby leading to safer sexual practices. Proximity to the disease (e.g., knowing someone with HIV/AIDS) has similarly been shown to be useful in educating

others about the disease [34, 47]. This finding confirms the wisdom of many community programs that utilize persons with HIV/AIDS to reach and motivate the community [6]. Also of interest, was the highly significant moderate/high risk (100%) associated with participants who were identified as receiving money, drugs or gift for sex, sharing needles to inject drugs, those who had sex partner(s) who used needles to inject drugs and where both partners were drinking before last sexual encounter. This was not surprising, because it is common to have restaurants and bars around military barracks in Nigeria, where alcohol and some time illicit drugs such as marijuana are sold.

Such social environments also support the meeting of new partners with undisclosed HIV status and engagement in risky sexual behaviors such as unprotected sex, which tend to increase their risk levels to maximum. This scenario is also supported by earlier findings that alcohol and marijuana use are directly correlated with HIV risk perception among military personnel [9, 11, 12, 14, 35]. Such socio-environmental characteristics have been associated with high HIV/AIDS prevalence rates [36]. Similarly, MacKellar et al. [37] recorded in their study, that participants who engaged in sexual and drug-use behaviors and perceived themselves at moderate/high lifetime risk were significantly more likely to have already acquired HIV. This assertion may also apply to some participants that were at high risk of contracting STIs/HIV in our study. Women in this group should therefore be encouraged to undertake a comprehensive STIs/HIV tests to ascertain their serostatus.

We observed very low agreements (K=-0.021-0.115) between self-perceived risk and epidemiologic notion of risk (assessed risk) in our study. These further confirmed the "*optimism bias*" and gross mismatch noted between self-perceived and epidemiologic risk for contracting STIs/HIV in our study population, and support earlier researchers' findings [25, 28, 29, 30]. Therefore, individual's perception of risk is not a reliable measure of the actual risk status among the female military personnel. Given that, optimistic biases represent an underestimation of risk; this may make the women less likely to take precautions to prevent the outcome from occurring. In this instance, any deviations from protective and health promoting behaviors (risk behaviors) are considered irrational and the product of the risk environment (barrack lifestyles). This may well be responsible for the long observed elevated risk of exposure to STIs/HIV among Nigerian military [6-9, 11]. In general, the impact of HIV/AIDS among African militaries have assumed alarming dimensions with prevalence rates of between 5.8% and 26.7% reported in selected countries [10]. The public health implications of the (in)accuracy of individuals' risk perception also highlight the importance of improving and expanding access to STIs/HIV testing, counseling and treatment among military personnel in Nigeria and indeed in sub-Saharan Africa militaries.

Individuals' knowledge of HIV transmission and accurate assessment of risk seems to be among the key factors in adoption of safer sexual practices [38-39]. However, this was not the case in our study, as we noted highly significant ($p<.01$) variations by socio-demographic characteristics (range: 26.7%-70.0%) in the proportion of the participants who were able to accurately estimate their risk levels through self-perception. Inaccurate risk perception by participants was therefore, considered a barrier to undertaking protective forms of behaviors and safer sex that could help them reduce the risk of contracting STIs/HIV. The increasing trend in accurate assessment of risk with increased age in our study may be related to the fact that increased age brings about maturity in cognitive abilities coupled with sexual experiences and increased knowledge of STIs/HIV risk behaviors, leading to rational perception and ultimately to realistic risk assessments. Similarly, our study revealed that educational levels played a significant role in accurate perception of risks, and increased from 30.4% among women with primary school education to 57.0% among college graduates. The level of education possibly increases response to prevention

messages and increase knowledge and understanding of all forms of protection and barriers [45, 46]. These could also enhance individual's sense of efficacy and control leading to a more accurate perception of risk for acquiring the disease. Our results further showed somewhat significant decreasing trends in self-perceived and epidemiologic risks with increased annual income of participants, and conversely, increasing trends in accurate risk assessments with increased annual income. Since income levels are often linked to educational attainments, higher annual income would imply an improvement in the standard of living of participants, leading to interest in ascertainment of HIV serostatus through testing, acquisition of STIs/HIV knowledge, adoption of protective measures and accurate perception of risk.

In the current study, while single women were able, to closely perceive their risk levels, only 38.2% of legally married women correctly perceived their actual risk levels. These findings have great implication for prevention strategies in the subpopulation, especially as this route is where majority of the HIV transmission takes place. Although unprotected sex among married couples is the cultural norm, many married women and men in Nigeria engage in unprotected extramarital sexual relations, thus exposing their spouses to high risk of acquiring STIs/HIV infections [6, 33]. It is therefore important for women to accurately assess the risk associated with their relationships, and to encourage condom use in all types of sexual relationships, including consensual and legal unions [15]. Although, condom use may signal mistrust, especially among married couples, addressing these issues and encouraging testing for married and regular partners during information and education campaigns should be considered an important part of STIs/HIV prevention efforts. Race/ethnicity may also influence sexual behavior through cultural beliefs and practices. Our study demonstrated that participants who were of Ibo tribe closely perceived their risk levels with 52.8% accuracy compared to the Hausas (38.8%). Similar racial and ethnic variation in risk perceptions have been reported among adolescents in South Africa [29]. Furthermore, the fact that participant of Hausa tribe were less likely than theYorubas and Ibos to have used condom during their last sexual encounter (results not shown) also underscore the fact that this group may be at elevated risk of contracting STIs/HIV infection. Our results suggest that education and prevention programs should be knowledge-based driven and culturally sensitive, and be specifically targeted at military women from the major races/ethnic groups in Nigeria, especially those from Hausa tribe.

We noted that different set of covariates tend to shape the risk landscape based on the two assessment methods except for condom use at last sexual encounter and duration since last HIV test, which were significant contributors in both self-perceived and epidemiologic STIs/HIV risk models. The low predictive value of self-perceived STIs/HIV risk model (26.7%) compared to epidemiologic STIs/HIV risk model (70%) implies that other confounding covariates not identified in the current study may be associated with self-perceived risk in the population. We noted that women who were Muslims were more at moderate/high risk of acquiring STIs/HIV infection than Christians, an observation that was further re-enforced by the 11.5% improvement in accurate risk assessment by female personnel who were Christians compared to their Muslim counterparts. Our finding corroborates with those of Bekele and Nichols [44] who reported that Muslims had higher risk of contracting HIV infection compared to Christians among African immigrants living in New York City. Our result underscores two points, first, the need to take into account religious background when designing educational interventions for military women and secondly, the need to intensify the involvement of religious authorities in STIs/HIV prevention efforts at military community levels. The general protective effects demonstrated by the self-perception model in our study may have a negative impact on the prevalence rates of the diseases among Nigerian military. This is because with sexual behavior being likely based upon subjective perceptions of risk rather than actual risk (epidemiologic risk), the women may continue to

feel invulnerable to STIs/HIV infection, thereby treating such as distant possibility, despite their continuous involvement in highly risky sexual behaviors.

The high predictive value of the epidemiologic notions of risk model (assessed risk) indicates the importance of integrating the associated covariates in STIs/HIV prevention intervention programs targeted at changing individual risk behaviors and perceptions, as well as the social contexts in which risky behaviors occur in the military population. For instance, while condom use at last sexual encounter was protective under self-perceived STIs/HIV risk model, participants who did not use condom during their last sexual encounter under epidemiologic STIs/HIV risk model were four times at moderate/high risk of contracting STIs/HIV than those who used condom. It is a common practice among most Nigerians to use condom on new or casual partners, CSWs or at risk individuals than for regular partners [6, 7, 19, 31, 33, 39]. This practice may be linked to our current finding that encounters with casual sexual partners were considered less riskier than those with non-casuals (33.1% vs. 53.6%) and resulted in protective odds effect. This is because the women might be tempted to underestimate the risk posed by their spouses or regular partners based on their expectations of mutual fidelity; while actual risk may be elevated among such women due to the risky sexual behavior of their partners [39]. Despite widespread awareness and availability of condoms, several reasons have been reported to hinder its use [6, 16, 19, 39]. When used consistently and correctly, condoms are highly effective in preventing the sexual transmission of HIV infection and reduce the risk of other STIs [15, 16, 39, 40]. However, it is important to mention that our study findings may be confounded by the fact that no distinction was made between condom use for pregnancy prevention and those for protection against STIs including HIV, thus, warranting caution in interpretation. At the personal level, perceived risks and costs of HIV and/or pregnancy should determine contraceptives use among married couples and sex partners. Therefore, prevention programs have an important role to play in creating greater awareness of the risk of HIV infection within marital and cohabiting relationships among Nigerian military population.

Although at the initiation of the study, participants claimed to be HIV negative, we noted that epidemiologic risks of acquiring STIs/HIV infection was significantly associated with increased duration since last HIV test from less than or equal to 3 months (33.3%) to greater than 12 months (63.2%). MacKellar et al. [37] similarly reported the tendency for their study participants to underestimate current or future HIV infection risks following their perceptions on prior negative HIV test results. Consequently, it may be important to provide voluntary counseling services to the female military personnel and to emphasize to them that a negative test result offers no assurance that one will remain free from HIV infection.

We demonstrated that epidemiologic risk increased significantly with increasing number of partners from 36.8% with single partner to 83.3% for participants who had four or more partners. Participants with two, and three or more partners were about 2 times and 14 times more at moderate/high risk of contracting STIs/HIV than those who had a single partner. Our study finding corroborates with earlier research studies, where HIV risk perceptions have been reported to be strongly and significantly associated with multiple partnerships [39, 41]. The use of alcohol or other drugs has been proposed as a contributing factor to sexual risk-taking, and may also be one of the most common and potentially modifiable HIV risk factors in our study population. Our finding supports this proposition, with single, and both sexual partners drinking, being 4 and 12 times more likely than participants for which neither of them was drinking, to be at moderate/high risk of contracting STIs/HIV, respectively. This is because alcohol and drugs are thought to interfere with judgment and decision-making. Other research studies [9, 35, 41] have similarly demonstrated that alcohol and drugs use in conjunction with sexual activity increases the probability of occurrence of risky behaviors thereby inhibiting the practice of safe sex. Thus, our finding, in conjunction

with those of others, emphasizes the need to integrate alcohol abuse policy in HIV prevention efforts in the Nigerian military and elsewhere.

Another key finding of this study was that having knowledge of someone with HIV/AIDS had a significant positive influence on the military women's risk status. It is possible that personal knowing someone infected with HIV/AIDS makes risk of the disease seem more real, thereby causing participants to curtail their involvement in risky sexual behaviors for fear of being a victim. Our proposition is sustained by Palekar et al. [47] report of a positive behavioral change among South African youth following knowledge of someone who died of AIDS. Thus, personally knowing someone with the HIV/AIDS disease may increase awareness about HIV risk to untested individuals leading to greater uptake of voluntary HIV testing and counseling and changes in HIV risk behaviors. Risk levels of participants who personally knew no one with HIV/AID significantly increased by eight times in our sample, underscoring the impact that knowing someone with the disease may have in the study population. Therefore, if the potential barriers and risk associated with disclosure [48] can be overcome; knowledge of someone with the HIV/AIDS disease may constitute a powerful tool for an intervention program to change behaviors in the military social network as well as the community.

Implications for STIs/HIV Prevention

Our study findings have several implications for STIs/HIV prevention strategies in the Nigerian military, with special reference to female military personnel. We found that the participants' perception of risk was contradictory to their actual behaviors as indicated by their epidemiologic notion of risk, with only 45.4% of the study population being able to accurately assess their STIs/HIV risk status. Consequently, prevention strategies aimed at individual behavior would only reduce partially the risk of acquiring and transmitting STIs/HIV, and suggest that changing the contexts in which risky behaviors occurs may be more successful than attempting to change the way the women think about risk [42]. Many researchers agree that people's perceptions of risk are based at least, in part, on factors that do not necessarily reflect objective reality or scientific fact [15, 42, 43].

However, some researchers have identified structural realities as powerful drivers of the diseases spread, and that these may substantially determine individual-level risks for acquiring sexually transmitted infections including HIV [7, 26, 42, 43]. Our results further demonstrate that correct assessment of risk is insufficient to guarantee the adoption of protective behaviors in the study population. Thus, prevention campaigns should not only promote and foster changes in individual behaviors, but should also address structural factors that encourage high-risk behaviors in the subpopulation.

The variation in correct assessments of perceived risk by socio-demographic factors reported in our study may be used as basic point of departure for designing effective military-focused health education campaigns with network-level interventions for the specific subgroups, taking into account the religious and cultural contexts, sex role/relation, behavioral and social norms. It is also important that the predictors of epidemiologic risk for acquiring STIs/HIV identified in the current study population be integrated into future education and prevention programs to help reduce the spread of the diseases. For instance, since personally knowing someone with HIV/AIDS significantly reduced sexual risk levels, prevention and intervention programs that create more open and less stigmatized environment, where individuals can freely disclose their HIV seropositive status to family members, friends and colleagues may help to increase perceived risk of STIs/HIV. Such prevention and/or intervention strategies need to support large-scale military community risk avoidance as well as change individual behavior. In addition, long-term vision for reducing the diseases transmission should encompass programs for alleviating poverty, gender economic

imbalances, policy changes including policies on alcohol and drugs abuse, provision of free preventive services and community actions. This framework may be useful because it shifts the focus of intervention from individuals to the social situations, processes, and structures in which individuals participate [43].

We therefore conclude that the STIs/HIV epidemic dynamics in the Nigerian military population seem to suggest a mixed landscape. The epidemic may be dynamically driven by personal decisions as well as the influence of community level norms and practices; and structural factors such as laws, military actions, economic conditions, and wider cultural beliefs [43], leading to the discrepancies observed in our current study between self-perceived and epidemiologic notions of risk. Therefore, perceptions of risk and actual correlations to behaviors need to be further examined in this population; preferably through mass STIs/HIV testing and counseling program. The biological data obtained from such intervention programs would serve as "*reality check*" and facilitate the adoption of optimal prevention strategies, and treatment options for infected persons. In addition, knowledge of one's HIV positive status can lead to change in behaviors to protect other people from being infected. In these regard, identifying social, cultural and structural-environmental factors that facilitate risk would be an important step in addressing the sexual health problems of the female military personnel and indeed the military population in Nigeria and other Sub-Saharan African countries.

References

1. Sagala JK. HIV/AIDS prevention strategies in the Armed forces in Sub-Saharan Africa-A critical review. Armed Forces Soc. 2008; 34(2):292–313.
2. UNAIDS. 2007 Sub-Saharan Africa AIDS Epidemiology Update. 2008.
3. Federal Ministry of Health. National HIV Seroprevalence Sentinel Survey: Process Findings. National AIDS/STDs Control Programme (NASCP); Abuja, Nigeria: 2005.
4. FMOH, Federal Ministry of Health. Department of Public Health, National AIDS/STI Control Programme. Technical Report. Federal Ministry of Health; Abuja, Nigeria: 2010. 2010 National HIV Sero-prevalence Sentinel Survey; p. 97
5. NACA. The National Agency for the Control of AIDS (NACA) The National HIV/AIDS Behaviour Change Communication Strategy 2009-2014. The National Agency for the Control of AIDS (NACA), Federal Republic of Nigeria; 2008. p. 205
6. Essien EJ, Monjok E, Chen H, et al. Correlates of HIV knowledge and sexual risk behaviors among female military personnel. AIDS Behav. 2010; 14(6):1401–1414. [PubMed: 20387111]
7. Essien EJ, Mgbere O, Monjok E, Ekong E, Abughosh S, Holstad MM. Predictors of frequency of condom use and attitudes among sexually active female military personnel in Nigeria. HIV/AIDS - Res and Palliat Care. 2010; 2:77–88.
8. Nwokoji UA, Ajuwon AJ. Knowledge of AIDS and HIV risk-related sexual behavior among Nigerian naval personnel. BMC Public Health. 2004; 4:24. [PubMed: 15210055]
9. Essien EJ, Ogungbade OO, Kamiru HN, Ekong E, Ward D, Holmes L. Emerging socio-demographic and lifestyle predictors of intention to use a condom in human immunodeficiency virus (HIV) intervention among uniformed services personnel. Mil Med. 2006; 171(10):1027–1034. [PubMed: 17076460]
10. United States Census Bureau Population Division International Program Centre. HIV/AIDS Surveillance Data Base. 2003. Available at http://www.census.gov/ipc/www/hivaidsn.html
11. Okulate GT, Jones OB, Olorunda MB. Condom use and other HIV risk issues among Nigeria soldiers: challenges for identifying peer educators. AIDS Care. 2008; 20(8):911–916. [PubMed: 18777219]
12. USAID/Nigeria. Comprehensive Integrated Approach to HIV/AIDS Prevention and Care in Nigeria, (CIHPAC). 2009. Investing in People – HIV/AIDS/TB.

13. UNAIDS. UNESCO. WHO estimates. International Institute for Strategic Studies. The Military Balance 2001-2002, October 2001. Oxford University Press; Oxford: p. p35
14. Yeager, R. Civil-Military Alliance to Combat HIV & AIDS (CMA) – 2003. HIV/AIDS: Implications for Development and Security in Sub-Saharan Africa; p. 15
15. Prata N, Morris L, Mazive E, Vahidnia F, Stehr M. Relationship between HIV Risk Perception and Condom Use: Evidence from a Population-Based Survey in Mozambique. Int Fam Plan Perspect. 2006; 32(4):192–200. [PubMed: 17237016]
16. Maharaj P, Cleland J. Risk perception and condom use among married or cohabiting couples in KwaZulu-Natal, South Africa. Int Fam Plan Perspect. 2005; 31(1):24–29. [PubMed: 15888406]
17. Meekers D, Klein M. Determinants of condom use among young people in urban Cameroon. Stud Fam Plann. 2002; 33(4):335–346. [PubMed: 12553189]
18. Catania JA, Kegeles SM, Coates TJ. Towards an understanding of risk behavior: an AIDS risk reduction model (ARRM). Health Educ Q. 1990; 17(1):53–72. [PubMed: 2318652]
19. Essien J, Meshack A, Ekong E, et al. Effectiveness of a situationally-based HIV risk-reduction intervention for the Nigerian uniformed services on readiness to adopt condom use with casual partners. Couns Psychother Health J. 2005; 1(1):19–30.
20. Ajuwon AJ, Shokunbi W. Women and the Risk of HIV Infection in Nigeria: Implications for Control Programs. Int Q Community Health Educ. 1996; 16(2):107–20. [PubMed: 20841040]
21. Feldbaum H, Lee K, Patel P. The national security implications of HIV/AIDS. PLoS Med. 2006; 6:e171. [PubMed: 16752951]
22. Beyrer C. HIV Epidemiology Update and Transmission Factors: Risks and Risk Contexts - 16th International AIDS Conference. Epidemiology Plenary. HIV/AIDS CID. 2007; 44(1):981–987.
23. Weinstein ND. Unrealistic optimism about future life events. J Personal Soc Psychol. 1980; 39:806–20.
24. Varghese B, Julie E, Maher JE, Peterman TA, Branson BM, Steketee RW. Quantifying the Per-Act Risk for HIV on the Basis of Choice of Partner, Sex Act, and Condom Use. Sex Transm Dis. 2002; 29(1):38–43. [PubMed: 11773877]
25. Lowy E, Ross MW. “It will never happen to me”: gay men’s beliefs, perceptions and folk constructions of sexual risk. AIDS Educ Prev. 1994; 6:467–482. [PubMed: 7702958]
26. Essien EJ, Mgbere O, Monjok E, Ekong E, Holstad MM, Kalichman SC. Effectiveness of a video-based cognitive-behavioral skills building HIV risk reduction intervention for female military personnel. Soc Sci Med. 2011; (72):63–71. 2011. [PubMed: 21106284]
27. Eiser, R. Social psychology: Attitudes, cognition and social behavior. Cambridge University Press; Cambridge, UK: 1986.
28. Ijadunola KT, Abiona TC, Odu OO, Ijadunola MY. College students in Nigeria underestimate their risk of contracting HIV/AIDS infection. Eur J Contracept Reprod Health Care. 2007; 12(2):131–137. [PubMed: 17559011]
29. Anderson KG, Beutel AM, Maughan-Brown B. HIV risk perceptions and first sexual intercourse among youth in Cape Town, South Africa. Int Fam Plan Perspect. 2007; 33:98–105. [PubMed: 17938092]
30. Kibombo R, Neema S, Ahmed F. Perceptions of risk to HIV infection among adolescents in Uganda: Are they related to sexual behavior? Afr J Reprod Health. 2007; 11:168–181. [PubMed: 18458740]
31. Adebayo, SB.; Mafeni, J.; Moreland, S.; Murray, N.; Armed Forces Programme on AIDS Control (AFPAC). Final technical report. 2002. Knowledge, attitude and sexual behavior among the Nigerian military concerning HIV/AIDS and STDs; p. 95
32. Bing EG, Ortiz DJ, Ovalle-Bahamon RE, Cheng KG, Huang FH, Enesto F, Duan N. HIV/AIDS behavioral surveillance among Angolan military men. AIDS Behav. 2008; 12(4):578–84. [PubMed: 17641966]
33. Caldwell, JC.; Orubuloye, IO.; Caldwell, P. Obstacles to behavioural change to lessen the risk of HIV infection in the African AIDS epidemic: Nigerian research. In: Caldwell, J., et al., editors. Resistances to Behavioural Change to Reduce HIV/AIDS Infection in Predominantly Heterosexual Epidemics in Third World Countries. Health Transition Centre, Australian National University; Canberra, Australia: 1999. p. 113-124.

34. Zimet GD, Hillier SA, Anglin TM, Ellick EM, Krowchuk DP, Williams P. Knowing someone with AIDS: the impact on adolescents. J Pediatr Psychol. 1991; 16:287–94. [PubMed: 1890555]
35. Essien EJ, Ogungbade GO, Ward D, Ekong E, Ross MW, Meshack A, Holmes L Jr. Influence of educational status and other variables on HIV risk perception among military personnel: A large cohort finding. Mil Med. 2007; 172(11):1177–1181. [PubMed: 18062392]
36. Schensul JJ, Levy J, Disch WB. Individual, contextual, and social network factors affecting exposure to HIV/AIDS risk among older adults in low-income senior housing complexes. J Acquir Immune Defic Syndr. 2003; 33(Suppl. 2):S138–S152. [PubMed: 12853863]
37. MacKellar DA, Valleroy LA, Secura GM, et al. Perceptions of Lifetime Risk and Actual Risk for Acquiring HIV Among Young Men Who Have Sex with Men. AIDS Behav. 2007; 11(2):263–270. [PubMed: 16791527]
38. Joint United Nations Programme on AIDS (UNAIDS). An Update on HIV Prevention Success in Senegal, Thailand and Uganda. UNAIDS; Geneva: 2001. HIV Prevention Needs and Successes: A Tale of Three Countries.
39. Adedimeji AA, Omololu FO, Odutolu O. HIV Risk Perception and Constraints to Protective Behaviour among Young Slum Dwellers in Ibadan, Nigeria. J Health Popul Nutr. 2007; 25(2): 146–157. [PubMed: 17985816]
40. Akwara PA, Madise NJ, Hinde A. Perception of Risk of HIV/AIDS and Sexual Behavior in Kenya. J Biosoc Sci. 2003; 35:385–411. [PubMed: 12887220]
41. Weiser SD, Leiter K, Heisler M, et al. A population-based study on alcohol and high-risk sexual behaviors in Botswana. PLoS Med. 2006; 3(10):e392. [PubMed: 17032060]
42. Chung CE. At Risk? Exploring the relationship between HIV-related knowledge and risky behavior in young females in Jamaica. Honors Projects. 2009 Paper 15. Available at http://digitalcommons.macalester.edu/geography_honors/15.
43. Rhodes T, Simic M. Transition and the HIV risk environment. BMJ. 2005; 331:220–223. [PubMed: 16037463]
44. Bekele M, Nichols K. Religion and HIV risk perception among African immigrants living in New York City. Int Conf. AIDS. 1998; 12:658.
45. Haque MR, Soonthorndhada A. Risk Perception and Condom-use among Thai Youths: Findings from Kanchanaburi Demographic Surveillance System Site in Thailand. J Health Popul Nutr. 2009; 27(6):772–783. [PubMed: 20099761]
46. Peltzer K, Gladys Matseke G, Mzolo T, Majaja M. Determinants of knowledge of HIV status in South Africa: results from a population-based HIV survey'. BMC Public Health. 2009; 9:174. doi: 10.1186/1471-2458-9-174. [PubMed: 19500373]
47. Palekar R, Pettifor A, Behets F, MacPhail C. Association Between Knowing Someone Who Died of AIDS and Behavior Change Among South African Youth. AIDS Behav. 2008; 12(6):903–912. [PubMed: 17985226]
48. Medley A, Garcia-Moreno C, McGill S, Maman S. Rates, barriers and outcomes of HIV serostatus disclosure among women in developing countries: implication for prevention of mother-to-child transmission programmes. Bull World Health Organ. 2004; 82:299–307. [PubMed: 15259260]

Table 1

Socio-Demographic Characteristics of Study Participants by Risk Assessment Methods

Characteristics	Total	STIs/HIV Risk Assessment Method					
		Self-Perceived			Epidemiologic (assessed)		
		No/Low Risk	Moderate/ High Risk	Test Statistics	No/Low Risk	Moderate/ High Risk	Test Statistics
	n (%) [a]	% [a]	% [a]	χ^2 (df)	% [a]	% [a]	χ^2 (df)
Overall	346 (100)	75.1	24.9	87.5 (1) ***	55.8	44.2	4.62 (1) *
Age Group (years)							
18-29	87 (25.1)	60.9	39.1		58.6	41.4	
30-39	193 (55.8)	75.6	24.4		56.0	44.0	
40 and above	66 (19.1)	92.4	7.6	20.00 (2) ***	51.5	48.5	0.77 (2)
Education Level							
Elementary School	23 (6.7)	47.8	52.2		73.9	26.1	
Junior Secondary	22 (6.4)	77.3	22.7		45.5	54.5	
Senior Secondary	221(64.1)	72.9	27.1		53.4	46.6	
College	79 (22.9)	88.6	11.4	17.50 (3) ***	60.8	39.2	5.32 (3)
Marital Status							
Never Married (Single)	235 (68.7)	66.8	33.2		61.3	38.7	
Legally Married	76 (22.2)	94.7	5.3		38.2	61.8	
Living as Partners	7 (2.0)	71.4	28.6		57.1	42.9	
Divorced/widowed/Separated	24 (7.0)	95.8	4.2	29.92 (3) ***	58.3	41.7	12.52 (3) **
Number of Children							
None	216 (62.4)	64.8	35.2		62.0	38.0	
One	35 (10.1)	91.4	8.6		60.0	40.0	
Two	39 (11.3)	84.6	15.4		38.5	61.5	
Three	37 (10.7)	97.3	2.7		27.0	73.0	

Characteristics	Total	STIs/HIV Risk Assessment Method					
		Self-Perceived			Epidemiologic (assessed)		
		No/Low Risk	Moderate/ High Risk	Test Statistics	No/Low Risk	Moderate/ High Risk	Test Statistics
	n (%) [a]	% [a]	% [a]	χ^2 (df)	% [a]	%[a]	χ^2 (df)
Four and above	19 (5.5)	100.0	0.0	35.19 (4) ***	68.4	31.6	22.06 (4) ***
Race/Ethnicity							
Hausa	67 (19.4)	64.2	35.8		50.7	49.3	
Ibo	53 (15.3)	71.7	28.3		77.4	22.6	
Yoruba	112 (32.4)	75.9	24.1		58.0	42.0	
Other	114 (32.9)	82.5	17.5	7.95 (3) *	46.5	53.5	14.91(3) **
Religion							
Christian	269 (77.7)	79.2	20.8		56.9	43.1	
Muslim	74 (21.4)	60.8	39.2		51.4	48.6	
Other	3 (0.9)	66.7	33.3	10.60 (2) **	66.7	33.3	0.864 (2)
Employment Status							
Active Service	329 (95.6)	74.8	25.2		55.9	44.1	
Trainee [b]	15 (4.4)	80.0	20.0	0.21 (1)	46.7	53.3	0.50 (1)
Annual Income (× 1000)[C]							
₦120-240	70 (20.3)	57.1	42.9		52.9	47.1	
₦241-360	173 (50.1)	75.7	24.3		49.	50.3	
₦361-500	92 (26.7)	84.8	15.2		67.4	32.6	
₦501 and above	10 (2.9)	100.0	0.0	20.02 (3) ***	70.0	30.0	8.67 (3) *

χ2 (df) = Chi-square (degree of freedom);

Significant levels:

[a] Some percentages may not add up exactly to 100% due to rounding;

[b] Refers to military personnel undergoing some form of training as of the study period;

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[c]One US dollar ($) is equivalent to 150 Naira (₦);

[*] $= p < 0.05$

[**] $= p < 0.01$

[***] $= p < 0.001$.

Table 2

Bivariate Association between HIV/AIDS Knowledge, Sexual Behavior, STIs/HIV-Related and Alcohol/Drug-related Risks, and Risk Assessment Methods

Factor	Total	Self-Perceived STIs/HIV Risk			Epidemiologic STIs/HIV Risk		
		No/Low Risk	Moderate/ High Risk	Test Statistics	No/Low Risk	Moderate/ High Risk	Test Statistics
	n (%)[a]	%[a]	%[a]	χ^2 (*df*)	%[a]	%[a]	χ^2 (*df*)
HIV/AID KNOWLEDGE							
HIV/AID Knowledge							
Poor	62 (17.9)	75.8	24.2		59.7	40.3	
Good	284 (82.1)	75.0	25.0	0.02 (1)	54.9	45.1	0.47 (1)
SEXUAL BEHAVIOR							
Cumulative no. of partners [++]							
1	87 (25.1)	87.4	12.6		63.2	36.8	
2	205 (59.2)	70.2	29.8		59.0	41.0	
3	48 (13.9)	70.8	29.2		33.3	66.7	
4+	6 (1.7)	100.0	0.0	12.05 (3)**	16.7	83.3	16.35 (3)***
Received money, drugs or gifts for sex							
Yes	10 (2.9)	60.0	40.0		0.0	100.0	
No	336 (97.1)	75.6	24.4	----[f]	57.4	42.6	----[f]***
Type of partner at last sex							
Non-casual (Regular)	192 (56.0)	80.2	19.8		46.4	53.6	
Casual	151 (44.0)	68.2	31.8	6.48 (1)**	66.9	33.1	14.42 (1)***
Condom used at last sexual encounter							
Yes	232 (67.6)	69.8	30.2		62.9	37.1	
No	111 (32.4)	85.6	14.4	9.92 (1)**	39.6	60.4	16.48 (1)***

Factor	Total	Self-Perceived STIs/HIV Risk			Epidemiologic STIs/HIV Risk		
		No/Low Risk	Moderate/ High Risk	Test Statistics	No/Low Risk	Moderate/ High Risk	Test Statistics
	n (%)[a]	%[a]	%[a]	χ^2 (*df*)	%[a]	%[a]	χ^2 (*df*)
STI/HIV-RELATED							
History of STIs Symptoms							
Yes	28 (8.2)	64.3	35.7		46.4	53.6	
No	313 (91.8)	76.0	24.0	1.90 (1)	57.2	42.8	1.21 (1)
Ever been tested for HIV							
Yes	196 (57.1)	74.5	25.5		52.0	48.0	
No	147 (42.9)	75.5	24.5	0.05 (1)	60.5	39.5	2.46 (1)
Duration since last HIV test							
<=3 months	58 (29.6)	60.3	39.7		66.7	33.3	
4 – 12 months	43 (21.9)	60.0	40.0		58.2	41.8	
> 12 months	95 (48.5)	94.7	5.3	40.49 (2)***	36.8	63.2	17.12 (2)***
HIV Status of last sex partner							
Never tested	16 (7.0)	62.5	37.5		81.3	18.8	
Tested and do not have the virus	77 (33.6)	76.6	23.4		57.1	42.9	
Tested and have the virus	6 (2.6)	66.7	33.3		33.3	66.7	
Never discussed about testing	130 (56.8)	75.4	24.6	1.65 (3)	43.8	56.2	10.42 (3)*
Personally known someone with HIV/AIDS							
Yes	89 (25.7)	82.0	18.0		79.8	20.2	
No	257 (74.3)	72.8	27.2	3.04 (1)	47.5	52.5	27.97 (1)***
No of persons known with HIV/AIDS							
None	257 (74.3)	72.8	27.2		47.5	52.5	
1-2 persons	72 (20.8)	83.3	16.7		77.8	22.2	
> 2 persons	17 (4.9)	76.5	23.5	3.38 (2)	88.2	11.8	28.58 (2)***

Factor	Total	Self-Perceived STIs/HIV Risk			Epidemiologic STIs/HIV Risk		
		No/Low Risk	Moderate/ High Risk	Test Statistics	No/Low Risk	Moderate/ High Risk	Test Statistics
	n (%)[a]	%[a]	%[a]	χ^2 (*df*)	%[a]	%[a]	χ^2 (*df*)
ALCOHOL/DRUG-RELATED							
Ever shared needles to inject drugs							
Yes	06 (1.7)	50.0	50.0		0.0	100.0	
No	340 (98.3)	75.6	24.4	-----[f]	56.8	43.2	-----[f**]
Ever had sex partner who used needles to inject drugs							
Yes	5 (1.4)	60.0	40.0		0.0	100.0	
No	341 (98.6)	75.4	24.6	-----[f]	56.6	43.4	-----[f*]
Drinking before last sexual encounter							
I was drinking	6 (1.7)	50.0	50.0		50.0	50.0	
My partner was drinking	24 (6.9)	70.8	29.2		45.8	54.2	
Both of us were drinking	35 (10.1)	57.1	42.9		0.0	100.0	
Neither of us were drinking	281 (81.2)	78.3	21.7	9.83 (3)*	63.7	36.3	52.34 (3)***
Drug use before last sexual encounter							
Had been using Drug	6 (1.7)	100.0	0.0		0.0	100.0	
My partner had been using drug	10 (2.9)	60.0	40.0		50.0	50.0	
Both of us were using drug	8 (2.3)	50.0	50.0		12.5	87.5	
Neither of us were using drug	321 (93.0)	75.7	24.3	14.58 (3)**	58.3	41.7	5.96 (3)

χ^2 (df) = Chi-square (degree of freedom);

Significant levels:

[a]Some percentages may not add up exactly to 100% due to rounding;

[++]Cumulative number of partners within the last 12 months;

[f]Fisher's exact test;

*= p<.05

** =p<.01

*** =p<.001.

Table 3

Measure of Agreement between Self-Perceived and Epidemiologic Notions of STIs/HIV Risk by Socio-Demographic Characteristics

Characteristics	Total	Measure of Agreement	
	N (%)[a]	Kappa Coefficient (*K*)	ASE[b]
Age Group (years)			
18-29	87 (25.1)	−0.290**	0.099
30-39	193 (55.8)	−0.148*	0.063
40 and above	66 (19.1)	0.036	0.067
Education Level			
Elementary School	23 (6.7)	−0.363*	0.173
Junior Secondary	22 (6.4)	−0.126	0.172
Senior Secondary	221(64.1)	−0.167**	0.060
College	79 (22.9)	0.032	0.082
Marital Status			
Never Married (Single)	235 (68.7)	−0.151*	0.062
Legally Married	76 (22.2)	−0.021	0.043
Living as Partners	7 (2.0)	−0.522	0.239
Divorced/widowed/Separated	24 (7.0)	0.115	0.109
Number of Children			
None	216 (62.4)	−0.157*	0.065
One	35 (10.1)	−0.164	0.086
Two	39 (11.3)	−0.061	0.102
Three	37 (10.7)	0.020	0.021
Four and above	19 (5.5)	---[e]	---[e]
Race/Ethnicity			
Hausa	67 (19.4)	−0.229*	0.114
Ibo	53 (15.3)	−0.237	0.098
Yoruba	112 (32.4)	−0.169*	0.082
Other	114 (32.9)	−0.057	0.069
Religion			
Christian	269 (77.7)	−0.132**	0.051
Muslim	74 (21.4)	−0.278*	0.109
Other	3 (0.9)1	−0.500	0.306
Employment Status			
Trainee[c]	15 (4.4)	−0.410*	0.200

Characteristics	Total	Measure of Agreement	
	N (%)[a]	Kappa Coefficient (*K*)	ASE [b]
Active Service	329 (95.6)	−0.150**	0.049
Annual Income (× 1000) [d]			
₦120-240	70 (20.3)	−0.412***	0.107
₦241-360	173 (50.1)	−0.164**	0.064
₦361-500	92 (26.7)	−0.032	0.090
₦501 and above	10 (2.9)	--- [e]	--- [e]

Significant levels:

[a] Some percentages may not add up exactly to 100% due to rounding;

[b] ASE: Asymptotic standard error, not assuming the null hypothesis.;

[c] Refers to military personnel undergoing some form of training as of the study period;

[d] One US dollar ($) is equivalent to 150 Naira (₦);

[e] No statistics were computed because self-perceived STIs/HIV Risk Assessment was constant.

* = p<.05

** =p<.01

*** =p<.001.

Table 4

Percentage Distribution and Adjusted Odds Ratios (AOR) of Accurate Assessment of STIs/HIV Risk Levels of the Study Population by Socio-Demographic Characteristics

Characteristics	Total	Accurate Risk Assessment[¥]		
	N (%) [a]	% [φ]	χ^2 (df)	AOR (95% CI)
Overall	346 (100.0)	45.4	---	---
Age Group (years)				
18-29	87 (25.1)	37.9		1.00 (Referent)
30-39	193 (55.8)	46.1		1.28 (0.66-2.47)
40 and above	66 (19.1)	53.0	38.57 (2) ***	5.09 (1.32-9.64) *
Education Level				
Elementary School	23 (6.7)	30.4		1.00 (Referent)
Junior Secondary	22 (6.4)	40.9		3.32 (0.78-14.05)
Senior Secondary	221(64.1)	43.4		1.28 (0.42-3.88)
College	79 (22.9)	57.0	132.71 (3) ***	1.21 (0.33-4.51)
Marital Status				
Never Married (Single)	235 (68.7)	46.8		1.00 (Referent)
Legally Married	76 (22.2)	38.2		2.43 (0.46-12.76)
Living as Partners	7 (2.0)	28.6		0.90 (0.25-3.22)
Divorced/widowed/Separated	24 (7.0)	62.5	181.69 (3) ***	0.38 (0.06-2.39)
Number of Children				
None	216 (62.4)	46.3		1.00 (Referent)
One	35 (10.1)	51.4		1.04 (0.42-2.58)
Two	39 (11.3)	38.5		0.61 (0.16-2.38)
Three	37 (10.7)	29.7		0.09 (0.02-0.49) **
Four and above	19 (5.5)	68.4	188.19 (4) ***	0.67 (0.10-4.60)
Race/Ethnicity				
Hausa	67 (19.4)	38.8		1.00 (Referent)
Ibo	53 (15.3)	52.8		1.43 (0.43-4.82)
Yoruba	112 (32.4)	46.4		1.06 (0.38-3.01)
Other	114 (32.9)	44.7	15.36 (3) **	0.93 (0.30-2.86)
Religion				
Christian	269 (77.7)	48.0		1.00 (Referent)
Muslim	74 (21.4)	36.5		0.71 (0.25-2.01)
Other	3 (0.9)	33.3	174.93 (2) ***	0.59 (0.05-7.83)
Employment Status				

Characteristics	Total	Accurate Risk Assessment[¥]		
	N (%) [a]	% [φ]	χ^2 (df)	AOR (95% CI)
Trainee [b]	15 (4.4)	26.7		1.00 (Referent)
Active Service	329 (95.6)	45.9	139.41 (1) ***	12.46 (2.03-26.42) **
Annual Income (× 1000) [c]				
₦120-240	70 (20.3)	30.0		1.00 (Referent)
₦241-360	173 (50.1)	41.6		1.46 (0.65-3.28)
₦361-500	92 (26.7)	60.9		3.56 (1.38-9.16) **
₦501 and above	10 (2.9)	70.0	69.90 (3) ***	5.23 (0.79-14.65)

Abbreviations: referent, reference category; χ^2 (df)= Chi-square (degree of freedom); AOR = adjusted odds ratio; 95% CI = 95% confidence interval;

Final Model Likelihood ratio test: $\chi^2 = 52.81^{***}$; Pseudo R-Square (Nagelkerke) = 0.193.

Significant levels:

[a] Some percentages may not add up exactly to 100% due to rounding;

[b] Refers to military personnel undergoing some form of training as of the study period;

[c] One US dollar ($) is equivalent to 150 Naira (₦);

[¥] Accurate self-perceived risk assessment by participants based on epidemiologic notions of STIs/HIV risk (used as "gold standard");

[φ] Percentage proportions of participants within group that accurately assessed their true STIs/HIV risk (epidemiologic risk)through selfperception;

* = p<.05

** =p<.01

*** p<.001.

Table 5

Multivariate Models Showing Covariates of Risk levels[¥] based on Self-Perceived and Epidemiologic Notions of STIs/HIV Risk Assessments[€]

	Self-Perceived STIs/HIV Risk[+]		Epidemiologic STIs/HIV Risk[++]	
Covariates	**AOR**	**95% CI**	**AOR**	**95% CI**
Education Level				
Elementary School	1.00	(Referent)		
Junior Secondary	0.05*	0.01-0.37	---	---
Senior Secondary	0.21++	0.04-0.99		
College	0.01	0.00-0.06		
Religion				
Christian	1.00	(Referent)		
Muslim	3.32*	1.29-8.51	---	---
Other	0.06	0.01- 1.09		
Type of partner at last sex				
Non-casual (Regular)	---	---	1.00	(Referent)
Casual			0.24*	0.08-0.75
Condom used at last sexual encounter				
Yes	1.00	(Referent)	1.00	(Referent)
No	0.06*	0.01-0.38	4.19*	1.39-12.66
Duration since last HIV test				
<= 3 months	1.00	(Referent)	1.00	(Referent)
4 – 12 months	1.10	0.45-2.67	7.85*	1.53-15.35
> 12 months	0.09**	0.02-0.33	14.19**	7.76-23.42
Cumulative no. of partners				
One	---	---	1.00	(Referent)
Two			2.31	0.72-7.36
Three and above			13.58**	3.20-27.62
Drinking before last sexual encounter				
Neither of us were drinking	---	---	1.00	(Referent)
My partner was drinking			4.28++	1.01-8.03
Both of us were drinking			12.00++	6.14-19.81
Personally known someone with HIV				
Yes	---	---	1.00	(Referent)

Covariates	Self-Perceived STIs/HIV Risk[+]		Epidemiologic STIs/HIV Risk[++]	
	AOR	95% CI	AOR	95% CI
No			8.33**	2.95-23.52

Abbreviations: referent, reference category; AOR = adjusted odds ratio; 95% CI = 95% confidence interval;

Significant levels:

¥ Risk levels defined as: No risk/Low risk and Moderate/High Risk;

€ Based on covariates that remained in the final multivariate logistic regression models of self-perceived and epidemiologic notions of STIs/HIV risk assessments;

+ Self-perceived Risk: Final Model Likelihood ratio test: $\chi^2 = 65.84^{**}$; Pseudo R-Square (Nagelkerke) = 0.267.

++ Epidemiologic Risk: Final Model Likelihood ratio test: $\chi^2 = 145.02^{**}$; Pseudo R-Square (Nagelkerke) = 0.700.

* = p<.05

** =p<.01

*** =p<.001.