# Risk Factors for HIV-1 Seroprevalence Among Family Planning Clients in Dar es Salaam, Tanzania

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ABSTRACT

Between March and September of 1995, women receiving family planning (FP) services in three large clinics in Dar es Salaam, Tanzania were invited to participate in a cross-sectional study. Consenting women were interviewed to obtain information about HIV risk factors, and blood for HIV testing was collected. The prevalence of HIV was 16.9% (95% CI: 14.4%–19.3%). The risk of HIV increased significantly with age. Compared with married women, the risk of HIV was significantly higher among cohabiting women (age-adjusted OR = 2.3; 95% CI = 1.5–3.5) and among women who were single, divorced or widowed (age-adjusted OR = 2.3; 95% CI = 1.2–4.4). The risk of HIV was also significantly higher among hotel workers (age-adjusted OR = 4.3; 95% CI = 1.4–12.9). Women with laboratory evidence of sexually transmitted diseases were at increased risk of HIV. This study shows that HIV is a major public health problem among FP clients in Tanzania. Innovative HIV interventions are needed to reduce further spread of HIV infection. (*Afr J Reprod Health* 2000; 4 [1]:88-99)

RÉSUMÉ

**Facteurs de risque de la seroprévalence du VIH-I chez les clientes de planning familial à Dar-Es-Salaam, Tanzanie.** Les femmes qui bénéficiaient des services du planning familial (PF) dans trois grandes cliniques à Dar-Es-Salaam en Tanzanie ont été invitées, entre les mois de mars et de septembre 1995, à participer à une étude transversale. Les femmes consentantes ont été interviewées en vue d'obtenir des renseignements sur les facteurs de risque VIH et le sang destiné à l'épreuve du VIH a été prélevé. La prévalence du VIH était 16,9% (95%CI: 14-19,3%). Le risque du VIH a augmenté d'une manière significative avec l'âge. Par rapport aux femmes mariées, le risque du VIH s'est révélé beaucoup plus haut parmi les femmes qui cohabitaient (l'âge ajusté OR = 2,3; 95% CI = 1,5-3, 5) et parmi les femmes célibataires, quelles soient divorcées ou veuves (l'âge ajusté OR = 2,3; 95% CI = 1, 2-4, 4). Le risque du VIH a été encore plus élevé parmi le personnel d'hôtel (l'âge ajusté OR = 4, 3; 95% CI = 1, 4-12, 9). Les femmes dont l'évidence basée sur la preuve de laboratoire a confirmé les maladies sexuellement transmises étaient en gros danger du VIH. Cette étude démontre le fait que le VIH demeure un problème majeur de la santé publique chez les clientes de la PF en Tanzanie. Il faut de nouvelles interventions VIH pour réduire davantage la propagation de l'infection du VIH. (*Rev Afr Santé Reprod* 2000; 4 [1]:88-99).

KEY WORDS: *HIV, women, family planning, prevalence, risk factors, Tanzania, Africa*

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## Introduction

About 69% of the more than 33 million people infected with HIV in 1999 reside in sub-Saharan Africa.[1] In most countries in East and Central Africa, the AIDS epidemic has spread widely in the general population affecting both high-risk groups[2,3] as well as low-risk populations such as antenatal clinic attendees[4] and family planning (FP) clients.[5,6] Tanzania has experienced a rapid spread of the HIV epidemic. As of December 1997, about 1.5 million people (≈ 5% of the total population) were estimated to have been infected by HIV.[7] The prevalence of HIV has been reported to be higher in urban than in rural areas,[8-10] and higher in women than men.[9,10]

Mother and child health (MCH)/FP services are often women's only contact with the health care system in countries of sub-Saharan Africa. Thus, provision of HIV intervention activities within MCH/FP clinics may be the most cost-effective approach to reach women of reproductive age. In addition, this strategy is consistent with the resolutions of the 1994 International Conference on Population and Development, which called for integrated reproductive health services.[11] As a result, there is increasing interest in the provision of HIV/STD control as integrated services within the existing MCH/FP programme in Tanzania. To plan these services, information about the prevalence of HIV among women using MCH/FP services is required. Although several studies have been conducted among sub-Saharan African MCH clients such as pregnant women,[4,12] few studies have been reported among FP clients.[5] As a result, we conducted this study to identify risk factors for HIV infection among women receiving FP services in three large clinics in Dar es Salaam, Tanzania.

## Methodology

### *Study Design*

Women who participated in this study were recruited in a cross-sectional study conducted primarily to examine the validity of sexually transmitted disease (STD) diagnostic algorithms. The details of data collection and methods of the study have been described elsewhere.[13] In brief, women attending three large FP clinics in Dar es Salaam were invited to participate in the study between March and September 1995. Each day, we enrolled 12 out of about 30 women either making their first visit to the clinics, or visiting the clinics to receive additional contraceptive supplies (continuing users). Women who reported that they were currently menstruating were excluded because of the difficulty in interpreting vaginal and cervical examination findings. All eligible women received a brief description of the purpose and procedures of the study. Consenting women (N = 908) were interviewed in a private room by trained nurses to obtain information about socio-demographic characteristics, obstetric history, contraceptive practice, sexual behaviour and detailed medical history. The questionnaire used in this study was similar to that used in a previous study conducted by our group at the same clinics.[5] After interview, pre-test counselling was done before blood was collected for syphilis and HIV testing. Later, a gynaecological examination was performed by a physician and vaginal and endocervical specimens were collected for laboratory diagnosis of STDs. All women were asked to come back to the clinic after one week for post-test counselling and results. Women with bacterial STDs received free treatment based on antibiotic sensitivity results and were encouraged to bring their partners for STDs counselling and testing. The Ethical Committee of the Tanzania National AIDS Control Programme approved the study protocol.

### *Laboratory Methods*

HIV-1 infection was diagnosed using an enzyme-linked immunosorbent assay (Wellcozyme Recombinant HIV-1, Wellcome Diagnostics, Research Triangle Park, NC, USA) and reactive samples were confirmed using Western blot (Dupont de Nemours, Wilmington, DE, USA). Interpretation of Western blot reactivity was according to the World Health Organization (WHO) criteria for HIV Western blots.[14] Syphilis antibodies were detected using a venereal disease research laboratory test for syphilis (VDRL, Murex Diagnostics, Dartford, UK). Vaginal fluid was collected and a wet mount was prepared and examined microscopically by an experienced technician for the presence of motile *Trichomonas vaginalis*. Swabs from the posterior fornix and endocervix were collected and placed in transport media for processing in the mi-

crobiology and immunology laboratory at Muhimbili University College of Health Sciences. Direct microscopy was done on a gram stained vaginal smear for the detection of *Candida* species, *Trichomonas vaginalis* and leukocytes. Isolation of *Neisseria gonorrhoea* was done by inoculation of the specimens on modified Thayer Martin medium followed by incubation in a candle extinction jar at 35°C for 24–48 hours. Isolates were identified on the basis of typical colony morphology, visualisation of gram-negative intracellular diplococci, and positive oxidase reaction and sugar fermentation tests. Endocervical swabs for detection of *Chlamydia trachomatis* antigen were collected and placed in the transport medium supplied by the manufacturer for processing at the African Medical Research Foundation (AMREF) laboratory. *Chlamydia trachomatis* antigen was detected using an antigen detection enzyme immunoassay (IDEIA Chlamydia, Dako Diagnostics Ltd, Cambridgeshire, UK). Positive samples were confirmed by a blocking assay from the same manufacturer.

### *Statistical Methods*

We summarised the associations between HIV status and predictor variables with age-adjusted odds ratios (OR) and 95% confidence limits. The age-adjusted OR was calculated from logistic regression models, which included age with each of the predictors. Age was grouped into five categories and entered in these models as indicator variables, grouped as follows: 16–20 years, 21–25 years, 26–30 years, 31–35 years and > 35 years. To describe potential interaction between husbands' level of education and women's age, we assessed the association between HIV and level of education stratified by women's age (age groups ≤ 25 years and > 25 years). The overall prevalence of HIV in these two age groups was compared using the Chi-square test.[15] To adjust for multiple risk factors simultaneously, multivariate analyses were performed using logistic regression models.[16] Variables were entered into the model based on level of significance in the bivariate analyses ($p < 0.20$), or if they were known or suspected to be important risk factors for HIV infection. After obtaining the final model, we tested the importance of spouse or male partner characteristics and sexual behaviour by adding these variables in the final model restricted to married or cohabiting women. Only significant variables ($p < 0.05$) were left in the final regression models.

## Results

Of 960 women approached, 908 (94.6%) agreed to participate in the study. Eleven women were excluded from the analyses because substantial information was missing from their questionnaires. The age of the women ranged from 16 to 47 years (mean = 26.4 years; median = 26 years), and 74.8% of the women were married. The majority of women (752 out of 897 or 83.8%) reported having completed at least 5–7 years of primary education and 59.3% gave housework as their main occupation. Out of 897 women with complete data, 152 (16.9%) were HIV positive (95% confidence interval: 14.4%–19.3%).

The associations between socio-demographic characteristics and HIV are presented in Table 1. With the exception of the oldest age category, the risk of HIV increased with increasing age. This trend was statistically significant when age was used as a continuous variable ($p$-value, test for trend = 0.02). Compared with married women, the risk of HIV was significantly increased among cohabiting women (age-adjusted OR = 2.3; 95% CI = 1.5–3.5) and among women who were single or divorced or widowed (age-adjusted OR = 2.3; 95% CI = 1.2–4.4). Although most categories of women's occupation were not associated with HIV, hotel workers had a significantly increased risk when compared with housewives (age-adjusted OR = 4.3; 95% CI = 1.4–12.9). However, only 14 (1.6%) women reported that they were hotel workers (of which 6 were HIV positive). The risk of HIV was positively associated with the level of education of the husbands or male partners ($p$-value, test for trend = 0.004). Compared with women with husbands or male partners that had no formal education, the risk of HIV was significantly increased among women who had a husband or male partner with primary education (age-adjusted OR = 3.4; 95% CI = 1.0–11.4) and further increased among those with at least secondary education (age-adjusted OR = 5.1; 95% CI = 1.5–17.4).

*Table 1* **Association between HIV and Socio-Demographic Characteristics among Women Using Family Planning Methods in Dar es Salaam, Tanzania (N = 897)**

| Characteristic | N | % HIV seropositive | Age-adjusted OR (95% CI[a]) |
|---|---|---|---|
| *Age (yr.)* | | | |
| 16–20 | 126 | 12.7 | 1.0 |
| 21–25 | 312 | 14.4 | 1.2 (0.6–2.1) |
| 26–30 | 259 | 18.5 | 1.6 (0.9–2.9) |
| 31–35 | 141 | 22.7 | **2.0 (1.1–3.9)** |
| ≥ 36 | 59 | 18.6 | **1.6 (0.7–3.7)** |
| p-value, test for trend | | | 0.20 |
| *Study clinic* | | | |
| Mwananyamala | 455 | 15.6 | 1.0 |
| Ilala | 289 | 18.0 | 1.2 (0.8–1.8) |
| Temeke | 153 | 19.0 | 1.2 (0.8–2.0) |
| *Marital status* | | | |
| Married (mono/polygamous) | 671 | 14.0 | 1.0 |
| Cohabiting | 173 | 25.4 | 2.3 (1.5–3.5) |
| Single/separated/divorced | 53 | 26.4 | 2.3 (1.2–4.4) |
| *Level of education* | | | |
| No formal education | 72 | 18.1 | 1.0 |
| Primary education (1–4 yr.) | 73 | 12.3 | 0.7 (0.3–1.6) |
| Primary education (5–7 yr.) | 689 | 17.1 | 1.1 (0.6–2.1) |
| Secondary education | 63 | 19.0 | 1.3 (0.5–3.2) |
| p-value, test for trend | | | 0.36 |
| *Occupation* | | | |
| Housework | 532 | 13.9 | 1.0 |
| Hotel worker | 14 | 42.9 | 4.3 (1.4–12.9) |
| Small scale trader | 291 | 19.6 | 1.4 (0.9–2.1) |
| Others | 60 | 25.0 | 2.0 (1.0–3.7) |
| *Age of husband or cohabiting male partner (yr.)*[b] | | | |
| 18–25 | 93 | 9.7 | 1.0 |
| 26–30 | 206 | 17.5 | 1.8 (0.8–3.9) |
| 31–35 | 210 | 17.1 | 1.4 (0.6–3.3) |
| ≥ 36 | 292 | 16.8 | 1.1 (0.5–2.6) |
| Don't know | 43 | 18.6 | 1.7 (0.6-4.9) |
| p-value, test for trend | | | 0.84 |
| *Level of education of husband or cohabiting male partner*[b] | | | |
| No formal education | 51 | 5.9 | 1.0 |
| Primary education (1–7 yr.) | 602 | 15.8 | 3.4 (1.0–11.4) |
| Secondary and above | 191 | 20.9 | 5.1 (1.5–17.4) |
| p-value, test for trend | | | < 0.01 |

[a]*CI denotes confidence interval.* [b]*Excludes women who were unmarried or not cohabiting with a male partner.*
*OR = odds ratio*

*Table 2* **Association between HIV, Sexual Behaviour and Contraceptive Use among Women Using Family Planning Methods in Dar es Salaam, Tanzania (N = 897)**

| Characteristic | N[a] | % HIV seropositive | Age-adjusted OR (95% CI[b]) |
|---|---|---|---|
| *Age at time of first sexual contact (yr.)* | | | |
| ≤ 15 | 253 | 20.9 | 1.0 |
| 16–17 | 284 | 13.4 | 0.6 (0.4–0.9) |
| ≥ 18 | 360 | 16.9 | 0.7 (0.5–1.1) |
| p-value, test for trend | | | 0.13 |
| *Number of sex partners in the past 3 months* | | | |
| 1 | 800 | 16.3 | 1.0 |
| ≥ 2 | 96 | 21.9 | 1.4 (0.8–2.3) |
| *Had sex with men other than spouse or cohabiting male partner in past 3 months* | | | |
| No | 774 | 15.5 | 1.0 |
| Yes | 70 | 25.7 | 1.8 (1.0–3.2) |
| *Had new sex partner in the past 1 month* | | | |
| No | 858 | 16.6 | 1.0 |
| Yes | 38 | 26.3 | 1.8 (0.9–3.8) |
| *Husband/male partner had sex with other women in the past 3 months* | | | |
| No | 147 | 15.0 | 1.0 |
| Yes | 101 | 24.8 | 1.7 (0.9–3.3) |
| Not sure/Don't know | 596 | 15.3 | 1.0 (0.6–1.6) |
| *Ever used condoms in the past 3 months?* | | | |
| No | 760 | 17.2 | 1.0 |
| Yes | 137 | 15.3 | 0.9 (0.6–1.5) |
| *Contraceptive methods used at recruitment* | | | |
| None | 236 | 17.8 | 1.0 |
| Oral contraceptive pills | 197 | 13.2 | 0.7 (0.4–1.1) |
| Injectable contraceptives | 402 | 17.7 | 0.9 (0.6–1.3) |
| Intrauterine device (IUD) | 59 | 22.0 | 1.1 (0.5–2.3) |

*[a]Totals may not add up to 897 because of missing information. [b]CI denotes confidence interval.* OR = *odds ratio*

In Table 2 we present the associations between sexual behaviour, contraceptive use and HIV. Most women (89.2%) had less than two sex partners in the three months before the survey. The risk of HIV was marginally significantly increased among women reporting that they had sex with a non-regular male partner in the past three months (age-adjusted OR = 1.8; 95% CI = 1.0–3.2) and among those who had a new sex partner in the past one month (age-adjusted OR = 1.8; 95% CI = 0.9–3.8). Only 137 (15.3%) had ever used condoms during the previous three months and most of these women (74.4%) were occasional users. The risk of HIV was not significantly reduced among

women who had ever used condoms. Injectable contraceptives (depot medroxyprogesterone acetate, Depo-Provera) were the most commonly used contraceptive methods (44.8%). Other contraceptive methods used were low-dose combined oral contraceptives (22.0%) and intrauterine device (IUD, copper T loop) (6.6%). There was no significant association between use of any contraceptive method and HIV.

*Table 3* **Association between HIV and Clinical Findings and Sexually Transmitted Diseases among Women Using Family Planning Methods in Dar es Salaam, Tanzania (N = 897)**

| Characteristic | N[a] | % HIV seropositive | Age-adjusted OR (95% CI[b]) |
|---|---|---|---|
| *Body rash on examination* | | | |
| No | 872 | 16.2 | 1.0 |
| Yes | 23 | 43.5 | 4.2 (1.8–9.9) |
| *Do you think you are at risk of having STDs?* | | | |
| No | 77 | 22.1 | 1.0 |
| Don't know | 296 | 15.2 | 0.6 (0.3–1.2) |
| Yes | 522 | 17.2 | 0.7 (0.4–1.3) |
| *Ever had abnormal vaginal discharge?* | | | |
| No | 781 | 16.1 | 1.0 |
| Yes | 116 | 22.4 | 1.5 (0.9–2.4) |
| *Ever had genital ulcer?* | | | |
| No | 855 | 16.7 | 1.0 |
| Yes | 42 | 21.4 | 1.4 (0.6–2.9) |
| *Neisseria gonorrhoea* | | | |
| No | 883 | 16.6 | 1.0 |
| Yes | 14 | 35.7 | 2.8 (0.9–8.6) |
| *Chlamydia trachomatis* | | | |
| No | 837 | 16.7 | 1.0 |
| Yes | 60 | 20.0 | 1.3 (0.7–2.6) |
| *Trichomonas vaginalis* | | | |
| No | 703 | 14.9 | 1.0 |
| Yes | 194 | 24.2 | 1.9 (1.3–2.8) |
| *Candida albicans* | | | |
| No | 830 | 17.2 | 1.0 |
| Yes | 67 | 13.4 | 0.8 (0.4–1.6) |
| *Syphilis*[c] | | | |
| No | 862 | 16.8 | 1.0 |
| Yes | 35 | 20.0 | 1.3 (0.5–3.0) |
| *At least one STD*[d] | | | |
| No | 626 | 14.1 | 1.0 |
| Yes | 271 | 23.6 | 2.0 (1.4–2.9) |

[a] *Totals may not add up to 897 because of missing information.* [b] *CI denotes confidence interval.* [c] *Positive on VDRL test.*
[d] *Women had N. gonorrhoea or C. trachomatis or T. vaginalis or syphilis.* OR = *odds ratio.*

The associations between HIV, clinical signs and STDs are shown in Table 3. Women with skin rashes on examination were significantly more likely to be HIV positive (age-adjusted OR = 4.2; 95% CI = 1.8–9.9). Genital tract infections were common in this population. *Trichomonas vaginalis* was the most commonly isolated organism (21.6%) followed by *Candida albicans* (7.5%), *Chlamydia trachomatis* (6.7%), syphilis (3.9%) and *Neisseria gonorrhoeae* (1.6%). Women with *N. gonorrhoea* were 2.8 (95% CI = 0.9–8.6) times more likely to be HIV infected. The risk of HIV was significantly increased among women with *T. vaginalis* (age-adjusted OR = 1.9; 95% CI = 1.3–2.8). Syphilis and candidiasis were not significantly associated with HIV. Overall, women with at least one of the STDs tested in this study (*T. vaginalis* or *C. trachomatis* or syphilis or *N. gonorrhoea*) were at significantly increased risk of HIV (age-adjusted OR = 2.0; 95% CI = 1.4–2.9).

To identify potential factors that might explain the observed positive association between HIV and spouse or male partner's education, the distribution of other predictors of HIV in three levels of education of male partner is presented in Table 4.

Women reporting that their husband or male partner had no formal education were significantly more likely to be older, less educated themselves, to have had multiple sex partners in the last 3 months and to have had sex with a non-regular male partner in the three months preceding the survey. However, condom use and the prevalence of genital infections did not vary significantly by level of education of husband or male partner. To assess potential interactions between women's age and husband's level of education, we calculated the risk of HIV by husband's education among women aged ≤ 25 years and > 25 years. Although the risk of HIV by husband's education differed in the two age groups (data not shown), the interaction term for these predictors was not statistically significant ($p$-value = 0.66).

*Table 4* **Selected Characteristics of Women Using Family Planning Methods by Husband/Regular Male Partner's Level of Education, Dar es Salaam, Tanzania**

| Proportion of women with characteristic | Husband/cohabiting partner's education | | | p-value[a] |
|---|---|---|---|---|
| | No education (N = 51) | Primary (1-7 yr.) (N = 602) | Secondary & above (N = 191) | |
| Aged ≥ 31 yr. | 49.0 | 21.4 | 16.2 | 0.0001 |
| Secondary education | 2.0 | 2.5 | 23.6 | <0.0001 |
| Hotel workers | 0.0 | 1.5 | 1.6 | 0.56 |
| ≥ 2 sex partners last 3 months | 21.6 | 10.3 | 6.8 | 0.006 |
| Had new sex partner last 3 months | 2.0 | 4.0 | 1.6 | 0.32 |
| Had sex with non-regular partner last 3 months | 15.7 | 9.0 | 4.2 | 0.004 |
| Husband/male partner had sex with other women in last 3 months | 9.8 | 11.8 | 13.1 | 0.50 |
| Ever used condom | 11.8 | 11.9 | 17.3 | 0.43 |
| Had *T. vaginalis* | 27.5 | 21.1 | 19.9 | 0.35 |
| Had *N. gonorrhoeae* | 0.0 | 1.7 | 1.0 | 0.99 |
| Had *C. trachomatis* | 7.8 | 6.1 | 6.3 | 0.83 |
| Had past vaginal discharge | 15.7 | 12.1 | 14.7 | 0.70 |
| Had past genital ulcer | 2.0 | 4.7 | 4.7 | 0.58 |

[a]*p-value, test for linear trend*

In multivariate analyses (Table 5), the risk of HIV remained significantly elevated among women who were older, unmarried, hotel workers, those with at least one STD, and among those who had sexual debut before reaching 16 years of age. Among married or cohabiting women, the risk of HIV was independently positively associated with increasing level of education of spouse or male partner after adjusting for all other risk factors.

*Table 5* **HIV Risk Factors in Multivariate Analyses among Women Using Family Planning Methods in Dar es Salaam, Tanzania (N = 897)**

| Predictor | Multivariate OR (95%CI)[a] |
|---|---|
| *Age (yr.)* | |
| 16–20 | 1.0 |
| 21–25 | 1.3 (0.7–2.5) |
| 26–30 | 2.0 (1.0–3.8) |
| 31–35 | 2.5 (1.2–5.0) |
| ≥ 36 | 1.9 (0.8–4.6) |
| p-value, test for trend | 0.006 |
| *Marital status* | |
| Married (mono/polygamous) | 1.0 |
| Cohabiting | 1.9 (1.2–3.0) |
| Single/separated/divorced | 2.0 (1.0–4.0) |
| *Occupation* | |
| Housework | 1.0 |
| Hotel worker | 3.1 (1.0–9.6) |
| Small scale trader | 1.2 (0.8–1.8) |
| Others | 1.5 (0.8–2.9) |
| *Had at least one STD*[b] | |
| No | 1.0 |
| Yes | 1.8 (1.2–2.6) |
| *Age at first sex (yr.)* | |
| ≤ 15 | 1.0 |
| 16–17 | 0.5 (0.3–0.8) |
| ≥ 18 | 0.7 (0.5–1.1) |
| *Level of education of husband/partner*[c] | |
| No formal education | 1.0 |
| Primary education (1–7 yr.) | 3.9 (1.1–13.0) |
| Secondary and above | 5.6 (1.6–19.5) |
| p-value, test for trend | 0.005 |

[a] *From a logistic regression model which included age, marital status, occupation, STD and age at first sex.*

[b] *Women who had N. gonorrhoea or C. trachomatis or T. vaginalis or syphilis.*

[c] *From a logistic regression model restricted to married or cohabiting women. This model included all variables shown in the table.*

## Discussion

In a previous study we conducted in these clinics in 1991/92, the prevalence of HIV was 11.5%.[5] The results presented in this report show that the prevalence of HIV in this population increased by about 5% during the subsequent 3–4 years. The rapid increase of HIV prevalence in this population of predominantly married women who are (mostly) not members of the conventional high-risk groups indicates that the HIV epidemic is spreading rapidly in Tanzania. Several studies have observed a high prevalence of HIV in other African countries. For example, a 1992 study in Rakai district of Uganda reported HIV prevalence of 19.7% among the adult population,[17] and in the Lusaka area of Zambia 22–35% of women of childbearing age were infected with HIV in 1997.[18] A 1991 study among women attending prenatal and paediatric clinics in Rwanda reported HIV prevalence of 32%.[19]

We identified several predictors of HIV seroprevalence in this population. As observed in other cross-sectional studies in sub-Saharan Africa,[5,20,21] the risk of HIV infection increased with age. However, results from prospective studies,[21,22] including one conducted by us in these clinics,[23] showed an opposite trend, with the highest risk of HIV among younger women. The apparent inconsistency between the results of cross-sectional and prospective studies might be due to varying duration of infection with age; with the higher prevalence among older women being related to a longer duration of HIV infection.[21]

The risk of HIV was significantly increased among unmarried women. Increased risk of HIV among unmarried women has been related to high-risk sexual behaviour and increased likelihood of multiple sexual partners.[24] The small number of women reporting to be hotel workers were at significantly increased risk of HIV. Similar findings have been reported by other studies in sub-Saharan Africa.[5,17,25] Although prostitution is illegal in Tanzania, commercial sexual activity tends to be focused on bars, restaurants and hotels. As a result, women working in these establishments have unusually high opportunity for multiple sexual partners and increased risk of acquiring HIV infection.[26] Given the magnitude of the HIV epidemic in Tanzania and the camouflaged form under which prostitution prevails in bars and hotels, well-designed interventions targeted at hotel and bar workers might help to reduce further spread of HIV.

Women with more educated husbands or cohabiting male partners were at significantly increased risk of HIV. Although we observed a similar association in our previous cross-sectional study,[5] in a prospective study conducted at the same clinics we did not observe this association.[23] The apparent inconsistency between results of cross-sectional and prospective studies in this population may be due to changes in the HIV epidemic dynamics. A stronger association between husband's level of education might have existed in the early phase of the epidemic before HIV prevalence had equalised across level of education in more recent years. This is supported by the lack of association between HIV and husband's level of education among younger women, with presumably more recent infections, and a significant positive association among older women. Women with educated husbands or cohabiting male partners were significantly younger, and less likely to have multiple or non-regular sexual partners, indicating that they were not members of the established high-risk groups. This suggests that the sexual behaviour of their husband or cohabiting male partner was the major determinant of HIV among these women. Several studies have observed increased reporting of multiple sexual partners among men with high level of education.[19,27,28]

Since educational attainment is a proxy for socio-economic status, the increased risk of HIV among women married or living with educated men in our study suggests that high socio-economic status is a risk factor for prevalence of HIV in this population. Other studies in sub-Saharan Africa have reported male partner's higher socio-economic status as a major predictor of HIV among women.[18,19,27,29] Men with higher socio-economic status tend to have disposable income that may be used to pay for sex or support multiple sexual partners.[29] Other studies have shown that poverty is a major factor forcing women to engage in high-risk sexual behaviour including commercial sexual activities.[30] These findings show that the association between socio-economic status and HIV is complex and changing over time, and it underscores the need for in-depth studies to improve our understanding about the role of income, edu-

cation and socio-economic status in the spread of HIV infection in sub-Saharan Africa.

A substantial proportion of women (11%) had multiple sex partners in the past three months, indicating that high-risk sexual behaviour was common in this population. Few women reported ever using condoms even though condoms were readily available at the study clinics, and the fact that most of the women were regular users of FP methods and were presumably trying to avoid pregnancy. These results suggest that efforts to promote safer sexual practices and condom use have been relatively unsuccessful in Tanzania. More innovative approaches, such as improving women's negotiation skills and changing men's negative attitude about condoms, might help to increase acceptability of condoms among women using FP methods.[31]

Women with body rash were at significantly increased risk of HIV infection. Skin conditions are common manifestations of HIV disease and are used in clinical staging of the disease.[32] Hence, the skin rashes were probably a manifestation of HIV infection. STDs were common in this population. Women with at least one of the four STDs we tested in this study had a significantly increased risk of HIV. Other studies have shown that both ulcerative and non-ulcerative STDs facilitate heterosexual transmission of HIV,[33,34] hence, STD prevention and control is a major priority in this population.

Although analysis of the initial cross-sectional study in this population showed significantly increased risk of HIV among users of the IUD,[5] results presented here did not show any association between HIV and IUD. However, due to small numbers of IUD users, this study had limited power to assess this association. We did not see any association between HIV and other modern contraceptive methods. These findings are not consistent with other studies that have reported increased risk of HIV among injectable contraceptive users.[35,36,37,38] Unlike previous studies conducted at the same clinics,[5,23] this study included a large group of injectable contraceptive users. Hence, we had enough power to assess the association between HIV and injectable contraceptives. The inconsistency between our results and those of other studies might be due to differences in the risk profile of women using injectable contraceptives. For example, in Tanzania, injectable contraceptives are recommended for older women not intending to have more children. Older women have been shown to be at lower risk of acquiring new HIV infections.[23] Overall, these findings provide further reassurance to women using modern FP methods in countries severely affected by the HIV epidemic.

Our study has several limitations. First, the study was conducted in selected large FP clinics in Dar es Salaam city, somewhat limiting the extent to which findings could be generalised. We decided to conduct this study in these clinics because one of our objectives was to validate existing diagnostic algorithms for STDs and to test new strategies that might be used to identify women with STDs in these settings in Tanzania. Secondly, women who had their menstrual period at the time of interview were excluded from participating in the study. This strategy was adopted because some of the diagnostic algorithms we evaluated were based on clinical signs that could not be observed or elicited in the presence of menstrual blood in the lower genital tract. As a result, we had an over-representation of women using injectable contraceptives in our study population. Users of injectable contraceptives such as Depo provera (medroxyprogesterone acetate) are known to experience amenorrhoea for varying periods of time.[39] Although these limitations might affect the ability to generalise our findings, they should have little impact on the internal validity of the results presented in this report.

In summary, we observed a very high prevalence of HIV among women who are not members of high-risk groups, confirming the fast spread of HIV in the general population. The risk of HIV infection was increased among women who were older, unmarried and those working in bars or hotels. Similarly, women married to educated men had significantly increased risk of HIV infection. However, most women did not report high-risk sexual behaviour, indicating that their male partners' sexual behaviour was the major determinant of risk in these women. These findings indicate the critical need for HIV interventions in facilities providing FP services in Tanzania.

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