# HIV Risk Factors among Pregnant Women in a Rural Nigerian Hospital

EA Etukumana[1], TD Thacher[2], AS Sagay[3]

***ABSTRACT***

***Objective:*** *Specific risk behaviours and practices promote the spread of HIV/AIDS. Identification of those at risk of the Human Immunodeficiency Virus (HIV) infection is an important step toward prevention of both vertical and horizontal transmission of HIV. This study sought to identify risk factors for HIV infection in pregnant women attending a rural antenatal clinic in Northern Nigerian.*

***Methods:*** *A cross-sectional descriptive study of pregnant women attending antenatal clinic at a rural mission hospital in Northern Nigeria between June and October 2005 was conducted. Data were collected with a structured questionnaire. HIV screening and confirmation were done for the pregnant women after voluntary counselling.*

***Results:*** *The study enrolled 350 pregnant women with a mean (± SD) age of 26.8 ± 6.4 years. HIV infection was not associated with smoking habits in women, alcohol intake in the women or their partners, prior blood transfusion, history of sexually transmitted infection or history of scarification. In multiple logistic regression, HIV infection was independently associated with suspecting their partner of extramarital sex (adjusted odds ratio 3.8, 95% CI 1.6, 9.0), post-primary education (AOR 2.4, 95% CI 1.1, 5.3), multiple sexual partners (AOR 2.4, 95% CI 0.97, 6.2) and cigarette smoking by a partner (AOR 3.0, 95% CI 0.95, 9.4).*

***Conclusion:*** *Multiple partners and extramarital sex remain a hindrance to the fight against HIV infection. Promoting the ABC approach (abstinence, be faithful, condom) may reduce risky behaviour as it has in other parts of Africa.*

**Key words:** Africa, HIV, pregnancy risk

# Factores de Riesgo de VIH entre las Mujeres Embarazadas en un Hospital Rural Nigeriano

EA Etukumana[1], TD Thacher[2], AS Sagay[3]

***RESUMEN***

***Objetivo:*** *Las prácticas y los comportamientos de riesgo específicos promueven la propagación del VIH/SIDA. La identificación de quienes se encuentran en riesgo de infección por el virus de la inmunodeficiencia humana (VIH) es un paso importante hacia la prevención de la transmisión vertical y horizontal del VIH. Este estudio buscó identificar los factores de riesgo de infección de VIH en las mujeres embarazadas que asisten a una clínica prenatal rural en el norte de Nigeria.*

***Métodos:*** *Se llevó a cabo un estudio descriptivo transversal de mujeres embarazadas que asisten a la clínica prenatal en un hospital rural misionero en Nigeria Norte, entre junio y octubre de 2005. Los datos fueron recogidos mediante un cuestionario estructurado. El pesquisaje y confirmación del virus de la inmunodeficiencia humana fueron realizados para las mujeres embarazadas tras recibir aconsejamiento voluntario.*

From: [1]Department of Family Medicine, University of Uyo, Uyo, Nigeria , [2]Department of Family Medicine, Mayo Clinic, Rochester, Minnesota, United States of America and [3]Department of Obstetrics and Gynecology, University of Jos, Jos, Nigeria.

Correspondence: Dr TD Thacher, Department of Family Medicine, Mayo Clinic, 200 First Street SW, Rochester, MN, 55902, United States of America. E-mail: thacher.thomas@mayo.edu

This work was submitted as a dissertation in part fulfillment of the Fellowship in Family Medicine of the West African College of Physicians.

***Resultados:*** *El estudio enroló a 350 mujeres embarazadas con una edad promedio (± SD) de 26.8 ± 6.4 años. La infección por VIH no estuvo asociada con el hábito de fumar entre las mujeres, la ingestión de alcohol por las mujeres o sus compañeros, las transfusiones de sangre previas, una historia de infecciones de transmisión sexual, o una historia de escarificación. En la regresión logística múltiple, la infección por VIH estuvo independientemente asociada con sospechas de relaciones sexuales extramaritales por parte de sus compañeros (odds ratio ajustado 3.8, 95% CI 1.6, 9.0), educación post-primaria (AOR 2.4, 95% CI 1.1, 5.3), parejas sexuales múltiples (AOR 2.4, 95% CI 0.97, 6.2) y el hábito de fumar cigarrillos por parte del compañero (AOR 3.0, 95% CI 0.95, 9.4).*

***Conclusión:*** *Las parejas múltiples y el sexo extramarital siguen siendo un estorbo para la lucha contra la infección por VIH. Promover el enfoque ABC puede reducir el comportamiento riesgoso, como ha ocurrido en otras partes de África.*

**Palabras claves:** África, VIH, riesgo de embarazo

**West Indian Med J 2010; 59 (4): 425**

## INTRODUCTION

Every day, more than 6800 persons worldwide become infected with HIV and over 5700 die from AIDS (1). Sub-Saharan Africa remains the most affected region in the global AIDS epidemic with more than two thirds (68%) of the total number of persons living with HIV. Unlike other regions, the majority of people living with HIV in Sub-Sahara Africa (61%) are women (1).

Mother-to-child transmission accounts for over 90% of the world's HIV-infected children (2). It is estimated that the number of orphans resulting from HIV infection may rise until 2010, by which time one third of African children may be orphaned (3). The national HIV prevalence in Nigeria among pregnant women steadily increased from 1.8% in 1991 to 5.8% in 2001 but dropped to 4.4% in 2005 (4). An urban hospital based study in Jos, Nigeria, reported a prevalence rate of 8.9% (5).

Several factors are associated with the spread of HIV and these include unprotected sex, multiple sexual partners, intravenous drug use, cigarette smoking and blood transfusion (6). A study of urban dwellers in Northern Nigeria identified multiple marriages, having a husband with other partners and being married to a banker/accountant as high risk factors for HIV infection in pregnancy (7). Other predictors of HIV were perceived risk of HIV, sexually transmitted infection (STI), candidiasis and bacterial vaginosis. Christian women of Catholic and Pentecostal denominations were also more likely to be HIV-infected compared with Moslem women. Urbanization, family disruption, poor socio-economic status and higher levels of education have also been identified as risk factors for HIV infection (8–10). Identification of those at risk of HIV infection provides potential opportunities for HIV prevention.

A cross-sectional study was carried out to determine the risk factors of HIV infection among pregnant women attending antenatal clinic in a rural Northern Nigerian hospital.

## SUBJECTS AND METHODS

The study was carried out in Zawan, a rural settlement about 20 kilometers outside the city of Jos, Nigeria. The majority of inhabitants are ethnic Berom that share similar cultural beliefs and practices. The major occupations in this community are farming and tin mining. The study was conducted at the antenatal clinic of the Our Lady's of Apostles Hospital, Zawan. The hospital has a 90-bed capacity and provides primary and secondary healthcare. The antenatal clinic attends to a daily average of 20 women.

A cross-sectional descriptive study was carried out between June and October 2005. Consecutive pregnant women who presented at the antenatal clinic and gave voluntary written informed consent were included in the study. Pregnant women who were severely ill were excluded from the study. Each woman was given information regarding the research objectives in English or the local language (Hausa or Berom) as appropriate. Data were collected with a structured questionnaire to assess potential risk factors associated with HIV infection. The questionnaire was written in English but interpreted in the local language (Hausa or Berom) for mothers who did not speak English.

Confidential pre-HIV test counselling was offered to each pregnant woman using a counselling protocol. Venous blood samples from each woman were screened for HIV-1 and HIV-2 using a rapid assay kit (Abott Determine HIV-1/2; Abott Laboratories, Abbott Park, Illinois, USA). The positive blood samples were confirmed in the AIDS Prevention in Nigeria laboratory at the Jos University Teaching Hospital with Western blot (Qualicode HIV-1/2 western Blot Kit; Immunetics Inc, Boston, MA, USA).

Enrolled women were assured of confidentiality of the study data and HIV status. Confidential post-HIV test counselling was provided. The study was approved by the Ethical Committee of the Jos University Teaching Hospital and by the management of Our Lady's of Apostles Hospital, Zawan. Sample size was estimated by assuming a HIV prevalence rate of 8.9% (5) and a sampling error of 3%. The calculated sample size was 346 women which was rounded up to 350.

Data entry and analysis were done with Epi Info 3.2.2 (CDC, Atlanta, Georgia, USA). All *p*-values less than 0.05 were considered significant.

## RESULTS

A total of 350 pregnant women were recruited. The baseline characteristics of enrolled women are shown in Table 1. The majority of pregnant women (98.3%) were married and the mean age was 26.8 ± 6.4 years, with a minority over 30 years of age. Nearly all enrolled women (96%) had at least some primary education and most women (65.4%) did not work outside the home.

Table 1: Characteristics of 350 Nigerian Women Attending Antenatal Clinic at Ola hospital, Zawan

| Characteristic | Frequency (%) | 95% confidence Interval (%) |
|---|---|---|
| **Marital status** | | |
| Married | 344 (98.3) | 96.1 – 99.3 |
| Single | 4 (1.1) | 0.4 – 3.1 |
| Divorced | 2 (0.6) | 0.1 – 2.3 |
| **Age group (yr)** | | |
| 16 – 20 | 62 (17.7) | 13.9 – 22.2 |
| 21 – 25 | 108 (30.9) | 26.1 – 36.0 |
| 26 – 30 | 92 (26.3) | 21.8 – 31.3 |
| 31 – 35 | 55 (15.7) | 12.1 – 20.1 |
| 36 – 40 | 23 (6.6) | 4.3 – 9.8 |
| 41 – 45 | 8 (2.3) | 1.1 – 4.6 |
| 46 – 50 | 2 (0.6) | 0.1 – 2.3 |
| **Occupation** | | |
| House wife | 229 (65.4) | 60.2 – 70.4 |
| Petty trader | 59 (16.9) | 13.2 – 21.3 |
| Civil servant | 35 (10.0) | 7.2 – 13.8 |
| Skilled worker | 12 (3.4) | 1.9 – 6.1 |
| Farmer | 9 (2.6) | 1.3 – 5.0 |
| Business | 6 (1.7) | 0.7 – 3.9 |
| **Partner's occupation** | | |
| Civil servant | 93 (26.6) | 22.1 – 31.6 |
| Skilled worker | 82 (23.4) | 19.2 – 28.3 |
| Petty trader | 82 (23.4) | 19.2 – 28.3 |
| Farmer | 45 (12.9) | 9.6 – 16.9 |
| Unemployed | 21 (6.0) | 3.8 – 9.2 |
| Business | 21 (6.0) | 3.8 – 9.2 |
| Unskilled worker | 6 (1.7) | 0.7 – 3.9 |
| **Education** | | |
| None | 14 (4.0) | 2.3 – 6.8 |
| Primary | 117 (33.4) | 28.6 – 38.7 |
| Secondary | 170 (48.6) | 43.2 – 53.9 |
| Tertiary | 49 (14.0) | 10.6 – 18.2 |
| **Partner's education** | | |
| None | 18 (5.1) | 3.2 – 8.2 |
| Primary | 80 (22.9) | 18.6 – 27.7 |
| Secondary | 175 (50.0) | 44.6 – 55.4 |
| Tertiary | 77 (22.2) | 17.8 – 26.8 |
| **Cigarette smoking** | | |
| No | 346 (98.9) | 96.9 – 99.6 |
| Yes | 4 (1.1) | 0.4 – 3.1 |
| **Partner smoking** | | |
| No | 330 (94.3) | 91.2 – 96.4 |
| Yes | 20 ( 5.7) | 3.6 – 8.8 |
| **Alcoholic intake** | | |
| No | 306 (87.4) | 83.5 – 90.7 |
| Yes | 44 (12.6) | 9.4 – 16.6 |
| **Partner's alcoholic intake** | | |
| No | 221 (63.1) | 57.9 – 68.2 |
| Yes | 129 (36.9) | 31.8 – 42.2 |
| **Blood transfusion** | | |
| No | 329 (94.0) | 90.8 – 96.2 |
| Yes | 21 (6.0) | 3.8 – 9.2 |
| **History of STI*** | | |
| No | 297 (84.9) | 80.7 – 88.4 |
| Yes | 53 (15.1) | 11.6 – 19.4 |
| **Scarification** | | |
| No | 302 (86.3) | 82.2 – 89.7 |
| Yes | 48 (13.7) | 10.4 – 17.9 |
| **Number of sexual partners** | | |
| 1 | 117 (33.4) | 28.6 – 38.7 |
| 2 | 144 (41.1) | 36.0 – 46.5 |
| 3 | 73 (20.9) | 16.8 – 25.6 |
| 4 | 9 (2.6) | 1.3 – 5.0 |
| 5 | 7 (2.0) | 0.9 – 4.3 |
| **Suspect partner of extramarital sex** | | |
| No | 313 (89.4) | 85.7 – 92.4 |
| Yes | 37 (10.6) | 7.6 – 14.4 |
| **Condom use** | | |
| No | 280 (80.0) | 75.4 – 84.1 |
| Yes | 70 (20.0) | 16.0 – 24.7 |

* Sexually transmitted infection

The prevalences of potential risk factors for HIV infection are shown in Table 1. Few women (1.1%) and their partners (5.7%) smoked. Alcohol intake was reported in 13% of women and in 37% of their male partners. There was no intravenous drug use or needle sharing among the subjects. A minority of subjects had a history of STI (15%), tribal scarification marks (14%) or blood transfusion (6%). The majority of women (67%) had a history of multiple sexual partners and 11% of the women suspected their partners of extramarital sex. The partners of most women (80%) did not use condoms.

The univariate associations of HIV infection with potential risk factors are shown in Table 2. The risk of HIV infection was not associated with age but advancing educational attainment was identified as a potential risk factor ($p < 0.01$). In women with a history of STI, 15.1% had HIV infection compared to 10.1% of those without such history ($p = 0.28$). In women with history of a single sexual partner, 5.1% had HIV infection whereas 13.7% of subjects with multiple partners had HIV infection ($p < 0.001$ for linear trend). The prevalence of HIV infection was 11.8% in women who did not use condoms and 7.1% among women who reported any condom use (OR 0.58, 95% CI 0.19, 1.63). Of those who suspected their male partners of extramarital sex, 27% had HIV infection compared with 8.9% of those who did not suspect their partners ($p < 0.001$). HIV infection was not associated with scarification mark ($p = 0.54$).

Table 2 (Cont'd): Association of HIV infection with potential risk factors

| Characteristic | Total (n) | HIV-positive (%) | Odds* ratio | 95% CI | *p* Value |
|---|---|---|---|---|---|
| **Marital status** | | | | | 0.69 |
| Married | 344 | 38 (11.0) | 1.0 | | |
| Single | 4 | 0 (0.0) | 0.0 | 0 – 13 | |
| Divorced | 2 | 0 (0.0) | 0.0 | 0 – 44 | |
| **Age group (yr)** | | | | | 0.87 |
| 16 – 20 | 62 | 8 (12.9) | 1.1 | 0.38 – 3.0 | |
| 21 – 25 | 108 | 13 (12.0) | 1.0 | | |
| 26 – 30 | 92 | 5 (5.4) | 0.42 | 0.11 – 1.3 | |
| 31 – 35 | 55 | 9 (16.4) | 1.4 | 0.52 – 3.9 | |
| 36 – 40 | 23 | 1 (4.3) | 0.33 | 0.01 – 2.5 | |
| 41 – 45 | 8 | 2 (25.0) | 2.4 | 0.22 – 15 | |
| 46 – 50 | 2 | 0 (0.0) | 0.0 | 0 – 41 | |
| **Occupation** | | | | | 0.007 |
| Unemployed | 229 | 22 (9.6) | 1.0 | | |
| Petty trader | 59 | 3 (5.1) | 0.5 | 0.09 – 1.8 | |
| Civil servant | 35 | 5 (14.3) | 1.6 | 0.43 – 4.7 | |
| Skilled worker | 12 | 5 (41.7) | 6.7 | 1.5 – 27 | |
| Farmer | 9 | 2 (22.2) | 2.7 | 0.26 – 15 | |
| Business | 6 | 1 (16.7) | 1.8 | 0.04 – 18 | |
| **Partner's occupation** | | | | | 0.049 |
| Civil servant | 93 | 12 (12.9) | 1.0 | | |
| Skilled worker | 82 | 14 (17.1) | 1.4 | 0.56 – 3.5 | |
| Petty trader | 82 | 3 (3.7) | 0.26 | 0.05 – 1.0 | |
| Farmer | 45 | 7 (15.5) | 1.2 | 0.40 – 3.8 | |
| Unemployed | 21 | 0 (0.0) | 0.0 | 0.0 – 1.5 | |
| Business | 21 | 1 (4.8) | 0.34 | 0.01 – 2.6 | |
| Unskilled worker | 6 | 1 (16.7) | 1.4 | 0.03 – 14 | |
| **Education** | | | | | 0.009 |
| None | 14 | 0 (0.0) | 0.0 | 0.0 – 4.4 | |
| Primary | 117 | 9 (7.7) | 1.0 | | |
| Secondary | 170 | 19 (11.2) | 1.5 | 0.62 – 3.8 | |
| Post-secondary | 49 | 10 (20.4) | 3.1 | 1.1 – 9.0 | |
| **Partner's education** | | | | | 0.49 |
| None | 18 | 1 (5.5) | 0.53 | 0.01 – 4.5 | |
| Primary | 80 | 8 (10.0) | 1.0 | | |
| Secondary | 175 | 29 (11.4) | 1.2 | 0.46 – 3.0 | |
| Post-secondary | 77 | 9 (11.7) | 1.2 | 0.39 – 3.6 | |
| **Cigarette smoking** | | | | | 0.91 |
| No | 346 | 38 (11.0) | 1.00 | | |
| Yes | 4 | 0 (0.0) | 0.00 | 0.00 – 12.66 | |
| **Partner smoking** | | | | | 0.04 |
| No | 330 | 33 (10.0) | 1.00 | | |
| Yes | 20 | 5 (25.0) | 3.00 | 0.89 – 9.59 | |
| **Alcohol intake** | | | | | 0.24 |
| No | 306 | 36 (11.8) | 1.00 | | |
| Yes | 44 | 2 (4.5) | 0.36 | 0.04 – 1.48 | |
| **Partner's alcohol intake** | | | | | 0.29 |
| No | 221 | 21 (9.5) | 1.00 | | |
| Yes | 129 | 17 (13.2) | 1.45 | 0.69 – 3.0 | |

Table 2: Association of HIV infection with potential risk factors

| Characteristic | Total (n) | HIV-positive (%) | Odds* ratio | 95% CI | *p* Value |
|---|---|---|---|---|---|
| **Blood transfusion** | | | | | 0.377 |
| No | 329 | 34 (10.3) | 1.00 | | |
| Yes | 21 | 4 (19.0) | 2.04 | 0.47 – 6.75 | |
| **History of STI** | | | | | 0.28 |
| No | 297 | 30 (10.1) | 1.00 | | |
| Yes | 53 | 8 (15.1) | 1.5 | 0.62 – 3.90 | |
| **Condom use** | | | | | 0.26 |
| No | 280 | 33 (11.8) | 1.00 | | |
| Yes | 70 | 5 ( 7.1) | 0.58 | 0.19 – 1.63 | |
| **Suspect partner of extramarital sex** | | | | | 0.0008 |
| No | 313 | 28 (8.9) | 1.00 | | |
| Yes | 37 | 10 (27.0) | 3.77 | 1.53 – 9.18 | |
| **Number of sexual partners** | | | | | < 0.001 |
| 1 | 117 | 6 (5.1) | 1.00 | | |
| 2 | 144 | 11 (7.6) | 1.53 | 0.50 –5.20 | |
| 3 | 73 | 15 (20.5) | 4.78 | 1.63 – 15.74 | |
| 4 | 9 | 2 (22.2) | 5.28 | 0.43 – 37.10 | |
| 5 | 7 | 4 (57.1) | 24.67 | 3.16 – 195.0 | |
| **Scarification** | | | | | 0.54 |
| No | 302 | 34 (11.2) | 1.00 | | |
| Yes | 48 | 4 (8.3) | 0.72 | 0.18 – 2.16 | |

In multiple logistic regression, suspecting their partner of extramarital sex (adjusted odds ratio 3.8, 95% CI 1.6, 9.0), post-primary education (AOR 2.4, 95% CI 1.1, 5.3), multiple sexual partners (AOR 2.4, 95% CI 0.97, 6.2) and cigarette smoking by a partner (AOR 3.0, 95% CI 0.95, 9.4) were independently associated with HIV infection.

## DISCUSSION

Specific risk behaviours and practices are responsible for the spread of HIV/AIDS (11). Suspicion of extramarital sex by their partners, multiple sexual partners, post-primary education, and cigarette smoking by a partner independently predicted the risk of HIV infection in rural Nigerian women presenting for antenatal care. We have previously reported the association of HIV with advancing educational attainment in this population (10). The present study confirms the association of HIV infection with cigarette smoking by a partner, as reported by others (5, 6). Cigarette smoking is more likely to be an indicator of high risk behaviour associated with transmission of HIV than it is a direct facilitator of HIV transmission.

Prior blood transfusion was not associated with HIV in this study similar to findings in Rwanda (12) but in contrast to previous studies (5, 13). This difference in the findings in this study may be attributed to the current pre-transfusion

blood screening and avoidance of unnecessary blood transfusion of patients.

In contrast to other studies (13–15), there might have been a failure to confirm an association of HIV with a history of STI due to reluctance to report such infections. However, failure to recognize the symptoms of STI, the frequent occurrence of asymptomatic STI in women or recall bias could also account for a lack of association. Some studies have reported a higher prevalence of HIV infection among those who had tattoos and scarification compared to those who did not (13, 16). Scarification was not identified as a risk factor for HIV infection in the present study and this was similar to the study of Berkley *et al* (17). Scarification practices were not common among the population in the present Nigerian series of study.

Alcohol consumption was not identified as a risk factor of HIV infection in this study in contrast to a study which found that women with male sexual partners who drank alcohol were at risk of HIV infection (18).

History of multiple sexual partners and suspected extra-marital sex in subjects' partners were identified as strong risk factors of HIV infection in agreement with other studies (18–21). The higher the number of past sexual partners, the greater the risk of HIV infection found in this study in agreement with previous studies (19, 20). Women with a history of many past sexual partners, not necessarily multiple sexual partners at a particular time, were at risk of having HIV infection.

Interestingly, HIV infection risk increased with increasing level of education in agreement with similar studies which identified a high level of education as HIV risk factor (22, 23). Condom use was not associated with a lower risk of HIV in this study. Only twenty per cent of women reported any condom use, despite a high level of HIV awareness in this population (24).

One limitation of this study was being hospital-based rather than community based. Thus, only rural women who chose to obtain antenatal care and gave consent were represented in the study. Another limitation may be the reluctance of women to report their sexual behaviour accurately. Increased reporting of risk factors would likely strengthen rather than dilute the positive association we describe.

In conclusion, multiple sex partners and extra-marital sex remain a hindrance to the fight against HIV infection. Promoting the ABC (abstinence, be faithful, condoms) approach may lead to a decline in multi-partner sexual behaviour and a decline in HIV prevalence as it did in Uganda (25).

## REFERENCES


1. UNAIDS/WHO. AIDS epidemic update, 2007.
2. De Cock KM, Fowler MG, Mercier F, de Vincenzi I, Saba J, Hoff E et al. Prevention of mother-to-child transmission in resource-poor countries: translating research into policy and practice. JAMA 2000; **283:** 1175–82.
3. UNAIDS/UNICEF. Children orphaned by AIDS: Frontline responses from Eastern and Southern Africa. Geneva: UNAIDS/UNICEF, 1999.
4. Federal Ministry of Health. 2005 HIV/AIDS sentinels seroprevalence survey in Nigeria technical report. Federal Ministry of Health, Abuja, 2005.
5. Federal Ministry of Health: Nigeria Institute of Medical Research/ National Action Committee on AIDS. Nigerians contribution to regional and global meetings on HIV/AIDS/STI, 1986–2003.
6. Turner BJ, Hauck WW, Fanning TR, Markson LE. Cigarette Smoking and maternal-child HIV transmission. J Acquir Immune Defic Syndr Hum Retrovirol 1997; **14:** 327–37.
7. Sagay AS, Kapiga SH, Imade GE, Sankale JL, Idoko J, Kanki P. HIV infection among pregnant women in Nigeria. Int J Gynaecol Obstet 2005; **90:** 61–7.
8. Ekweozor CC, Olaleye DD, Tomori O, Saliu I, Essien EM. Sexually transmitted diseases in Ibadan in the 1990's: HIV infection – an additional dimension. Afr J Med Sci 1994; **23:** 363–7.
9. Peckham C, Gibb D. Mother-to-child transmission of the human immunodeficiency virus. N Engl J Med 1995; **333:** 298–02.
10. Etukumana EA, Thacher TD, Sagay AS. HIV prevalence in pregnant women attending a rural hospital in Nigeria. Int J Gynecol Obstet 2008; **100:** 181–2.
11. Federal Ministry of Health. 2001 HIV/syphilis sentinels seroprevalence survey in Nigeria technical report. AIDS/STD control Programme. Federal Ministry of Health, Abuja, 2001.
12. Chao A, Bulterys M, Musanganire F, Habimana P, Nawrocki P, Taylor E et al. Risk factors associated with prevalent HIV-1 infection among pregnant women in Rwanda. Int J Epidemiol 1994; **23:** 371–80.
13. Harrison LH, da Silva AP, Gayle HD, Albino P, George R, Lee-Thomas S et al. Risk factors for HIV-2 infection in Guinea-Bissau. J Acquir Immune Defic Syndr 1991; **4:** 1156–60.
14. Hunter DJ, Maggwa BN, Mati JK, Tukei PM, Mbugua S. Sexual behaviour, sexually transmitted disease, male circumcision and risk of HIV infection among women in Nairobi, Kenya. AIDS 1994; **8:** 93–9.
15. Laga M, Nzila N, Goeman J. The interrelationship of sexually transmitted disease and HIV infection: implications for the control of both epidemics in Africa. AIDS 1991; **5 suppl 1:** S55–63.
16. Pepin J, Dunn D, Gaye I, Alonso P, Egboga A, Tedder R et al. HIV-2 infection among prostitutes working in The Gambia: association with serological evidence of genital ulcer and with generalized lymphadenopathy. AIDS 1991; **5:** 69–75.
17. Berkley SF, Widi-Wirsky R, Okware SI, Downing R, Linnan MJ, White KE et al. Risk factors associated with HIV infection in Uganda. J Infect Dis 1989; **160:** 22–30.
18. Johnson AM, Laga M. Heterosexual transmission of HIV. AIDS 1988; **2 suppl 1:** S49–56.
19. Ayisi JG, van Eijk AM, ter Kuile FO, Kolczak MS, Otieno JA, Misore AO et al. Risk factors for HIV infection among asymptomatic pregnant women attending an antenatal clinic in Western Kenya. Int J STD AIDS 2000; **11:** 393–01.
20. Perry D, Reid M, Thame M, Fletcher H, Mullings A, McCaw-Binns A et al. HIV infection seroprevalence and risk factor study among pregnant women attending the Antenatal Clinic at the University Hospital of the West Indies, Kingston, Jamaica. West Indian Med J 2002; **51:** 80–3.
21. Abbot RC, NDour-Sarr A, Diouf A, NDoye T, Ba D, Tall N et al. Risk factors for HIV-1 and HIV-2 infection in pregnant women in Dakar, Senegal. J Acquir Immun Defic Syndr 1994; **7:** 711–7.
22. Fylkesnes K, Musonda RM, Kasumba K, Ndhlovu Z, Mluanda F, Kaetano L et al. The HIV epidemic in Zambia: socio-demographic prevalence patterns and indications of trends among childbearing women. AIDS 1997; **11:** 339–45.
23. Kapiga SH, Shao JF, Lwihula GK, Hunter DJ. Risk factors for HIV infection among women in Dar-es-Salaam, Tanzania. J Acquir Immune Defic Syndr 1994; **7:** 301–9.
24. Etukumana EA, Thacher TD, Sagay AS. HIV/AIDS awareness among pregnant women in a rural Nigerian hospital. Trop J Obstet and Gynaecol. In press.
25. Green EC, Halperin DT, Nantulya V, Hogle JA. Uganda's HIV prevention success: the role of sexual behaviour change and national