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HIV/Tuberculosis Co-Infection among Patients Attending a Referral Chest Clinic in Nasarawa State, Nigeria

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Abstract: Human immunodeficiency virus (HIV) and *Mycobacterium tuberculosis* (TB) coinfection rate was investigated among patients referred to a chest clinic in Nasarawa State, Nigeria. Out of the 344 patients who presented with respiratory problems at the clinic, 44.8% had *M. tuberculosis* infection, 24.7% HIV infection and 12.8% HIV/tubercle bacilli co-infection. Coinfection rate in HIV infected persons (HIV^+) was 51.8 and 28.6% in those with *M. tuberculosis* infection. The relative risk of HIV positive persons being coinfected was 1.075, while it was 0.401 for TB infected persons. The estimated Odds Ratio (OR) shows that the risk of co-infection was 2.68 times higher among HIV^+ persons than among those with tuberculosis. The attributable risk was 45% and shows the extent to which co-infection could be attributed to HIV infection. A key socio-economic variable, eating in groups, was significantly correlated with coinfection ($r = 0.107$; $p<0.05$). The results of this study may provide a useful policy guide in the formulation of HIV and tuberculosis control measures in Nigeria.

Key words: Human immunodeficiency virus, *Mycobacterium tuberculosis*, coinfection, Nasarawa State, Nigeria, risk ratios of infection

INTRODUCTION

Human Immunodeficiency Virus (HIV) and *Mycobacterium tuberculosis* (TB) coinfection is a fast-growing problem in the AIDS pandemic in Africa and Asia (Aaron *et al*., 2004). About one- third of all patients with tuberculosis also have HIV infection (Bevilacqua *et al*., 2002). Many people who have the tubercle bacillus are not aware of it; the infection becomes reactivated when the body immune system is weakened by other infections such as the HIV. People living with HIV seem more vulnerable to tuberculosis (TB) than HIV uninfected persons. HIV fuels the progression of latent TB infection to active disease (Vazquez *et al*., 1994) and it is responsible for the increase in the number of TB cases (Yassin *et al*., 2004). Brown *et al*. (2006) reported highest rates of tuberculosis among people infected with HIV.

Although a lot of studies has been done on HIV and TB coinfection occurrence rates, little information is available on the coinfection rates in Nigeria. The aim of this study was to investigate the status of HIV/tuberculosis among patients presenting at a referral chest clinic in Alushi, Nasarawa State and to determine the extent to which HIV is responsible for tuberculosis (i.e., attributable risk). The information provided in this study may be a useful guide in planning TB control programs among HIV infected persons.

MATERIALS AND METHODS

Study population: Patients who presented with respiratory problem at a referral chest clinic in Alushi, Nasarawa State, Nigeria were used for the study. Sputum samples were collected in sterile plastic containers between 8.00 am and 12.00 noon from September 2004 to January 2005 with the consent of the clinic's management. As sputum was collected, socio-demographic information from the patient was recorded.

Tuberculosis diagnosis: The Ziehl-Neelsen staining technique as described by Benson (1990) was used. An air-dried smear of concentrated sputum in slide was covered with carbolfuchsin , steamed for 5 min and was decolorized with acid-alcohol for about 20 sec when cool. The slide was rinsed briefly with water, and methylene blue, a counter stain, was applied for 30 sec. The slide was rinsed with water to remove excess stain, blotted dry with Whatman's filter paper and examined under oil immersion.

HIV diagnosis: ELISA method as described by Chessbrough (1990) was used. About 5 mL of patient's blood in a test-tube was centrifuged at 60 revolutions min^{-1} for 30 min. The supernatant serum was collected for analysis using Trinity Biotech USA Capillus

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HIV-1 and HIV-2 test kits. A pink coloration signified HIV positive serum, but a colorless reaction signified HIV negative serum.

Statistical techniques: Descriptive and inferential analytical techniques as described by Umeh *et al.* (2001) were used.

RESULTS

Three hundred and forty-four patients comprising 169 males and 175 females were examined for HIV and *M. tuberculosis* infections. As shown in Table 1, 12.79% of the study population had HIV and TB coinfection. Table 2 presents the number of males and females that were HIV/TB coinfected. Rate of coinfection was significantly higher in females than in males ($t = 2.26$, $p<0.05$).

The risk of coinfection for HIV infected persons was 1.075, while it was 0.401 for those infected with *M. tuberculosis* (Table 3). The odds ratio was 2.68 and attributable risk (i.e, the extent to which coinfection could be attributed to HIV infection) was 45%.

The risk of tuberculosis among HIV infected and HIV uninfected patients were compared (Table 4). The odds ratio was 1.45 and implies that HIV infected persons are likely to get TB 1.45 times more than HIV uninfected persons. In females, the risk of TB was 1.6 times higher in HIV infected females than in uninfected females and was 1.3 times in HIV-infected males than in uninfected ones. This result means that the risk of TB is higher among HIV infected females than in HIV infected males.

Table 1: Infection rates of subjects

Infections	Rates (N = 344)
HIV	85 (24.7%)
TB	154 (44.8%)
HIV/TB coinfection	44 (12.7%)

Table 2: Occurrence of HIV infection among males and females infected with *M. tuberculosis.*

		Coinfection status	
Infection	Sex	HIV +ve (n = 44)	HIV ve (n = 110)
TB+ve	Male	16(36.4%)	62(56.4%)
	Female	28(36.6%)	48(43.6%)

($\chi^2 = 5.029$, $t = 2.26$, $p = 0.025$)

As Table 5 shows, the social habit of eating together was significantly correlated with HIV/TB coinfection ($r_{eating} = 0.107$, $p<0.05$). When people eat and sleep together the likelihood of transmitting the infectious disease agents is higher. For example, the *tubercle bacillus* is transmitted through air contaminated by nasal and oral secretion from patients with tuberculosis.

DISCUSSION

Our results have shown a rate of HIV/TB coinfection higher than previously reported (Cortes and Saraceni, 1996; Obiora *et al.*, 2004; Yassin *et al.*, 2004). The varying rates of HIV/TB coinfection may be attributed to social and economic differences in the countries in question. The estimated risk ratio shows that coinfection was about three times higher in HIV infected persons than in those with *M. tuberculosis* infection. As much as forty-five percent of coinfection cases could be attributed to HIV infection. This result corroborates the finding (Brown *et al.*, 2006) that tuberculosis is highest among people infected with HIV and that HIV infection is likely to be one of the factors responsible for the recent increase

Table 3: Risk ratios of coinfection among of HIV and *M. tuberculosis* infected persons coinfected with HIV and TB infectious agents

Coinfection	HIV+ve n = 85	TB+ve n =154
Yes	51.8% (44)	28.6% (44)
No	48.2% (41)	71.4% (110)
Relative risk of coinfection	1.075	0.401
Odds ratio	1.074/0.401 = 2.68	
Attributable risk	[(51.8-28.6)*100]/51.8 = 45%	

Table 4: Estimated risk ratios of tuberculosis among HIV-infected and HIV uninfected persons

Population	Risk of TB for cohort HIV(+ve/-ve)	Risk value
All	HIV+	1.07
(N = 344)	HIV-	0.739
	Odds Ratio	1.45
Males	HIV+	1.244
(N = 169)	HIV-	0.952
	Odds Ratio	1.308
Females	HIV+	1.403
(N = 175)	HIV-	0.857
	Odds Ratio	1.638

Table 5: Correlations of coinfection with some social habits

Variables	Coinfection	Eating	Sleeping	Income	Smoking	Alcoh	Occupn	TB	HIV
Coinfection	1.000								
Eating in groups	0.107*	1.000							
Sleeping in groups	-0.116*	-0.024	1.000						
Income per month	-0.019	-0.144**	-0.001	1.000					
Smoking	0.037	0.025	0.014	-0.018	1.000				
Alcohol consumption	0.028	-0.001	0.013	0.156**	0.073	1.000			
Occupation	-0.042	-0.131*	-0.081	0.754**	-0.093	0.060	1.000		
Tuberculosis	0.425**	0.282**	-0.243**	0.027	0.125*	0.039	0.021	1.000	
HIV infection	0.669**	0.016	-0.067	-0.001	-0.006	0.118*	-0.049	0.081	1.000

*Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

in tuberculosis. People with HIV/AIDS face a significantly higher risk of developing tuberculosis than HIV uninfected persons (Knox and Guglielmo, 2006) HIV weakens the immune system and predisposes those with latent TB infection and HIV to active TB disease.

The risk of being coinfected with TB was significantly higher in HIV positive females than in HIV positive males, unlike previous studies (Obiora *et al*., 2004; Yassin *et al*., 2004) that found no significant difference in the proportion of males and females coinfected with HIV and TB. Women are more likely to have lowered immunity probably because of the stress produced by their biological, economic and cultural roles as care-givers. For instance, women in their reproductive years are found to be at a higher risk of infectious diseases than their male counterparts (Daniel *et al*., 2005).

The HIV/TB coinfection was significantly and positively correlated with the social habit of eating in groups. Tuberculosis, being a respiratory infection, is spread from person to person through contaminated air, nasal or oral secretions. The *tubercle bacilli* are discharged into the air when a person with tuberculosis of the lungs or throat coughs or sneezes. Coinfection, however, seemed not to be affected by other socio-demographic factors such as age, occupation, monthly income, smoking and alcohol consumption.

Given the high rate of HIV/TB coinfection in the population studied, we advocate prompt and intensive tuberculosis intervention programs among HIV infected persons. The rate of HIV/TB coinfection could be reduced if proper hygienic habits and social practices are encouraged in the general population.

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