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### Epidemiology

## Comparative Study of HIV Associated Pulmonary Tuberculosis in Chest Clinics from Two Regions of Edo State, Nigeria

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### Abstract:

A comparative study of HIV associated pulmonary tuberculosis (HIV-PTB) was carried out in Chest Clinics situated in Benin and Irrua environs of Edo State, Nigeria, using microscopical and serological methods. In Irrua environs, HIV-PTB co-infection is higher in females (12.5%) than in males (9.2%) but not statistically significant ( $P > 0.05$ ). In Benin, HIV-PTB is also higher in females (11.3%) than in males (7.2%) but not statistically significant ( $P > 0.05$ ). In Benin, PTB is statistically high among  $\leq 20$  years and 21–30 years old subjects (50% and 28.7% respectively,  $P < 0.05$ ), while HIV is statistically high among age group 31–40 years and 41.50 years (23.5% and 27.9% respectively,  $P < 0.05$ ). HIV-PTB co-infection is also statistically high among drivers and traders (13.8% and 12.6% respectively,  $P < 0.05$ ) in Benin. Generally, there is no significant difference in the prevalence of HIV, PTB and HIV-PTB infection rate in the two regions when sex and occupation of the subjects are considered ( $P > 0.05$ ). However, subjects of  $\geq 60$  years old have a significantly

higher PTB disease in Benin than their counterpart in Irrua (28.6% and 0% respectively,  $P < 0.05$ ).

**Key words:** HIV, PTB, Edo State

### Introduction

The association between HIV and tuberculosis present an immediate and grave public health and socio-economic threat in developing countries.<sup>1</sup> Persons infected by tubercle bacilli have about a 10% chance of developing tuberculosis during the remainder of their lives: thus, they have a less than 0.5% chance of developing overt disease annually<sup>2</sup>, while 10% of persons infected by both TB and HIV develop tuberculosis disease annually.<sup>3</sup> The implication of HIV infection is that it activates dormant tuberculosis to rapid disease progression of tuberculosis and death.<sup>4</sup> In fact, tuberculosis is now the most common opportunistic infection in Africa patients who die from AIDS.<sup>5</sup> Reports show that active tuberculosis increases the

morbidity and fatality of HIV infected person and about one-third die of tuberculosis.<sup>3</sup>

Despite the fact that patients with HIV-related tuberculosis often respond to standard short course chemotherapy, those in Africa are almost 4 times as likely to die of tuberculosis than HIV-negative patients within 13 months of diagnosis, mostly in the first month of therapy.<sup>6</sup> Even if therapy induces a bacteriological cure, the life span of the patient is still shortened for reasons not yet known.<sup>2</sup> However, there is evidence that immune responses in tuberculosis and in other infection induce cytokines that enhance the replication of HIV and this drives the patient into full picture of AIDS.<sup>7</sup> There is also evidence that TNF- $\alpha$  and other immunological mediators released in tuberculosis lead to transactivation of the HIV provirus and its subsequent replication.<sup>8</sup> Furthermore, tuberculosis causes decrease in number of CD<sub>4</sub> T-lymphocyte<sup>9</sup>, which may synergies with that induced by HIV.

In 1992, WHO estimated that about 4 million people have been infected with both *M. tuberculosis* and HIV since the beginning of the pandemic, with 95% being in developing countries.<sup>10</sup> The largest increase in tuberculosis has occurred in locations and demographic groups with the highest HIV prevalence, which suggests that the epidemic of HIV is at least partially responsible for the increase of tuberculosis.<sup>11</sup>

## **Materials and Methods**

### *Sample Population And Selection*

Patients clinically suspected of having pulmonary tuberculosis (PTB) were used in this study; systematic sampling method<sup>12</sup> was used by selecting every third patient visiting the clinic for the first time. Finally, 102 patients (54 males and 48 females) from Irrua environs and 303 patients (153 males and 150 females) from Benin environs had their sputum and blood samples collected for analysis.

### *Sample Collection*

Three sputum specimens were collected from each subject. These were 'first spot' specimen, an early morning specimen and a 'second spot' specimen.<sup>10</sup> The selected subjects were given two dry, clean, universal containers each. They were instructed to produce sputum from a deep cough into one of the containers on the first day they visited the clinic (first spot specimen), and thereafter 2ml of venous blood was collected from each patient that same day into a clean, dry test tube. The subjects took the second universal container home and they were instructed to produce an early morning sputum from a deep cough (early morning specimen). On arrival to the laboratory with the early morning specimen, another sputum specimen (second spot specimen) was collected from each subject. The samples were taken to the laboratory for analysis.

### *Sample Analysis*

All the sputum specimens were analysed in a safety cabinet for the presence of acid fast bacilli (AFB) using the Ziehl-Neelsen method.<sup>13</sup>

The blood specimens were screened for the presence of HIV using WHO strategy-two of HIV antibody screening<sup>14</sup>, by using the latex aggregation method (Capillus HIV-1/ HIV-2) as described by Cambridge Diagnostic; and the indirect solid phase enzyme immunoassay (EIA) method (Immunocomb HIV-1 and HIV-2) as described by Organics.

### *Data Analysis*

The data generated was analyzed statistically, and the chi-square test was used to ascertain the influence of sex, age, occupation and environment on the prevalence of HIV, PTB, and HIV related tuberculosis.

## Results

Three reference centers used in this study are Irrua Specialist Hospital, Irrua; University of Benin Teaching Hospital, Benin and Central Hospital, Benin.

In Irrua, 102 subjects (54 males and 48 females) were examined, 13 (12.7%) were found to be infected with HIV; 16 (15.7%) had PTB, while 11 (10.8%) had HIV and PTB (HIV-PTB) and 62 (60.8%) were neither infected with HIV nor PTB (Non HIV/Non

PTB). HIV infection is higher in females 9 (18.8%) than males 4 (7.4%), difference not statistically significant ( $P > 0.05$ ). Similarly, HIV-PTB is also higher in females (6 patients, 12.5%) than males (5 patients, 9.2%) but not statistically significant ( $P > 0.05$ ). PTB is found to be higher in males (11 patients, 20.4%) than females (5 patients, 10.4%) but not statistically significant ( $P > 0.05$ ). (See Table 1)

**Table 1: Distribution of HIV and PTB by sex of subjects in Irrua**

Subjects	Number Examined	Number Positive			
		HIV alone (%)	PTB alone (%)	HIV-PTB (%)	Non HIV/Non PTB
Male	54	4 (7.4)	11 (20.4)	5 (9.2)	34 (63.0)
Female	48	9 (18.8)	5 (10.4)	6 (12.5)	28 (58.3)
Total	102	13 (12.7)	16 (15.7)	11 (10.8)	62 (60.8)

**Key:** HIV: Human Immunodeficiency Virus; PTB: Pulmonary tuberculosis; HIV-PTB: HIV related pulmonary tuberculosis

In Benin City and its environs, 303 subjects (153 males and 150 females) were examined, 55 (18.2%) had HIV, 72 (23.8%) had PTB, 28 (9.2%) had HIV-PTB, while 148 (48.8%) had neither HIV nor PTB. HIV in females (35 patients, 23.3%) is statistically higher than in males (20 patients, 13.1%) ( $P < 0.05$ ). Although, HIV-PTB co-infection in females (17 patients, 11.3%) is also higher than males (11 patients, 7.2%), and PTB is higher in males (43 patients, 28.1%) than females (29 patients, 19.3%), they are not statistically significant ( $P > 0.05$ ). (See Table 2)

**Table 2: Distribution of HIV and PTB by sex of subjects in Benin City**

Subjects	Number examined	Number Positive			
		HIV alone (%)	PTB alone (%)	HIV-PTB (%)	Non HIV/Non PTB (%)
Male	153	20 (13.1)	43 (28.1)	11 (7.2)	79 (51.6)
Female	150	35 (23.2)	29 (19.3)	17 (11.3)	69 (46)
Total	303	55 (18.2)	72 (23.8)	28 (9.2)	148 (48.8)

In Irrua, HIV infection is relatively higher among subjects of age groups 30–40 years (22.5%) and 41– 50 years (14.3%) but the difference not statistically significant ( $P > 0.05$ , Table 3). PTB is however statistically higher in subjects of age group 21–30 years (40%,  $P < 0.05$ , Table 3). Although HIV-PTB co-infection among the various age groups range between 0% to 19%, their differences are not statistically significant ( $P > 0.05$ , Table 3).

**Table 3: Distribution of HIV and PTB by age groups of subjects in Irrua**

Age range (yrs)	n	Number (%) of patients positive											
		HIV alone (%)			PTB alone (%)			HIV-PTB (%)			Non HIV/Non PTB (%)		
		M	F	T	M	F	T	M	F	T	M	F	T
≤20	2	0 (0)	0 (0)	0 (0)	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)	1 (50)
21-30	15	0 (0)	1 (6.7)	1 (6.7)	4 (26.7)	2 (13.3)	6 (40)	0 (0)	1 (6.7)	1 (6.7)	3 (20)	4 (26.7)	7 (46.7)
31-40	40	3 (7.5)	6 (15)	9 (22.5)	5 (12.5)	1 (2.5)	6 (15)	2 (5)	2 (5)	4 (10)	11 (27.5)	10 (25)	21 (52.5)
41-50	21	1 (4.8)	2 (9.5)	3 (14.3)	1 (4.8)	2 (9.5)	3 (14.3)	2 (9.5)	2 (9.5)	4 (19)	8 (38.1)	3 (14.3)	11 (52.3)
51-60	13	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (7.7)	1 (7.7)	6 (46.1)	6 (46.1)	12 (92.3)
>60	11	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (9.1)	0 (0)	1 (9.1)	6 (54.5)	4 (36.4)	10 (90.9)
Total	102	4(3.9)	9(8.8)	13(12.7)	11(10.8)	5(4.9)	16(15.7)	5(4.9)	6(5.9)	11(10.8)	34(33.3)	28(27.5)	62(60.8)

**Key:** n = number of subjects examined; M = males; F = Females; T = Total

Table 4 shows the distribution of HIV and PTB by the age groups of the subjects in Benin and its environs. HIV infection is statistically higher among age groups 31–40 years (25.3%) and 41–50 years (27.9%,  $P < 0.05$ ), while PTB is statistically higher among age groups  $\leq 20$  years (50%) and 21–30 years (28.7%,  $P < 0.05$ ). However, the distribution of HIV-PTB co-infection among the various age groups is not statistically significant ( $P > 0.05$ ).

**Table 4: Distribution of HIV and PTB by age groups of subjects in Benin City**

Age range (yrs)	n	Number (%) of patients positive											
		HIV alone (%)			PTB alone (%)			HIV-PTB (%)			Non HIV/Non PTB (%)		
		M	F	T	M	F	T	M	F	T	M	F	T
$\leq 20$	22	0 (0)	0 (0)	0 (0)	4 (18.2)	7 (31.8)	11 (50)	0 (0)	0 (0)	0 (0)	7 (31.8)	4 (31.8)	11 (50)
21-30	94	2 (2.1)	13 (13.8)	15 (16)	17 (18.1)	10 (10.6)	27 (28.7)	2 (2.1)	6 (6.4)	8 (8.5)	23 (24.5)	21 (22.3)	44 (46.8)
31-40	87	9 (10.3)	13 (14.9)	22 (25.3)	13 (14.9)	7 (8)	20 (23)	6 (6.9)	6 (6.9)	12 (13.8)	21 (24.1)	12 (13.8)	33 (37.9)
41-50	61	8 (13.1)	9 (14.8)	17 (27.9)	6 (9.8)	3 (4.9)	9 (14.8)	2 (3.3)	3 (4.9)	5 (8.2)	16 (26.2)	14 (23)	30 (49.2)
51-60	25	1 (4)	0 (0)	1 (4)	0 (0)	1 (4)	1 (4)	1 (4)	1 (4)	2 (8)	9 (36)	12 (49)	21 (84)
>60	14	0 (0)	0 (0)	0 (0)	3 (21.4)	1 (7.1)	4 (28.6)	0 (0)	1 (7.1)	1 (7.1)	3 (21.4)	6 (42.9)	9 (64.3)
Total	303	20 (6.6)	35 (11.6)	55 (18.2)	43 (14.2)	29 (9.6)	72 (23.8)	11 (3.6)	17 (5.6)	28 (9.2)	79 (26.1)	69 (22.8)	148 (48.8)

Table 5 shows the distribution of HIV and PTB among the subjects according to their occupation. In Irrua (Table 5), HIV infection is more in drivers (22.2%) and traders (20.4%), PTB is more in drivers (22.2%) and students (40%), while HIV-PTB co-infection is more among drivers (22.2%). However these differences in the infection rate among the various occupations are not statistically significant ( $P > 0.05$ ).

**Table 5: Distribution of HIV and PTB by occupation of subjects in Irrua.**

Occupation	n	Number (%) of patients positive											
		HIV alone (%)			PTB alone (%)			HIV-PTB (%)			Non HIV/Non PTB (%)		
		M	F	T	M	F	T	M	F	T	M	F	T
CS	9	0 (0)	0 (0)	0 (0)	1 (11.1)	0 (0)	1 (11.1)	0 (0)	0 (0)	0 (0)	5 (55.6)	3 (33.3)	8 (88.9)
DR	9	2 (22.2)	0 (0)	2 (22.2)	2 (22.2)	0 (0)	2 (22.2)	2 (22.2)	0 (0)	2 (22.2)	3 (33.3)	0 (0)	3 (33.3)
FM	20	0 (0)	0 (0)	0 (0)	2 (10)	0 (0)	2 (10)	1 (5)	0 (0)	1 (5)	17 (85)	0 (0)	17 (85)
ST	15	0 (0)	1 (6.7)	1 (6.7)	5 (33.3)	1 (6.7)	6 (40)	1 (6.7)	0 (0)	1 (6.7)	3 (20)	4 (26.7)	7 (46.7)
TR	49	2 (4.1)	8 (16.3)	10 (20.4)	1 (2)	4 (8.2)	5 (10.2)	1 (2)	6 (12.2)	7 (14.3)	6 (12.2)	21 (42.9)	27 (55.1)
Total	102	4 (3.9)	9 (8.8)	13 (12.7)	11 (10.8)	5 (4.9)	16 (15.7)	5 (4.9)	6 (5.9)	11 (10.8)	34 (33.3)	28 (27.5)	62 (60.8)

**Key:** n = number of subjects examined; M = males; F = Females; T = Total; CS = Civil servants; DR = Drivers; FM = Farmers; ST = students; TR = Traders

Table 6 shows the distribution of HIV and PTB among the subjects by their occupation in Benin City and its environs. Drivers and traders (13.8% and 12.6% respectively) show a significantly high rate of HIV-PTB co-infection ( $P < 0.05$ ), whereas there is no significant difference in the infection rate of HIV and PTB among the various occupations ( $P > 0.05$ ).

**Table 6: Distribution of HIV and PTB by occupation of subjects in Benin City**

Occupation	n	Number (%) of patients positive											
		HIV alone (%)			PTB alone (%)			HIV-PTB (%)			Non HIV/Non PTB (%)		
		M	F	T	M	F	T	M	F	T	M	F	T
CS	15	2 (13.3)	0 (0)	2 (13.3)	5 (33.3)	0 (0)	5 (33.3)	1 (6.7)	0 (0)	1 (6.7)	5 (33.3)	2 (13.3)	7 (46.7)
DR	29	4 (13.8)	0 (0)	4 (13.8)	10 (34.5)	0 (0)	10 (34.5)	4 (13.8)	0 (0)	4 (13.8)	11 (37.9)	0 (0)	11 (37.9)
FM	12	2 (16.7)	0 (0)	2 (16.7)	4 (33.3)	0 (0)	4 (33.3)	0 (0)	0 (0)	0 (0)	6 (50)	0 (0)	6 (50)
ST	73	1 (1.4)	7 (9.6)	8 (11)	12 (16.4)	9 (12.8)	21 (28.8)	1 (1.4)	0 (0)	1 (1.4)	22 (30.1)	21 (28.2)	43 (58.9)
TR	174	11 (6.3)	28 (16.1)	39 (22.4)	12 (6.9)	20 (11.5)	32 (18.4)	5 (2.9)	17 (9.8)	22 (12.6)	35 (20.1)	46 (26.4)	81 (46.6)
Total	303	20 (6.6)	35 (11.6)	55 (18.2)	43 (14.2)	29 (9.6)	72 (23.8)	11 (3.6)	17 (5.6)	28 (9.2)	79 (26.1)	69 (22.8)	148 (48.8)

**Key:** As in Table 5

In comparing the incidence of HIV and PTB in Benin and its environs with Irrua and its environs, there is no significant difference between the two regions when the sex of the subjects are considered ( $P > 0.05$ ). Whereas, subjects aged 60 years and above have significantly high level of PTB in Benin (28.6%) than their counterparts in Irrua (0%,  $P < 0.05$ ), there is however no significant difference in the incidence of HIV and PTB by occupation of subjects from the two regions ( $P > 0.05$ ).

### Discussion

This study revealed HIV infection rate of 18.2% and 12.7% for Benin and Irrua environs respectively, while the male to female ratio of the HIV infection were 1 to 1.8 and 1 to 2.5 respectively. Report from some places in Nigeria show HIV prevalence rate to be over 10%,<sup>15</sup> while studies in Uganda and Zaire showed that HIV in women outnumbered that of men by 1.2.<sup>16</sup> The differences in the infection rate in females and males could be as a result of biological factors such as higher susceptibility to infection and behavioural factors such as early exposure to sexual activity that is common to women due to economic circumstances. Another reason could be as a result of various customs in African countries, women are subordinated to their husbands and as such do not have much say in issues related to sexual relationship.

HIV-PTB infection rate recorded in Irrua (10.8%) and Benin (9.2%) is in agreement with reports by Idigbe *et al.*,<sup>17</sup> Onipede *et al.*,<sup>18</sup> and Okogun *et al.*<sup>19</sup> Idigbe *et al.*,<sup>17</sup> reported HIV-PTB co-infection rate of 5.2% from Lagos State, while Onipede *et al.*,<sup>18</sup> reported 12.9% from Ile-Ife, Ogun State. Okogun *et al.*,<sup>19</sup> also reported a prevalence rate of 5.3% from Abeokuta and environs in Ogun State.

The HIV-PTB co-infection in this study is however low when compared with reports from other parts of the globe. Studies among TB patients in New York City, Miami, San Francisco and Seattle show HIV prevalence

of 30–50%.<sup>21,20,22</sup> The lower rate of HIV-PTB recorded in this study may be due to sampling method. The American investigators based their studies on known PTB patients, most of whom might be homosexual and intravenous drug abusers, and are thus more likely to be HIV positive.

The higher co-existence of HIV-PTB recorded among females from the two regions is probably related to higher incidence of HIV infection that predisposed the females to tuberculosis. HIV has been recognized to play an important role in the activation of dormant tuberculosis.<sup>23</sup>

The significantly high HIV-PTB co-infection among drivers (13.8%) and traders (12.6%) in Benin environs, and its higher rate among drivers in Irrua (22.2%) suggests a higher exposure of HIV and infective droplets among these people who often travel to different places.

The significantly high PTB infection among age-group  $\leq 20$  years old in Benin (50%) and 21–30 years in Benin and Irrua (28.7% and 40% respectively) could be as a result of increase in exposure to infection droplets when these people go out for daily activities. It has been reported that majority of TB cases occurred between the ages of 15–59 years.<sup>10</sup>

Although, this study was carried out in the chest clinics from two regions of Edo States (Benin environs and Irrua environs), it should be noted that there is no significant difference in the incidence of HIV, PTB and HIV-PTB in the two regions. Whereas, the significantly high incidence of PTB recorded among people above 60 years in Benin region could be as a result of higher population (urban region), which inadvertently increases the number of infective droplets in the atmosphere.

### Recommendations

The co-existence of HIV and tuberculosis has been seen as one of the most serious threats to human health<sup>24</sup> because HIV positive person already infected by *M.*

*tuberculosis* has an 8% chance of developing overt disease within a year or up to 50% chance during the remainder of their relative short life span.<sup>25</sup> The future impact of HIV infection on tuberculosis worldwide will depend on changes in the annual tuberculosis infection rate, the prevalence of infection by the tubercle bacillus in the at-risk age group and the prevalence of HIV infection.<sup>2</sup> Since increase in HIV infection rate leads to increase in tuberculosis disease, there is need to re-examine the strategies for their effective control. The most important aspect of this control programme is public awareness and good health education on how tuberculosis and HIV are transmitted. The control of tuberculosis should involve measures which are aimed at identifying and controlling the sources of infection, preventing reactivation of tuberculosis in people at higher risk, treatment of diseased individuals and public enlightenment.

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