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# HIV infection among patients with pulmonary tuberculosis in Nigeria

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**Summary**

Respiratory problems like Pneumocystic carinni and Pulmonary tuberculosis (PTB) are among the common opportunistic infections in patients with HIV/AIDS. The risk of acquiring *Mycobacterium tuberculosis* in a community becomes greater with increase in the number of HIV positive persons with active tuberculosis. This study was carried out to determine the magnitude of HIV infection among PTB patients in different parts of Nigeria as part of the year 2000 national HIV surveillance programme. Blood samples were collected on blotting paper from a total of 2826 individuals attending TB clinics between 1st of September and 1st November, 2000. Samples were collected from patients with confirmed PTB from 12 states in the 6 geopolitical/health zone (2 states/zone) of Nigeria as part of high risk sentinel population groups. Samples were tested for the presence of HIV antibodies using commercial ELISA (Genescreen HIV-$^1/_2$, Sanofi Pasteur, Paris). All initially reactive samples were retested with a rapid EIA (Gene II, Sanofi Pasteur, Paris) according to the WHO recommendations (option II). HIV Prevalence in the states varied from 4.2% in Oyo to 35.1% in Benue States with a median prevalence of 17.0%. HIV Prevalence increased with age to a peak of 23.9% among PTB patients 30-39years and then declined progressively to 12.8% among those 60 years and above. A relatively high HIV infection rate (13.8%) was found among the young adolescent age group 10-19 years. There was no significant difference in the rate among male and female PTB patients tested. Comparison with results of previous HIV sero-surveys shows a steady increase in HIV prevalence among PTB patients over the years. The high prevalence of HIV among young PTB patients aged 10-19 years in this study is worrisome and must be noted for intervention. .

**Keywords:** *HIV, tuberculosis, pulmonary, patients, surveillance, Nigeria*

**Résumé**

Les problémes respiratoires comme la carinne pneumocystique et la tuberculose pulmonaire(TP) sont parmi les infections opportunistes commun chez les patients ayant le VIH/SIDA.Le risque d'acquérir le mycobactérum tuberculeux dans une communauté est devenu trés élevé avec l'augmentation du nombre de séropositif ayant une tuberculose active. Cette étude avait pour but de déterminer la magnitude del'infection du VIH parmi les patients TP dans 12 états de 6 zones géopolitque(2 états par zone) du Nigéria, durant le programme de surveillance du VIH.Les échantillons ont été collectés chez 2826 individus en clinique confirmer TP positive entre le 1iére Septembre au 1iére Novembre 2000. Les échantillons étaient testés en presence des anticorps du VIH utilisant l'ELISA commercial (géne screen HIV1/2,Sanofi Pasteur, Paris).Tous les échantillons positive étaient re-analysés avec l' EIA rapide basé sur les recommendations de l'OMS(Option II). Le taux du VIH variait entre 4.2% a Oyo a 35.1% a Bénue dans l'état du Delta avec un taux médian de 17.0%. La prevalence augmentait avec l'age avec le peak a 23.9% des TP entre 30-39 ans et décrut progressivement a 12.8% parmi ceux de plus de 60ans. Le taux relatif d'infection du VIH (13.8%) était parmi les adolescents entre 10-19 ans. Il n'y avait pas de difference signicative entre les taux parmi les hommes et les femmes ayant la tuberculose pulmonaire(TP) examinés.La comparaaison avec d'autres résulats démontrait une augmentation progréssive avec le temps. Le taux élevé des tuberculeux pulmonaire aux 10-19 ans est inquiétant et nécessite une attention particuliére.

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## Introduction

HIV/AIDS is now well known not only as a global health crisis but also a developmental crisis in many countries. Recent reports have shown that it is fast becoming a security problem in some countries especially in sub-Saharan Africa with the highest HIV/AIDS burden in the world [1]. According to UNAIDS, 42 million people were living with HIV/AIDS as at the end of 2002 [2] and 75% of them are in Sub-saharan Africa.

The rate of new infection with HIV/AIDS is determined by the current phase of the epidemic in a country [1]. In Nigeria, the results of the 2001 sentinel surveillance showed a median rate of 5.8% among the general population signifying that the infection has reached its epidemic phase in the country [3]. An increase in prevalence has been reported among different population groups since 1986 when the first case of AIDS was reported in Nigeria [4, 5, 6].

The later phase of HIV infection is characterized by re-occurrence of opportunistic infections of different viral, bacterial, fungal and parasitic pathogens [7]. Among opportunistic infections in patients with HIV/AIDS, the

most frequent are respiratory tract infections such as Pneumocystic carinni and pulmonary tuberculosis [7, 8]. Early and correct diagnosis of these infections have markedly improved the prognosis of HIV patients [9].

The relationship between HIV and PTB has been well established in many countries including Nigeria [10, 11, 12, 13]. As HIV weakens people's immune system, it makes them more vulnerable to developing active tuberculosis [8, 12, 14]. Thus, PTB has become a common cause of death among people with HIV infection [13]. In addition, the risk of acquiring PTB in a community becomes greater with increase in number of HIV positive people developing active tuberculosis.

In this report we present the results of the year 2000 HIV sentinel surveillance among PTB patients in Nigeria.

## Materials and methods

*Study population*

Individuals recruited for this study included patients with active PTB from 12 states in the 6 health zones of the country (Fig 1). Samples from all the sites were collected simultaneously within 8 weeks (1st of September to 1st of November 2000) as part of the national HIV surveillance programme. Demographic information including age, sex and marital status of the subjects were obtained during sample collection. The study protocol was approved by the Federal Ministry of Health, Abuja, Nigeria.

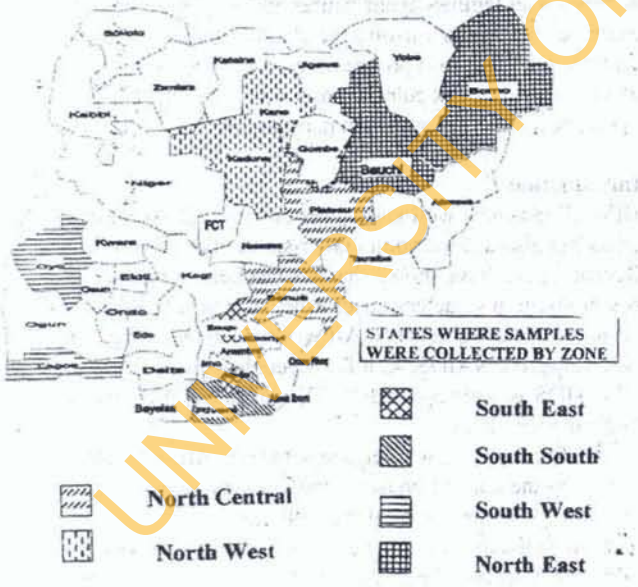


**Fig. 1:** Map of Nigeria showing the 12 States where blood samples were collected for the study

*Sample collection and Processing*

Blood sample was collected from each subject directly onto filter paper by finger prick method. The filter paper was coded, allowed to dry at room temperature and stored at –20°C for transportation to the Department of Virology, University College Hospital, Ibadan for central HIV testing. A total of 2826 samples were collected for the study.

Elution of blood from the filter paper was done by addition of 300ul of PBS into a sterile tube containing two filter paper conffeties (about 1cm in diameter) and vortexing. The filter paper discs were left in the buffer over-night to ensure complete elution before commencement of the assay.

*Serology*

Blood elute from each sample was tested for the presence of HIV antibodies using Genescreen HIV-1/2 (Sanofi, Pasteur) plate ELISA. Initially reactive samples were further tested with Genie II HIV-1/HIV-2 (Sanofi Pasteur), which is a dual rapid EIA with ability to detect and differentiate specific antibodies to HIV-1 and HIV-2. Both assays were carried out as recommended by the manufacturer.

*Data Analysis*

Demographic and laboratory data of the subjects were analyzed using the EPIINFO software. Chi-square test was used to compare the differences.

## Results

*Demography*

The overall age pattern of the patients (Table 1) shows that the age of highest occurrence of PTB in Nigeria was 20 – 29years (37.2%) while the age of lowest occurrence was among individuals in age range < 10yrs (0.9%). This pattern was observed in all the zones and states with the exception of Borno, which had the highest age of occurrence of PTB among persons aged 30 – 39years (33.9%) where the age group was also found to be closely followed with a high occurrence of 28% among patients 20 – 29years. A progressive increase in the occurrence of PTB was observed with age to a peak of 37.2% in patients 20-29years and then declined to the lowest rate of 1.3% among individuals above 70 years of age.

The gender distribution of PTB patients enrolled for this survey shows that more male (63%) than female (37%) subjects presented with PTB in all the zones and states with the exception of Lagos that had equal rate (**Table 2**). Furthermore, in both Kano and Kaduna states in the North West and Bauchi in the North East, there were at least twice as many males as female patients with PTB in the study site during the period of this survey. More married (59.3%) than unmarried (40.7%) PTB patients were enrolled for the survey.

*HIV among PTB Patients*

HIV prevalence among PTB patients in the states varied from 4.2% in Oyo to 35.1% in Benue states (Fig. 2), with a median prevalence of 17.0%. The highest prevalence of HIV infection was found in the North Central zone (32.7%), followed by 24.4% in the North East, while the lowest prevalence was found in the South West (11.8%). On the other

**Table 1**: Age distribution of pulmonary tuberculosis patients tested for HIV infection in Nigeria

| Zones | States | 0 - 9 | 10 - 19 | 20 -29 | 30 - 39 | 40 - 49 | 50 - 59 | 60 - 69 | >70 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| South East | Abia (ab) | 1(0.4%) | 20(7.1%) | 125(44.5%) | 53(18.9%) | 32(11.4%) | 26(9.3%) | 17(6.0%) | 7(2.5%) | 281 |
| | Enugu (en) | 0 | 16(8.8%) | 48(26.5%) | 47(26%) | 29(16.7%) | 25(13.8%) | 14(7.7%) | 2(1.1%) | 181 |
| Sub-total South | | 1(0.2%) | 36(7.8%) | 173(37.4%) | 100(21.6%) | 61(13.2%) | 51(11.0%) | 31(6.7%) | 9(1.9%) | 462 |
| South | Akwa Ibom(ak) | 0 | 41(18.0%) | 92(40.4%) | 46(20.2%) | 28(12.3%) | 15(6.6%) | 5(2.2%) | 1(0.4%) | 228 |
| | Rivers (rv) | 0 | 39(16%) | 93(38.1%) | 64(26.2%) | 31(12.7%) | 8(3.3%) | 6(2.5%) | 3(1.2%) | 244 |
| Sub-total South | | 0 | 80(16.9%) | 185(39.2%) | 110(23.3%) | 59(12.5%) | 23(4.9%) | 11(2.3%) | 4(0.8%) | 472 |
| West | Lagos (la) | 11(3.7%) | 31(10.3%) | 113(37.7%) | 75(25.0%) | 30(10.0%) | 20(6.7%) | 15(5.0%) | 5(1.6%) | 300 |
| | Oyo (oy) | 0 | 23(8.9%) | 105(40.5%) | 66(25.5%) | 38(14.7%) | 13(5.0%) | 13(5.0%) | 1(0.4%) | 259 |
| Sub-total North | | 11(0.2%) | 54(9.7%) | 218(39.0%) | 141(25.2%) | 68(12.2%) | 33(5.9%) | 28(5.0%) | 6(1.2%) | 559 |
| East | Borno (bo) | 2(1.7%) | 12(10.2%) | 33(28.0%) | 40(33.9%) | 19(16.1%) | 9(7.6%) | 2(1.7%) | 1(0.8%) | 118 |
| | Bauchi (ba) | 2(0.8%) | 26(10.4%) | 91(36.3%) | 63(25.1%) | 36(14.3%) | 13(5.2%) | 13(5.2%) | 7(2.8%) | 251 |
| Sub-total North | | 4(1.2%) | 38(10.3%) | 124(33.6%) | 103(27.9%) | 55(14.9%) | 22(6.0%) | 15(4.1%) | 8(2.1%) | 369 |
| Central | Benue (bn) | 0 | 18(7.5%) | 79(33.1%) | 70(29.3%) | 41(17.2%) | 23(9.6%) | 6(2.5%) | 2(0.8%) | 239 |
| | Plateau(pl) | 2(0.8%) | 18(7.3%) | 93(38.0%) | 58(23.7%) | 42(16.7%) | 21(8.6%) | 9(3.7%) | 3(1.2%) | 246 |
| Sub-total North | | 2(0.4%) | 36(7.4%) | 172(35.5%) | 128(26.4%) | 83(16.9%) | 44(9.1%) | 15(3.1%) | 5(1.0%) | 484 |
| West | Kano (kn) | 3(1.5%) | 28(14.4%) | 64(33.0%) | 52(26.8%) | 32(16.5%) | 9(4.6%) | 3(1.5%) | 3(1.5%) | 194 |
| | Kaduna(kd) | 4(1.9%) | 16(7.6%) | 86(40.8%) | 55(26.1%) | 39(18.5%) | 8(3.8%) | 2(0.9%) | 1(0.5%) | 211 |
| Sub-total | | 7(1.7%) | 44(10.9%) | 150(37.0%) | 107(26.4%) | 71(17.5%) | 17(4.2%) | 5(1.2%) | 4(1.0%) | 405 |
| Total | | 25(0.9%) | 288(10.5%) | 1022(37.2%) | 689(25.0%) | 397(14.4%) | 190(6.9%) | 105(3.8%) | 36(1.3%) | 2752 |

**Table 2:** Sex distribution of patients with pulmonary tuberculosis tested for HIV infection in Nigeria

| Zones | States | Number tested | Male | | Female | |
|---|---|---|---|---|---|---|
| | | | N | % | N | % |
| South East | Abia | 281 | 166 | 59.1 | 115 | 40.9 |
| | Enugu | 184 | 93 | 50.5 | 91 | 49.5 |
| sub-total | | 465 | 259 | 55.7 | 206 | 44.3 |
| South South | Akwa Ibom | 228 | 121 | 53.1 | 107 | 46.9 |
| | Rivers | 250 | 140 | 56.0 | 110 | 44.0 |
| sub-total | | 478 | 261 | 54.6 | 217 | 45.4 |
| South West | Lagos | 300 | 150 | 50.0 | 150 | 50.0 |
| | Oyo | 259 | 137 | 52.9 | 122 | 47.1 |
| sub-total | | 559 | 287 | 51.3 | 272 | 48.7 |
| North East | Borno | 118 | 68 | 57.6 | 50 | 42.4 |
| | Bauchi | 251 | 173 | 68.9 | 78 | 31.1 |
| sub-total | | 369 | 241 | 65.3 | 128 | 34.7 |
| North Central | Benue | 239 | 136 | 56.9 | 103 | 43.1 |
| | Plateau | 247 | 146 | 59.0 | 101 | 40.8 |
| sub-total | | 486 | 282 | 58.0 | 204 | 41.9 |
| North west | Kano | 250 | 162 | 64.8 | 88 | 35.2 |
| | Kaduna | 219 | 141 | 64.4 | 78 | 35.6 |
| Sub-total | | 469 | 303 | 64.6 | 166 | 35.4 |
| Total | | 2826 | 1633 | 57.8 | 1193 | 42.2 |

hand, HIV prevalence among PTB patients in the two states within a zone was fairly similar (Fig 2). However, there were significant differences in the rate between the two states of Lagos (20.8%) and Oyo (4.2%) in the South West as well as Kano (12.4%) and Kaduna (31.3%) in the North West zone.

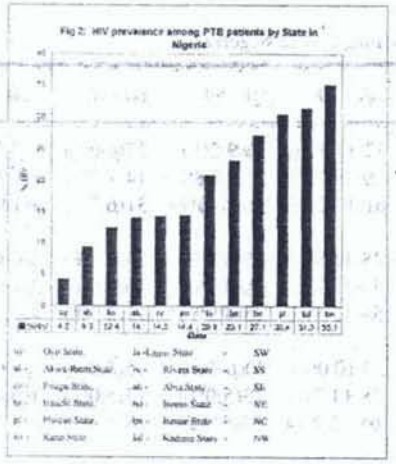

Fig. 2:

In addition, the results show a progressive increase in the prevalence of HIV infection from 13.8% among individuals 10 – 19 years old, 18.0% in those 20-29years to a high prevalence of 23.9% among PTB patients 30 – 39 years age group. Although still considerably high, the prevalence declined from 21.9% among patients 40-49years to 12.8% among those 60 years and above (**Fig 3**). While more males presented with PTB than females, results show a similar HIV prevalence between the 2 groups ($P = 0.87$) (Table 3).

**Table 3:** HIV prevalence by gender among patients with pulmonary tuberculosis in Nigeria

| Gender | No Tested | No positive | % HIV | 95% C-I |
|---|---|---|---|---|
| Males | 1582 | 305 | 19.3 | 17.4-21.3 |
| Female | 1170 | 222 | 19.0 | 16.8-21.3 |
| Total | 2752 | 527 | 19.1 | |

*P value = 0.87*

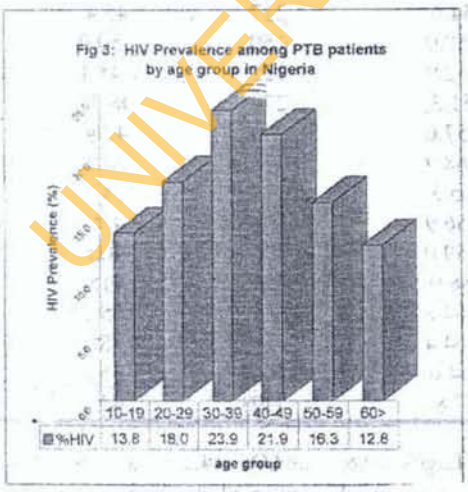


Fig. 3:

Analysis of the marital status of the subjects showed that 1592 of the PTB patients included in the survey were married while 1093 were unmarried. HIV infection rate was found to be significantly ($P<0.01$) higher among married (19.9%) than unmarried (17%) PTB patients in the country.

## Discussion

Although the samples collected and analyzed from PTB patients for this survey varied between sites and zones, the difference may only be a reflection of accessibility of this population group to health facilities than the true burden of PTB in the different locations. However, it was observed that 71% of the PTB patients recruited for this study were in the age range of 20-40 years with 37% in 20-29 years age group. This observation has a serious implication on the health of people in these age ranges. These population groups constitute the most productive sector of a nation, but now over burdened with PTB in Nigeria.

Although it cannot be ascertained from the results of this study why persons in the various age groups were more infected with PTB, it is most likely that exposure to PTB may be due to work related activities involving over crowding and close contact by this most active group of the population in the country. This explanation becomes more plausible by the fact that more male than female subjects presented with PTB in all the zones and States with the exception of Lagos. This is further supported by the observation of twice as many males than females with PTB in the northwest and northeast. On the other hand, the very high male to female ratio among PTB patients observed in some parts of the country may indicate difference in accessibility or utilization of health facilities by male and female population groups in these places [15, 16]. The finding of relatively high rate of PTB among the very young children, 0-9 years of age is disturbing. This is unusual and may indicate certain immunocompromising factors among this supposedly highly immuno-competent age group and/or greater exposure of young children to PTB in our society [8, 11].

It is well known that transmission of TB occurs by air-borne spread of infection droplets. The source of infection is a person with TB of the lung (pulmonary tuberculosis- PTB) who is coughing. Two factors determine an individual's risk of exposure; the concentration of droplet nuclei in contaminated air and the length of exposure. Infected person can develop PTB at any time. Various biological, physical and emotional stresses may trigger progression of infection to disease. The most important factors are those that weaken the immune system such as HIV infection.

The global problem of PTB has been worsened by HIV pandemic during the past two decades [17, 18, 19]. HIV infection renders a person infected with tuberculosis much more likely to develop overt PTB and evolution of

the disease is considerably accelerated. Presently about 8-10% of all cases of TB worldwide are related to HIV infection, but the association is stronger in many African countries, often 20% or more [11, 19, 20, 21].

The 1999 HIV prevalence among pregnant women (general population) aged 15-49 years in Nigeria showed range of 0.5-21% with a median prevalence of 5.4%. It showed that HIV infection has reached the epidemic phase in the country. The results of the present study show a range of 4.2%-35.1% with a median prevalence of 17% among PTB patient. Higher prevalence of HIV infection among PTB patients than the general population observed in the study is consistent with the reports from other parts of the world especially other Africa countries [18, 21, 22]. However, a comparison of the result of this study with those of previous ones shows a steady increase in HIV prevalence among PTB patients from 2.2% (1991/92), 7.9 (1993/94) to 13% (1995/96) and 17% (2000).

The observation of zonal differences in HIV prevalence among PTB patients in the country conforms to the pattern of HIV infection in the general population [3, 23]. For instance the north-central zone with the highest HIV prevalence in general population by 1999 survey also had the highest HIV infection rate among PTB patients in year 2000. Similarly the variations observed within zones are in agreement with the pattern in the general population [23]. This is exemplified by the difference between Lagos and Oyo in southwest with HIV prevalence of 20.8% and 4.2% respectively as well as Kaduna and Kano in Northwest with HIV prevalence of 31.3% and 12.4% respectively among PTB patients. This shows a correlation between HIV infection in the general population and development of PTB following exposure.

There was a progressive increase in the prevalence of HIV infection with age among PTB patients enrolled for this study peaking at 30-39 years (23.9%). The 1999 ANC sentinel study showed the highest HIV prevalence among individuals 20-29 years in the general population [23]. The difference in the age pattern of HIV infection in the general population and among PTB patients further shows the significance of HIV infection as the underlying factor to higher risk of development of PTB in Nigeria. This is consistent with findings from other TB endemic African countries with high prevalence of HIV infection [19, 21, 24]. It is however worrisome the observation of high occurrence of PTB and corresponding high prevalence of HIV infection among children under 5 years in this country. This may indicate a high incidence of mother to child transmission of HIV among infected pregnant women with subsequent exposure of their babies to TB.

The overall male to female ratio of 1:1 among PTB patients despite higher preponderance of male PTB patients is interesting but conforms with HIV infection pattern in the general population in Nigeria [23]. This shows that the major mode of transmission in the country is still by heterosexual means. The finding of a significantly higher ($P$=0.0001) prevalence of HIV infection among married than unmarried PTB patients tested for this study also supports previous reports [3, 5, 23, 25] of major heterosexual route of transmission of HIV in the country.

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