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## **Epidemiology of Pulmonary Tuberculosis in Some Parts of Abia State, Federal Republic of Nigeria**

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**Abstract:** The objectives of this study is to generate epidemiological data on tuberculosis, detect risk factors and other epidemiological issues involved in its transmission in some parts of Abia State, Nigeria. Sputum samples were collected aseptically from patients in some Public hospitals in Abia State and transported to Microbiology Laboratory, Federal Medical Centre, Umuahia. Isolates were confirmed at Microbiology Laboratory, Abia State University from January 2005-December, 2006. Sputum samples were decontaminated by using N-Acetyl-L-Cystein/NaOH method and 1 mL of decontaminated sample was plated on Lowenstein-Jensen medium and incubated at 37°C for at least 14 weeks. Out of 998 sputum examined, *Mycobacterium tuberculosis* was isolated from 198 (16.83%). Males had higher prevalence of infection in each year of study than females. Infection rates remained higher in dry season than rainy season in both 2005 and 2006. Traders, public and civil servants, police officers, Timber workers, teachers, drivers, students and pupils are among the population at risk in Abia State. Out of 198 positive sputum samples, 95 (47.97%) were new cases in 2006. This calls for the attention of public health workers, governmental and non-governmental agencies for concerted efforts against the disease in this region.

**Key word:** Tuberculosis, public health, incidence, prevalence, Nigeria

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### **INTRODUCTION**

Tuberculosis has existed in humans since antiquity; it is believed to have originated with the first domestication of cattle (Madigan and Martinko, 2006). Evidence of tuberculosis occurred in human skeletal remains and mummies from as early as 4000BC (Balcells *et al.*, 2006) *Mycobacterium* infections, including tuberculosis (TB) and leprosy are bacterial diseases of global importance.

An estimated 2 billion people are infected with *Mycobacterium tuberculosis* (Stewart *et al.*, 2005). In United States, there is a decreasing trend of proportion of TB cases. However, another obstacle towards the eradication of the disease is emergence of multi-drug resistant strains *M. tuberculosis* (Onwuchekwa, 2004). Every year, the disease infects 8 million people.

The global incidence rate of TB per capita is growing by approximately 1.1% per year (Kipp *et al.*, 2008). Pulmonary tuberculosis refers to tuberculosis inside the lungs. This means that the pathogen remains in the lung for quite a period of time. However, it is important to note that the pulmonary tuberculosis could migrate and develop outside the lungs and affect virtually all the organs in the body (Noertjojo *et al.*, 2002).

Tuberculosis is the most important infectious cause of adult deaths and persons living with Acid Fast Bacilli (AFB) in their sputum are most infectious group in the community (Rose, 1979). In countries with high incidence of TB, risk for infection among children in contact with adult having

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TB is 30% to 50%, which is higher than the risk reported in industrialized countries (Almeida *et al.*, 2001). Morbidity and mortality associated with TB are greatest in developing nations. The highest prevalence and estimated risks of infection are found in South East Asia and Sub Saharan Africa (Leung, 1999).

In countries where standard of living is low and health resources are scarce, the prevalence of infection is high and 80% of cases involve persons in their productive age (15-59 years) (Leung, 1999). This research investigated the epidemiology of pulmonary tuberculosis in Abia State of Nigeria from 2005-2006. In India, Kolappan and Goppi (2005) reported 36% infection rate in a survey of 459 Tamil Nadu citizens.

The incidence of pulmonary and extra-pulmonary tuberculosis (EPTB) in North Carolina has increased from 13.50% of all reported cases in 1975 to 21.06% in 2006. This relative increase may be an underestimate due to recent changes in case definitions. In Africa, due to the low standard of living, famine and inadequate shelter with attendant overcrowding, the TB scourge has increased.

In Nigeria, Umo *et al.* (2005) reported 62.30% incidence of pulmonary tuberculosis in Ekpene Obom (Etinam), Akwa-Ibom, Nigeria. Similarly, a prevalence of 31% among Kano residents has been reported by Nwankwo *et al.* (2005).

In Aba, 32.5% prevalence rate of pulmonary tuberculosis caused by Acid Fast Bacillus among men and women between 15-59 years age bracket was reported by Chigbu and Iroegbu (2004). The specific aims and objectives of this prospective study were; to find out some epidemiological data including prevalence and Incidence rates, use such data to intensify awareness campaign against tuberculosis in the area.

## **MATERIALS AND METHODS**

Sampling was non-randomized as sputum samples were collected from all patients who visited the TB units of the public hospitals. The units are only for treatment of tuberculosis and not for any other airway infection.

Sputum samples after proper labeling were decontaminated by N-acetyl-L-Cystein/NaOH; the sediments were plated on freshly prepared Lowenstein-Jansen medium. Culture plates were incubated at 37°C for at least 14 weeks. Isolates occurring after incubation which were acid fast with alcohol, showed niacin accumulation characteristics and were nitrate negative were regarded as *Mycobacterium tuberculosis* as was recommended by Tang *et al.* (2006). Cases of tuberculosis were diagnosed from January 1, 2005 through December, 23 2006.

### **Ethical Considerations and Approvals**

Ethical approval for the study was received from the committees for biomedical researches in all the public hospitals samplings were done. Approvals followed strict adherence to the Helsinki Declaration (World Medical Association, 2000).

### **Statistical Analysis**

All statistical analysis were performed using the statistical package IPI-INFO, Version 6, produced by World Health Organization in collaboration with the Centre for Disease Control and Prevention.

## **RESULTS**

Between January 2005 and December 2006, 168 cases of pulmonary tuberculosis (TB) were reported to the public hospitals used in this study. Out of total number of 998 patients whose sputum was examined, 198 were found to be infected by *Mycobacterium tuberculosis*. This gives an infection rate of 16.83%.

Table 1: Incidence and sex distribution of pulmonary tuberculosis in some parts of Abia State, Nigeria

Local government area	Newly diagnosed (2005)	Newly diagnose (2006)	No. of new cases (2005)	No. of males (2006)	No. of males (2005)	No. of females (2005)	No. of females (2006)
Umuahia North	31(42.5)	53(55.80)	53	14(45.20)	34(64.20)	17(54.80)	19(55.90)
Umuahia South	18(24.7)	12(12.63)	12	13(72.22)	8(66.66)	5(27.78)	4(33.33)
Ikwuano	7(24.7)	15(15.79)	15	4(57.14)	9(60.9)	3(42.86)	6(40.00)
Umunneochi/Isukwato	3(4.11)	3(3.16)	3	-(0.0)	3(100.0)	3(100.0)	-(0.0)
Bende	6(8.22)	2(2.11)	2	5(83.33)	1(50.0)	1(16.67)	1(50.0)
Isiala Ngwa	3(4.11)	2(2.11)	2	2(66.70)	2(100.0)	1(16.67)	-(0.0)
Aba North	5(6.85)	4(4.21)	4	2(40.0)	4(100.0)	3(60.0)	-(0.0)
Aba South	-(0.0)	4(4.21)	4	-(0.0)	2(50.0)	-(0.0)	2(50.0)

Total No. of sampling in 2005 = 401 Total No. of AFB positive samples in 2005 = 73 Total No. of sampling in 2006 = 597. Total No. of AFB positive sample in 2006 = 95. Values in brackets are in percentages

Table 2: Proportion of tuberculosis in Abia regions with respect to the age group of patients (male and female)

Local government area	Children ≤ 17 years (2005-2006)	18-50 years (2005-2006)	≥ 50 years (2005-2006)
Umuahia North	4 (5.5) - (0)	24(32.9) 49 (51.60)	2(2.74) 4 (4.21)
Umuahia South	-(0) - (0)	16(21.9) 12 (12.6)	1(1.37) - (0)
Ikwuano	-(0) - (0)	5(6.85) 9 (9.47)	1(1.37) 6 (6.32)
Umunneochi/Isukwuato	-(0) - (0)	1(1.37) 3 (3.20)	1(1.37) - (0)
Bende/Arochukwu	-(0) - (0)	7(9.59) 2 (2.11)	-(0.0) - (0)
Isiala Ngwa	-(0) - (0)	3(4.11) 1 (1.110)	-(0.0) 1 (1.1)
Aba North	-(0) - (0)	7(9.59) 3 (3.20)	-(0.0) 1 (1.10)
Aba South	-(0) - (0)	-(0.00) 4 (4.21)	-(0.0) - (0)

Total No. of AFB positive samples in 2005, Initial = 73. Total No. of AFB positive samples in 2006, New cases = 95. Values in brackets are in percentages

Among the 168 confirmed cases of pulmonary TB, 103(61.31%) and 65 (38.69%) were male and female, respectively. The male-to- female ratio was 1.2:1 and 1.9:1 in 2005 and 2006, respectively (Table 1). Of the 168 confirmed cases of pulmonary TB, 84 (50%) were from Umuahia North, 30 (17.86%) were from Umuahia South, 22(13.10%) were from Ikwuano, 6 (3.51%) were from Isukwuato/Umunneochi, 8 (4.76%) were from Bende. 5 (2.97%) were from Isialangwa, 9 (5.36%) were from Aba North as 4 (2.38%) were from Aba South. Umuahia North had the highest frequency of infection of 50%.

There was a significant difference between the frequency of infection in 2005 and 2006. Out of 401 patients examined in 2005, 75 had pulmonary TB, giving a prevalence of 18.20%. Out of 597 patients examined in 2006, 95 had pulmonary TB, giving a prevalence rate of 15.91%. The prevalence of infection was higher in 2005 than in 2006 ( $p \geq 0.50$ ) (Table 1). Five percent of the participating population had pulmonary tuberculosis, all of which are inhabitants of Umuahia North.

In 2005, 63(86.31%) TB patients were males and females within the ages of 18 years through 50 years and 5(6.85%) TB patients were male and female greater or equal to 50 years of age (Table 2).

In 2006, there was no reported case of pulmonary tuberculosis among children in all the participating local government areas while adult males and females within the ages of 18-50 years had incidence rate of 87.37% . Patients greater or equal to 50 years of age had 12 (12.63%) incidence rates. The most affected age group in all cases is 18-50 years.

Two seasons that exist in Nigeria are the dry season and rainy season, which begin from October-March and April to September, respectively (Table 3). We found out that in 2005, out of 73 patients documented, 50(68.49%) occurred in the dry season as 23 (31.51%) occurred in the rainy season. In 2006, out of the 95 confirmed cases, 59 (62.11%) occurred in the dry season as 36 (37.89%) occurred in the rainy season.

Documentation from register shows that people in the following walks of life: trading, farming, public and civil service, teaching, armed forces, timber work, driving, students and pupils are infected. Out of 168 confirmed cases, 35(20.83%) were traders, 29(17.26%) were farmers, 20(11.90%) were

Table 3: Seasonal variation of pulmonary tuberculosis in some parts of Abia State, 2005-2006

Local government areas	No. of new cases in 2005			No. of new cases in 2006		
	DS	RS	p-value	DS	RS	p-value
Umuahia North	20(64.50)	11(35.50)	0.89	37(69.80)	16(30.20)	0.79
Umuahia South	12(66.60)	6(33.40)	0.51	5(41.70)	7(58.30)	0.43
Ikwuano	4(57.14)	3(42.86)	0.31	6(40.0)	9(60.0)	0.50
Umunneochi/Isukwuato	3(100.0)	-(00.0)	0.50	3(100.0)	-(00.0)	0.50
Bende/Arochukwu	4(66.60)	2(33.40)	0.49	2(100.0)	-(00.0)	0.48
Isiala Ngwa	3(100.0)	-(00.0)	0.50	1(50.0)	1(50.0)	0.00
Aba North	4(80.0)	1(20.0)	0.50	2(50.0)	2(50.0)	0.00
Aba South	-(00.0)	0(00.0)	0.00	3(80.0)	1(20.0)	0.41

DS = Dry season (October-March); RS = Rainy season (April-September). p-value $\geq$ 0.50 are significant. Total No. of cases in 2005 = 73. Total No. of new cases in 2006 = 95. Values in brackets are in percentages

Table 4: Proportion of pulmonary tuberculosis in some parts of Abia State in terms of occupation of patients from 2005-2006

Occupation in Abia	No. of patients (2005)	No. of patients (2006)	p-value	Total No. of TB patients (2005-2006)
Trading	16(21.92)	19(20.00)	0.55	35(20.83)
Farming	15(20.55)	14(14.74)	0.47	29(17.26)
Public and civil services	10(13.70)	10(10.53)	0.00	20(11.90)
Teaching	8(10.96)	14(14.74)	0.58	22(13.10)
Armed forces	5(6.85)	10(10.53)	0.51	15(8.92)
Students and pupil	4(5.50)	12(12.63)	0.57	16(16.84)
Timber workers	6(8.21)	5(5.26)	0.00	11(6.55)
Driving	9(12.33)	11(11.58)	0.50	20(11.90)

Total No. of cases in 2005 = 73; Total No. of new cases in 2006 = 95. Total No. of confirmed cases from 2005-2006 = 168. p-value $\geq$ 0.50 are significant. Values in brackets are in percentages

public and civil servants, 22(13.10%) were teachers, 15(8.92%) were police officers, 16(16.84%) were students and pupils, 11 (6.53%) were timber workers, 20 (11.90%) were drivers. Traders (20.83%) and farmers (17.26%) had the highest proportion from 2005-2006 (Table 4).

## DISCUSSION

From this study, out of 401 patient's studied in 2005, *Mycobacterium tuberculosis* was isolated from 73(18.20%). In 2006, out of 597 patients investigated, *Mycobacterium tuberculosis* was isolated from 95 (15.91%). The incidence rate in 2006 was less than the prevalence rate in 2005. This is not surprising as chemotherapy and awareness creation may have played big roles in the reduction of trend of infection.

Analysis showed that Umuahia North in 2005 and 2006 had the highest prevalence and incidence rates of 42.5 and 55.80%, respectively, as Umuahia South in 2005 and 2006 had prevalence rates of 24.7 and 12.63%, respectively. The higher prevalence of the disease in Umuahia North in each year of study could be as a result of the fact that most patients who visited the TB register are mainly residents of Umuahia North. The number of towns that make-up Umuahia North are higher than the number of towns that make-up Umuahia South. This had resultant increase in the number of participants from Umuahia North, when compared with other participating local government areas. Ikwuano, Umunneochi/Isukwuato Bende, Isiala Ngwa, Aba North, Aba South having very low prevalence and incidence rates because residents of these regions did not visit the register frequently. This could be as a result of poor awareness creation.

Residents of these regions have wrong notion that the disease is incurable, thus they do not visit nearby clinics for medical consultation. Some of them resort to natural or traditional therapy, which does not cure the disease, rather becomes a risk factor in the emergence of drug resistant strains of *M. tuberculosis*. These local herbs used in treating this disease in this region might be structurally

related to the first and second line drugs such as streptomycin, isonicotinic acid hydrazide (INH), rifampicin and quinolones. Incidentally, the herbs which have no pharmaceutical standardization in all respect will not knock-off all the strains of *Mycobacterium* organisms. This leads to selection of resistant strains. If the herbs are truly related to the antibiotics used against tuberculosis in terms of Chemistry, these selected strains will inhibit the antibiotics. This becomes a risk factor in the emergence of multi- drug resistant *Mycobacterium tuberculosis*.

Patients with a pulmonary tuberculosis relapse admitted that they did not strictly adhere to the prescriptions. This calls for urgent creation of awareness and strict implementation of the Directly Observed Therapy, Short course (DOTS) strategy, which is internationally recommended. The strategy is not strictly observed in some parts of Abia State because of poverty and resource limitation. This study is comparatively similar to a report on a survey of 6,102 in Netherlands, where 62% had pulmonary tuberculosis (Borgdoff *et al.*, 2001).

In addition, in the Italian Liguria, 38% cases of pulmonary tuberculosis was reported by Paolo *et al.* (2005). Similarly in Texas (USA), a 2.8% prevalence rate of pediatric tuberculosis was reported using traditional and molecular tools (Wootton *et al.*, 2005).

According to age distribution, this study is similar to that of Kolappan and Goppi (2002) which reported that in Tamil Nadu, India, men had prevalence rates 2-4 times higher than women. However, this study is dissimilar to that of Chigbu and Iroegbu (2004) which reported that Females (38%) had more infection than males (28%) in Eastern Nigeria. Among the 168 confirmed cases of pulmonary TB, 103(61.31%) and 65 (38.69%) were male and female, respectively. The male- to- female ratio was 1.2:1 and 1.9:1 in 2005 and 2006, respectively. This result is not surprising as the culture of Abia State demands that most out door activities be carried out by males than females. Such higher environmental exposures of males than females could account for these significant differences in sex prevalence. Most of the males in Abia State are involved in commercial driving, trading, farming, timber works, more than their female counterparts as such should have higher exposure than the female counterparts.

Patients within 18-50 years of age had the highest proportion of pulmonary TB. This is probably as a result of the fact that they are able bodied men and woman with higher exposure to the environment. It was reported in Kano, Nigeria that the highest prevalence rate of pulmonary tuberculosis occurred more among patients within 21-30 years of age (Nwankwo *et al.*, 2005).

In 2005, 4(5.5%) children in Umuahia North were found to have pulmonary TB. Parents of those children admitted that they were not vaccinated with any vaccine including BCG. This calls for more awareness Creation on the roles of immunization programs on child's diseases resistance, especially in the rural areas where resources are limited. There is an effect of seasonal variation on the prevalence of the disease in some parts of Abia State.

From this study, it was discovered in 2005 that the prevalence of pulmonary TB in the study area was significantly higher during the dry season than in the rainy season. Similarly, in 2006, all the participating local government areas had higher prevalence rates of the disease in dry season than the rainy season. This suggests that government may need to consider the upsurge of infection during dry seasons in their annual budgets.

In 2005 and 2006, traders had the highest prevalence rates of 21.72 and 20%, respectively amidst other professionals at risk. This is probably because of their contact with different group of buyers in different states of health and the Environment. In the general market, people living with tuberculosis are not restricted from buying and selling, and during the process the populations who are not immuned against the disease become infected.

Farmers were second to traders on the prevalence as they had prevalence rates of 20.55 and 14.74% in 2005 and 2006, respectively. This is not surprising, as farming is among the major occupation of the people under study. *Mycobacterium* organisms inhabit the soil layers as normal flora and during the process of soil tillage, the organism's escapes into the air and infect the farmers.

Chigbu and Iroegbu (2004), in Abia State-Nigeria, reported that the highest prevalence occurred among hairdressers and farmers. Other professions reported to have the risk of the infection include: teaching, timbering, driving, armed forces, students and pupils. Students/ pupils in 2005 and 2006 had prevalence rates of 5.5 and 12.65%, respectively. Most of these students admitted that they stay in small and poorly ventilated hostels with other students. Poor ventilation is a risk factor in the transmission of tuberculosis. Homes/hostels which are overcrowded and one individual who has the infection and lives in the overcrowded environments will circulate the infected air droplets to other students. This brings up the recommendation, that schools and colleges should engage students into routine microbiologic investigations to detect early stages of tuberculosis on campuses in Abia State.

Ubakala and Afaraukwu are villages in Umuahia, whose residents have the superstitious belief that tuberculosis is a hereditary disease and has no therapy. Tuberculosis in this region is erroneously regarded as a death sentence. There is need for concerted efforts of public health workers, to bring awareness campaigns in these regions.

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