

## Prevalence and Patterns of Multimorbidity of Tuberculosis, Human Immunodeficiency Virus and Diabetes Mellitus in Anambra State, Nigeria

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### Abstract

**Background/purpose:** The proportion of subjects with multiple medical conditions is increasing worldwide. Coexistence of tuberculosis (TB), human immunodeficiency virus (HIV) and diabetes mellitus (DM) in the same person was investigated.

**Materials and Methods:** A prospective survey was conducted among patients aged  $\geq 15$  years who presented at TB/directly observed treatment clinics of Nnamdi Azikiwe University Teaching Hospital, Nnewi, and St. Charles Borromeo Hospital, Onitsha. Diagnosis of pulmonary tuberculosis was based on National Tuberculosis Guidelines using Ziehl-Neelsen technique for acid fast bacilli in sputum. Fasting blood glucose concentration was performed using glucose oxidase method and diabetes diagnosed if fasting blood glucose concentration was  $\geq 126$  mg/dl. HIV sero-status was determined by a serial testing using three rapid test kits, including Determine, UniGold, and StatPak.

**Results:** A total of 1487 presumptive TB cases participated in the study. The concomitant occurrence of TB/HIV/DM in the same person was observed in 24 out of 1487 patients (1.6%). A higher prevalence (2.3%) was seen in males than females (1.1%) and in the age group of 25-34 years. Co-morbidity patterns revealed TB/HIV co-infection rate of 6.4% and TB/DM rate of 3.6%. In both cases, males and the age group of 25-34 years had a higher co-infection rate. HIV infection was the most common morbidity (52%) with infection higher in females.

**Conclusion:** The prevalence of multi-morbidity of TB/HIV/DM in Anambra State was 1.6%. Males and the age group of 25-34 years had higher morbidity. It is therefore important to integrate the management of TB/HIV/DM to improve early case detection and reduce their morbidities.

**Keywords:** Tuberculosis; Human immunodeficiency virus; Diabetes mellitus; Multi-morbidity

**Abbreviations:** MM-Multi: Morbidity; TB: Tuberculosis; PTB: Pulmonary Tuberculosis; HIV: Human Immunodeficiency Virus; DM: Diabetes Mellitus; AIDS: Acquired Immune Deficiency Syndrome; NAUTH: Nnamdi Azikiwe University Teaching Hospital; SCBH: St. Charles Borromeo Hospital.

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## **Introduction**

Multi-morbidity (MM) is defined as the co-existence of more than one chronic condition in the same person over a specific period [1-3]. Chronic conditions consist of non-communicable conditions, long term mental disorders, and ongoing physical/structural impairment, as well as persistent communicable conditions such as tuberculosis and human immunodeficiency virus infections [4].

Tuberculosis (TB), diabetes mellitus (DM) and human immunodeficiency virus infection (HIV) rank among the top ten causes of mortality all over the world [5]. Of the three, two are communicable diseases i.e TB and HIV, and diabetes is a chronic non-communicable condition. The association between communicable and non-communicable diseases has been recognized for centuries [6].

It has become clear that two of the most common infectious diseases in Africa, tuberculosis and HIV/AIDs may also be closely related to chronic communicable diseases [7]. Different studies have documented that diabetes predispose to tuberculosis and increase the risk of progression from latent tuberculosis infection to active tuberculosis [8-11]. Antiretroviral therapy for HIV infection, on the other hand may increase the risk of metabolic syndrome and thus predispose to Type 2 diabetes and cardiovascular [12-14]. The epidemic growth of diabetes occurs in the developing countries where tuberculosis is highly endemic [15].

Pulmonary tuberculosis remains the disease with the highest global mortality for a single infectious agent [16]. Nigeria is ranked high among the world's 22 high TB burdened countries. Nigeria is also estimated to have the highest number of people with diabetes mellitus (approximately 1, 218, 0000 people affected) while Reunion has the highest prevalence of diabetes in the African Region [17].

Against this background, the burden of HIV and TB remains high in Nigeria. HIV prevalence in Nigeria stands at 4.6% in the general population [18]. How then will overburdened public health services in resource-poor countries that have high rates of infection with HIV, poor tuberculosis control infrastructures and crowded living conditions cope as the overlap between those with communicable and non-communicable disease increase?

We therefore aimed to study the patterns and prevalence of tuberculosis, HIV, and diabetes multi-morbidity in Anambra state, Nigeria.

## **Materials and Methods**

This prospective study was carried out at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi and St. Charles Borromeo Hospital (SCBH), Onitsha, all in Anambra state, Nigeria. NAUTH is the largest tertiary hospital and referral centre in Anambra state. SCBH is a foremost missionary hospital with state-of-the-art facilities. In both hospitals, anti-tuberculosis and anti-retroviral medicines are provided free.

### **Subjects**

Individuals aged 15 years and older who were presumptive TB cases (had cough for  $\geq 2$  weeks) who either self presented to the TB/directory observed treatment clinic or referred from peripheral health centers for assessment were invited to participate and enrolled at the time of presentation to the clinic. A random sampling of the presumptive TB cases was adopted

### **Methods**

Diagnosis of smear positive pulmonary tuberculosis was based on the National TB Guidelines. Presumptive TB cases submitted two sputum specimens on the spot within 1 hour interval. Smears were stained using the Ziehl-Neelsen technique. In accordance with recent WHO policy change [19], all smears with one or more AFB/100 HPF were considered positive.

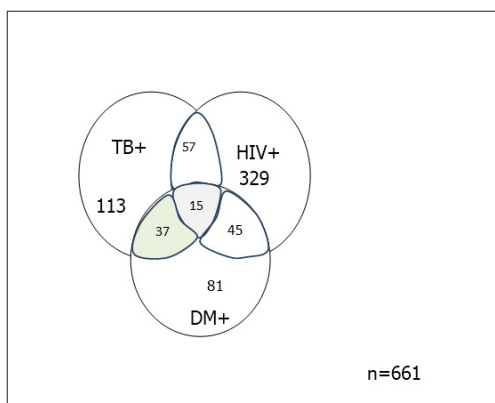
Fasting blood glucose (FBG) concentration was determined using the glucose oxidase method and diabetes confirmed if FBG concentration was  $\geq 126$  mg/dl [20].

The Nigerian National HIV testing algorithm recommended by the World Health Organization for resource- poor countries was used for HIV testing. It is a serial testing using 3 rapid test kits namely Determine (Inverness, Japan), UniGold (Trinity, Ireland) and StatPak (chemodiagnostic, Spain). Determine was used as the first screening test kit. This was followed by uniGold, to confirm a positive result while StatPak served as a tie breaker.

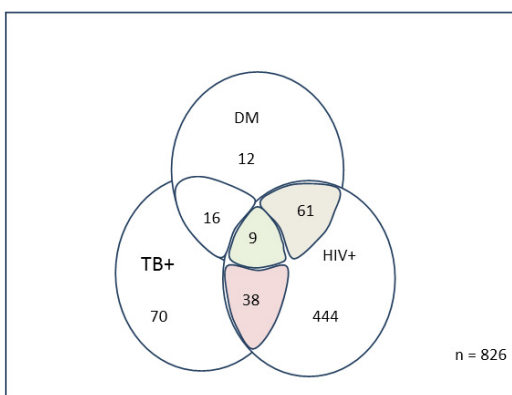
Ethical approval for the study was obtained from ethical committees of both hospitals. All patients consented to participate in the study.

**Results**

A total of 1487 presumptive TB cases participated in the study. The concomitant occurrence of TB/HIV/DM in the same individual revealed a prevalence of 1.6% (24/1487). Males were concomitantly more infected (2.3%) than females (1.1%) (Figure 1).

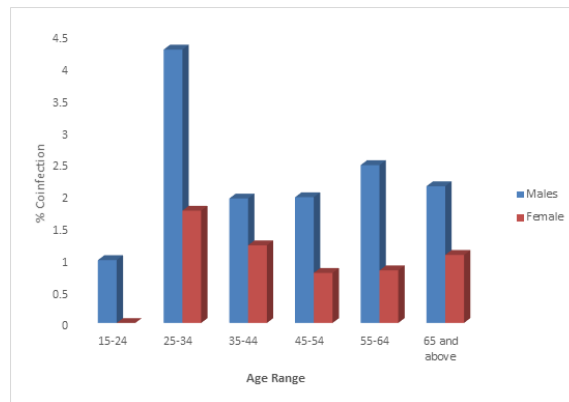


**Figure 1A:** Concomitant occurrence of TB/HIV/DM in the male subjects.



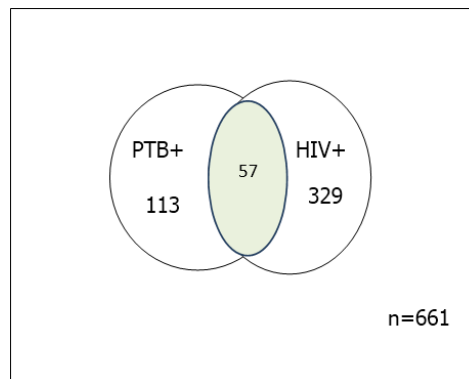
**Figure 1B:** Concomitant occurrence of TB/HIV/DM in the female subjects.

Figure 2 shows the age distribution of concomitant TB/HIV/DM patients. The age group of 25-34 years had a higher infection rate.

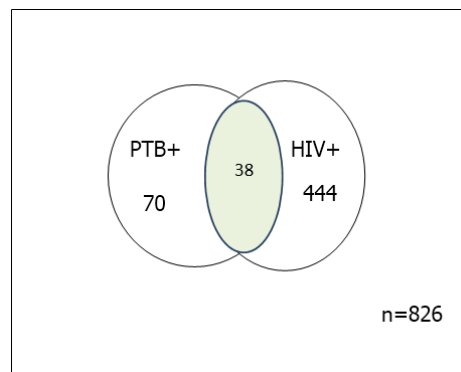


**Figure 2:** Age and gender distribution of the TB/HIV/DM patients.

The co- morbidity patterns shows a TB/HIV co- infection rate of 6.4%. TB/HIV co-infection was higher in males (8.6%) than in females (4.6%) (Figure 3).

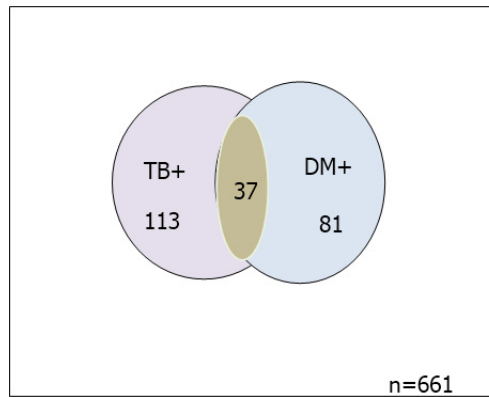


**Figure 3A:** Co-infection of HIV and PTB in male subjects of the study population.

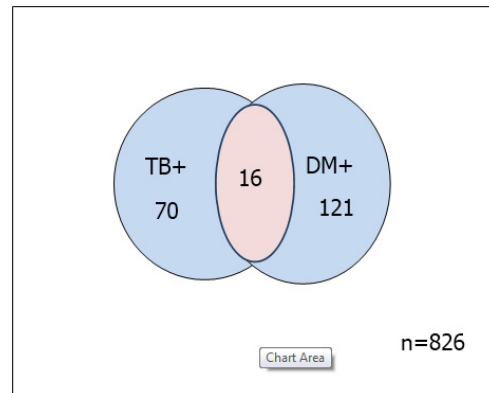


**Figure 3B:** Co-infection of HIV and PTB in female subjects of the study population.

TB/DM co-infection rate of 3.6% was observed in the study. Males 37(5.6%) were more infected than females 16(1.9%)( Figure 4).

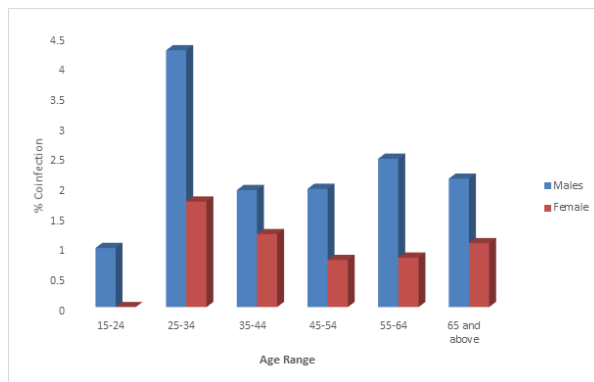


**Figure 4A:** Co-infection of DM and PTB among male subject.



**Figure 4B:** Co-infection of DM and PTB among female subjects.

The age group of 25-34 years was more coinfected while 15-24years had the least infection (Figure 5).



**Figure 5:** Age distribution DM/TB coinfected patients.

Among the 1487 patients, HIV infection was the most common morbidity (52%). Overall, the prevalence of tuberculosis, HIV and diabetes was higher in females (54.8%) than males (45.2%) as presented in table 1

Disease category	N = 1487 Males infected (%)	Females infected (%)	Total (%)
Pulmonary tuberculosis	113 (61.7)	70 (38.3)	183 (12.3)
Diabetes mellitus	81 (40.1)	121 (59.9)	202 (13.6)
HIV	329 (42.60)	444 (57.4)	773 (52.0)
Total	523 (45.2)	635 (54.8)	1158 (77.9)

**Table 1:** Prevalence TB, HIV and DM in the study population.

## Discussion

The concept of multi-morbidity is an issue of public health significance. In our study, the concomitance of TB/HIV/DM in the same individual was found in 24 of the 1487 patients, giving a prevalence of 1.6%. Similar studies in Brazil, South Africa and Abakaliki, Nigeria [21-23] had reported prevalence rates of 1.14%, 3.5% and 2.8% respectively. This highlights the importance of multi-morbidity.

Multi-morbidity result is in complex disease patterns that may have multiplicative and not merely additive consequences and health outcomes. This could diminish patient's ability to manage their conditions. Such consequences may include increase in mortality, decrease quality of life, complications of treatment and higher utilization of health care system [24].

Nigeria's poor health care systems may not cope with such burden. Multi-morbidity of TB/HIV/DM was more frequent in males and in the age group of 25-34 years. Gender and age has been associated with both tuberculosis and multi-morbidity [25] and other studies had reported that men develop tuberculosis more often [26-27]. The study areas, Nnewi and Onitsha are populated by male traders and trading in these areas are often conducted in overcrowded environments which could aid tuberculosis transmission and multi-morbidity. Its prevalence in young people of 25-34 years could have serious economic /health implications as this subset is Nigeria's predominant population group [28] and the most productive age range of any society [29]. Labor force in the country may be adversely affected and various sectors of the economy will suffer.

Tuberculosis has well been documented as the most important opportunistic infection among HIV-infected patients [30]. In this study, TB/HIV co-infection rate of 6.4% was observed. This is in line with some previous TB/HIV co-infection rates in Nigeria: 5.9% in the Niger Delta [31], 6.3% in Onitsha [32], but lower than 18.4% observed in Lagos [33] and 19% in Durban [34]. The high prevalence rates suggest strong association between tuberculosis and HIV infection in the study areas. The higher TB/HIV in males could be as a result of attitude of men towards indiscriminate sex.

Diabetes and tuberculosis (DM/TB), two diseases of immense public health significance has been linked together [35]. We found a DM/TB prevalence of 3.6% with a higher infection in the age group of 25-34 years. A similar but higher prevalence of 5.3% was earlier reported in Abakaliki, Nigeria. Previous literature supports that diabetes is an important risk factor for the development of pulmonary tuberculosis [6,8]. A possible mechanism of the association of the diabetes and tuberculosis is the depression of the immune response from protective immune system which in turn facilitates the progression of latently infected Mycobacterium tuberculosis to active tuberculosis [36].

Human immunodeficiency virus infection was the most common morbidity (52%) in this study. This was an expected result as there is a high prevalence of HIV/AIDS in the country. Nigeria also accounts for 10% of global HIV infection [17]. Females had higher HIV infection than males. It has earlier been reported [37,38] that HIV prevalence was three times higher in females than males. The cultural

norms in the study areas where women are expected to meet male sexual needs, poverty and prostitution might account for higher HIV infection in women.

## Conclusion

The multi-morbidity of TB/HIV/DM revealed a prevalence of 1.6% in Anambra State. Multi-morbidity was more frequent in males and age group of 25-34 year old. It is therefore imperative that healthcare systems in Nigeria should integrate TB/HIV/DM control programmes to improve early case detection and reduce their morbidities.

## Conflict of interest

We have no conflict of interest to declare

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