**Prevalence of Tuberculosis ~~Infection~~ among Inmates of Makurdi and Gboko Prisons, Benue State, Nigeria.**

**ABSTRACT**

Prison inmates are often tagged “the forgotten ones” and are among the populations with high risk for dangerous and contagious diseases. This study was carried out to determine the prevalence of pulmonary tuberculosis infection among Nigerian Correctional Service, Maximum Security Custodial Center, and minimum custodial center in Makurdi and Gboko, Nigeria., ~~using~~ ~~Structurally~~ Structured ~~designed~~ questionnaires were administered to these inmates. Blood samples of 144 inmates within the age ranges of 21 years and above 60 years ~~plus~~ were screened for pulmonary tuberculosis. Sputum samples were collected among inmates and were investigated for pulmonary tuberculosis by GeneXpert. Of the 144 inmates screened, 134(93.06%) were males and 10(6.94%) were females, and the overall prevalence of pulmonary tuberculosis obtained from the study was 2.76%. Tuberculosis infection was higher (4.07%) within the age range of 31-40 years. The prevalence of the infection ~~with respect to~~ during their months of stay in prison showed that inmates with a short period (6-12) months (4.81%) of stay were most infected with this disease. In relation to gender, males had a higher prevalence (5.92%) than females. There was no statistical relationship between the prevalence of Tuberculosis ~~infection~~ (P>0.05) ~~with respect to~~ concerning age groups, occupation, and duration of stay among the inmates and there was a statistical relationship between the prevalence of Tuberculosis ~~infection~~ (P<0.05) with respect to gender among the inmates. New prison inmates should be screened for TB ~~infection~~ before admission into the prison and any prisoner with TB ~~infection~~ should be properly followed up in the prison and after release from prison to ensure complete treatment

**Key Words**: Prevalence, Tuberculosis, Inmates, ~~Infection~~

The keywords should not be fewer than 5

**Introduction**

According to Ishaku and Mamman (2014), prisoners carry a much greater burden of illness than other members of thesociety, they harbour diseases that are determined both by the environment from which they come ~~from~~ and by the prison in which they live. Most health professionals find it difficult to work in a prison setup, due to undernutrition, lack of concern, inadequate facilities, and expertise, which deteriorates the health of inmates. Abah *et al*. (2018) observed that there are problems of severe drug abuse~~s~~, alcoholism, trauma, homicide, suicide, malaria fever, tuberculosis (TB), HIV/AIDS, Sexually Transmitted Diseases (STDs), and skin and helminth~~es~~ infection among prisoners.

Tuberculosis (TB) is an infectious bacterial disease caused by *Mycobacterium tuberculosis* complex. It is spread through the air when people who have an active TB disease cough, sneeze, or otherwise spread aerosol of respiratory fluids through the air (Banu *et al.,* 2010). Nigerian Correctional Service, Security Custodial Center, is often a high-risk environment for TB transmission because of severe overcrowding, poor nutrition, poor ventilation, and limited access to sufficient health care. Moreover, these inmates are predominantly males, typically aged 15 - 45 years, and come predominantly from poorly educated and socioeconomically deprived sectors of the population where TB infection and transmission are higher. One infectious prisoner with TB may infect the others very efficiently. The combination of overcrowding, poor nutrition, poor ventilation and lack of screening for TB has turned these centers into breeding grounds and incubators for TB (Banu *et al.,* 2010).

High prevalence rates of TB in prisons of developing countries have been reported by others, Lawal *et al.* (2009)reported a high prevalence of TB in Kuje Prisons in the Federal Capital Territory, Abuja, Nigeria Noeske *et al.* (2014*)* reported a point prevalence rate of 3.5% in Cameroon. Rao (2014) reported a prevalence of active TB in jail population in Karachi of 3.75 times higher than general population. In Bangladesh, Banu *et al.* (2010) found a prevalence of 13.5% in Dhaka Central Jail.

This present study was conducted to access the prevalence of pulmonary tuberculosis (PTB) and the contribution of active case finding for Tuberculosis elimination program and control in Makurdi and Gboko Nigerian Correctional Service, both maximum and minimum security custodial centers in Benue State, Nigeria.

**2. MATERIALS AND METHODS**

**2.1 Study Area**

The study wascarriedout in Makurdi and Gbokometropolis both in Benue State, Nigeria. The State lies in the middle of the country (North Central Geo-Political Zone) and shares boundaries with Cameroon and five other states namely, Nasarawa to the north, Taraba to the east, Cross River and Enugu to the south, and Kogi to the west. Benue State derives its name from the River Benue, the second largest river in Nigeria. The most prominent geographical feature of the State is the River Benue. The State has a population of about 5 million, and an area of about 34,059 sq. km. Benue state lies within the hot humid zone with seasonal temperature variation throughout the year and experiences two distinct major seasons ~~in the year~~. The seasons are dry and wet ~~seasons~~. The wet season occurs between April to October, while the dry season usually occurs between November to March (Mngutyo and Ogwuche, 2013). Does seasonal variation play a role in the transmission of Mycobacterium tuberculosis?

**2.2 Study Population**

The study population included the Makurdi and Gboko prisons in Benue State, Nigeria. The population of inmates in Makurdi and Gboko prisons ~~as~~ at the time of the study was 452 inmates in Makurdi and 274 inmates in Gboko prisons, respectively, with a staff strength of 89 employees spread across different departments in Makurdi and Gboko

**2.3 Sample size and parameters.**

 A sample size of 90 inmates in Makurdi prison and 54 inmates in Gboko prison was collected as samples for the study. The sampling parameters adopted for this study were based on random sampling. A total number of samples collected for the study were 144 sputum samples (Niaing *et al.,* 2006).

**2.4 Sample collection**

Exactly 2 ml of sputum samples were collected with a prior instruction given to the prisoner on how best to produce it. Inmates were advised to rinse their mouths twice with water, unscrew the lid on the sputum sample collection container. Prisoners were asked to take a deep breath (inhale deeply), cough vigorously, and expectorate the material (sputum) into a sterile screw-copped specimen collection container and cover it properly (Monica Cheesbrough, 2018).

 Sputum samples were labeled accordingly and were triple packaged and placed in the cold box and taken to the laboratory for analysis. At the laboratory, the sample lids were all secured by ensuring that their lids were well closed (Sputum cups). Samples were now stored at a maximum temperature of 4 oCfor 4-10 days waiting for the day to carry out analysis (Monica Cheesbrough, 2018).

**2.5 Preparation of sputum sample to be used on Gene-Xpert for the diagnosis of TB.**

 The working area was disinfected with 10% bleach. Xpert MTB/RIF cartridge was labeled with the sample ID. The labels on the lid of the cartridge or obstruct the existing 2D barcode on the cartridge. Labeling was done on the side of the cartridge. The sputum collection container was unscrewed, the sample reagent 1:2 (v/v) was added, and the lid was closed again. The remaining specimens were left in leak–proof sputum cups (sputum collection container) and were returned to the refrigerator. Each sample was shaken vigorously for 15 times. Samples were incubated at room temperature (27±20C) for 5 minutes and were again shaken vigorously for another 15 times. Samples were again re-incubated for another 10 minutes. This was done until samples were liquefied with no visible clumps of sputum. Samples that were not fully liquefied were shaken again vigorously and re-incubated for another 3-5 minutes (Wipa *et al.,* 2016).

**2.6 Preparation of cartridge for use on GeneXpert**

Testing commenced within 30 minutes of adding the sample to the cartridge, using a sterile transfer pipette provided, a liquefied sample was aspirated into the transferred pipette until the meniscus was above the minimum mark (2 ml). The cartridge lid was then opened. The sample was transferred slowly into the cartridge port to minimize the risk of aerosol formation. The cartridge lid was closed firmly by making sure that the lid snapped into place. The remaining liquefied sample was kept back into the refrigerator for up to 12 hours at 2-8.0 oC. The procedure above was carried out on all the sputum samples (Iram *et al.*, 2015).

**2.7 Testing on the GeneXpert instrument.**

The sputum of each inmate was mixed with the reagent that was provided with the assay, and a cartridge containing the mixture was placed in the GeneXpert machine.

All processing from this point on was fully automated, and GeneXpert results were viewed on GeneXpert software.

**3. RESULTS**

**3.1 Prevalence of Tuberculosis ~~Infection~~ among inmates ~~in relation to~~ concerning gender**

Of the 144 inmates screened in Makurdi and Gboko Medium and Security Prisons for Pulmonary tuberculosis, 134 (3.0%) were males and 10 (0.0%) were females. The overall prevalence of pulmonary tuberculosis obtained from the study was (2.8%). (Where is the result Table Example Table 3.1)

**3.2 Tuberculosis ~~infection~~ distribution in inmates with various age groups**

The prevalence of tuberculosis ~~infection~~ with respect to age groups shown that 31-40years had the highest prevalence of (4.8%) followed by21-30years had (1.7%) and 40 & above years had (0.0%) prevalence.(Where is the result Table)

**3.3 Prevalence of Tuberculosis ~~Infection~~ among inmates in relation to occupation**

Prevalence of tuberculosis ~~Infection~~ among inmates in relation to occupation revealed the prevalence rate of (4.4%) among farmers, followed by artisans (3.3%), civil servants (2.6%) and business men and women (0%)

**3.4 Prevalence of Tuberculosis ~~Infection~~ among inmates in relation to duration of stay.**

Prevalence of tuberculosis infections with respect to the duration of stay in the prison indicate 6-12months had the highest prevalence of (7.7%) followed by 40 and above months (5.0%), while 13-18, 19-24 and 25-39 months of Say had (0% ) prevalence of tuberculosis ~~infection.~~ (On which table?. Quote the table)

**Table 1: Prevalence of Tuberculosis ~~Infection~~ among inmates in relation to gender**

|  |  |  |  |
| --- | --- | --- | --- |
| Gender | No. examined  | No. Positive (%) | No. Negative (%) |
| Male | 134 | 4(3.0) | 130(97.0) |
| Female | 10 | 0(0.0) | 10(100) |
| Total | 144 | 4(2.8) | 140(97.2) |

**Table 2: Tuberculosis infection distribution in inmates with various age groups**

|  |  |  |  |
| --- | --- | --- | --- |
| Age  | No. Examined | No. Positive (%) | No. Negative (%) |
| 21-30 | 58 | 1(1.7) | 57(98.3) |
| 31-40 | 62 | 3(4.8) | 59(95.2) |
| 40 & Above | 45 | 0(0.0) | 45(100) |
| Total | 144 | 4(2.8) | 140(97.2) |

**Table 3: Prevalence of Tuberculosis Infection among inmates in relation to occupation.**

|  |  |  |  |
| --- | --- | --- | --- |
| Occupation | No. Examined | No. Positive (%) | No. Negative (%) |
| Civil Servants | 39 | 1(2.6) | 38(97.4) |
| Business Men/Women | 30 | 0(0.0) | 30(100) |
| Artisans | 30 | 1(3.3) | 29(96.7) |
|  |  |  |  |
| Farmers | 45 | 2(4.4) | 43(95.6) |
| Total | 144 | 4(2.8) | 140(97.2) |

**Table 4: Prevalence of Tuberculosis Infection among inmates in relation to duration of stay.**

|  |  |  |  |
| --- | --- | --- | --- |
| Duration of Stay (Months) | No. Examined | No. Positive (%) | No. Negative (%) |
| 6-12 |  39 | 3(7.7) | 36(92.3) |
| 13-18 |  30 | 0(0.0) |  30(100) |
| 19-24 |  25 | 0(0.0) |  25(100) |
| 25-39 |  30 | 0(0.0) | 30(100) |
| 40 & Above |  20 | 1(5.0) | 19(95.0) |
| Total |  144 | 4(2.8) | 140(97.2) |

**4. DISCUSSION**

The Tuberculosis prevalence rate of 2.8% reported in this study among inmates in Makurdi and Gboko prisons in Benue State. This is lower than the study conducted in Aba prison 11.6% by Emmanuel *et al.* (2015); in the same Aba federal prison 10.9% by Lawrence *et al.* (2010); in North Gondai Zone in Ethiopia prison 10.4% by Moges *et al.* (2012) and in Eastern Ethiopia prison 8.9% by Addis *et al.* (2015). The possible reasons for the difference might be associated with variation in the diagnostic methods used, Such as sputum microscopy (Acid fast bacilli) culture, and GeneXpert by the previous study and GeneXpert in this case (Rewrite here). The low prevalence rate may also mean that there might be comparatively good Tuberculosis ~~infection~~ control in these prison system of Makurdi and Gboko prisons. This could also be due to the introduction of Tuberculosis control unit at the State Ministry of Health and Human Services and also the use of GeneXpert in the diagnostic of tuberculosis which gives an accurate result as compare to sputum microscopy. The higher prevalence rates in other cases may also mean that there was no good Tuberculosis control in such places.

On the other hand, this prevalence rate was higher than in the studies conducted on prisoners in South- Western, Nigeria prisons 1.2% by Adesokan *et al.* (2015); in Ghana 0.9% by Kwabla *et al*. (2015) and in Uganda 2.0% by Owokuhaisa *et al*. (2014). The explanation for the difference might be due to the variation of study setting, study population, diagnostic methods used and better Tuberculosis control system in other prisons than in Makurdi and Gboko prisons or in these countries than Nigeria.

In relation to Gender, Tuberculosis prevalence rate among prisoners in Makurdi and Gboko prisons as recorded revealed that male prisoners (3.0%) recorded high prevalence rate than their female counterpart recording (0%). This finding is consistent with that of some studies carried out in other parts of Nigeria and Ethiopia by Lawrence *et al.* (2017); Emmanuel *et al.* (2015) and Mucheye *et al.* (2017) respectively.

Tuberculosis infection distribution in inmates with various age groups among these prisoners in Makurdi and Gboko prisons within the age group of 31-40 years (4.8%) was higher while age groups of 21-30 had (1.7%) and 40 & above had (0.0%) prevalence rate as recorded. These results are comparable to that of Mucheye *et al*. (2017) in Ethiopia and those results recorded by Adesokan *et al*. (2015) and Emmanuel *et al*. (2015) in Nigeria.

In relation to occupation, Tuberculosis among prisoners in Makurdi and Gboko prisons as recorded in Table 3 which shows high prevalence rate among farmers (4.4%) than other occupation in Makurdi and Gboko prisons. This is comparable with the report in Ethiopia by Mucheye *et al.* (2017). The possible reason for the report may be that, farmers are coming from the non hygienic environment and that could attribute to high prevalence rate among them.

Prevalence of tuberculosis due to duration of stay in the two prisons, this study recorded prevalence rate of Tuberculosis infection among prisoners that stay within 6-12 months (47.7%) and 40 & above months (5.0%) of stay as reported. While others inmates recorded (0.0%) prevalence rate in Makurdi and Gboko. This reason could be that the management of the prisons may not be taking care of the prisons environment and that could lead to Tuberculosis high prevalence rate among the prisons. More so, those inmates within 6-12 months might have contacted the Tuberculosis outside the prison environment before coming into the prisons.

**5. Conclusion**

 Tuberculosis infection recorded among inmates from the two prisons was low; therefore basic health education about this disease should be incorporated into the curricular of the inmates in all the Nigerian prisons.

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