Biological Reports

Prevalence of Pulmonary Tuberculosis among HIV/AIDS Patients attending General Hospital Okpoga North Central Nigeria

RESEARCH ARTICLE

How to cite this article

Ada, T. R., Iyanda, F.A. and Ali,E. A.(2019), Prevalence of Pulmonary Tuberculosis among HIV/AIDS Patients attending General Hospital Okpoga North Central Nigeria, ***Biological Rep.*, 4** (8), Pp 19.

Received: August 08,2019

Accepted: August 10, 2019

Published: August 15, 2019

Corresponding author

Ada RaymontTersoo

tersooada@gmail.com

AdaTersoo Raymond, Iyanda Francis Adams and Ali Eric Ahangba

Department of Biological Sciences, Benue State University, Makurdi, Nigeria.

ABSTRACT

Pulmonary Tuberculosis (PTB) is one of the most opportunistic infection among HIV/AIDS patients and is a major cause of mortality among the HIV/AIDS patients, Benue State is still one of the most HIV endemic state in Nigeria. This study aims to determine the prevalence of pulmonary tuberculosis (PTB) among HIV/AIDS patients attending general hospital Okpoga in north central Nigeria. A total number of 150 sputum samples of HIV/AIDS patients were collected and examined from October 2017 to February 2018. Ziehl-Neelsen stechnique(microscopy) and molecular method (Genexpert) were used to examine the specimens for the detection of Mycobacterium tuberculosis. Out of 150 patients examined, 23 were infected with PTB, showing the overall prevalence of PTB among HIV/AIDS patients to be 15.33% with a P-value (0.38) which was not statistically significance, while prevalence in relation to age was observed to be highest among age group ≥61years (23.08%) and lower among <1-20years(4.76%).Prevalence in relation to sex was higher among females 13(15.48%) than males 10(15.15%).Distribution of PTB in relation to occupation was highest among the traders 11(22.45%) and students had the lowest 1(5.88%) while prevalence decreases progressively based on the levels of education from tertiary been the lowest 3(11.54%) and the illiterates had the highest prevalence 8(16.67%). From the result of this finding, it is important to treat the infected individuals and carry out public health enlightenment on PTB.

Keywords: Pulmonary tuberculosis, HIV/AIDS

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by the organism *Mycobacterium tuberculosis[1]*. Tuberculosis which typically attacks the lungs is known as Pulmonary Tuberculosis (PTB) and accounts for over 90% of all TB cases, the organism can also affect other parts of the body and this is known as Extra-pulmonary Tuberculosis (ETB). It is usually transmitted through the air when people who have an active PTB infection cough, sneeze, or otherwise discharge droplets into the air [2].

Most infections are asymptomatic and latent, but about one in ten latent infections eventually progresses to active disease especially when there is an alteration of the immune system, which if left untreated, kills more than 50% of those infected [3].

According to [4], about 8.6 million people developed PTB worldwide in 2012 and about 1.1 million people with PTB are co-infected with HIV. The report also states that an estimated 2.9 million people living with PTB did not receive any treatment and about 1.3 million people died from active PTB and 320,000 were HIV-associated PTB deaths with 50 percent of death occurring in women.

A number of factors make people more susceptible to PTB infection, although the most important risk factor globally is HIV which has been estimated to be responsible for about 13% of all TB cases and it is a particular problem in sub-Saharan Africa, where rates of HIV are high. Lawn andZumla [5]reported that Pulmonary Tuberculosis is also closely linked to both ignorance, overcrowding and malnutrition, making it one of the principal diseases of poverty.Those at high risk thus may generally include; people who inject illicit drugs, inhabitants and employees of locales where vulnerable people gather (e.g. prisons and homeless shelters), medically underprivileged and resource-poor communities, high-risk ethnic minorities, children in close contact with high-risk category patients, and health care providers serving these patients [6]. Other possible risk factors that predispose individuals to pulmonary tuberculosis have been reported to include; chronic lung disease, those who smoke cigarettes and alcoholism [7].

Tuberculosis is endemic in Nigeria and Nigeria is far worse hit by this global epidemic in Africa. Nigeria is currently ranks 7thin the world and 2nd in Africa among the 30 countries with the highest burden of TB, PTB/HIV [8], andin the other hand, Benue state still remained one of the highest HIV endemic state in Nigeria [9].Aernan*et al* in[10] a study on TB/HIV co-infection among patients attending selected secondary health centers in Gboko, Benue State, reported a

30.6% co-infection rate. And anotherrecent research show the prevalence of pulmonary tuberculosis among HIV patients attending tertiaryhospitals in Benue State to be 15.3% this result showed that PTB is endemic in the state [11].More investigations on pulmonary tuberculosis cases are needed in other to ascertain the true burden of the co-epidemic in this study area and initiate necessary management, prevention and control measures. To this end, the present study aims to determine the prevalence of pulmonary tuberculosis (PTB) among HIV/AIDS patients attending general hospital Okpoga in north central Nigeria.

EXPERIMENTAL PROCEDURES

Study Population

The study population included all HIV patients attending the medical and ART laboratory of the General Hospital Okpoga with persistent cough that had lasted for more than three weeks, blood stained sputum, weight loss, prolonged tiredness, loss of appetite, night sweat etc. which are indicative of pulmonary tuberculosis infection.

Sample Size

A total number of 150 sputum specimens were randomly collected from HIV patients attending the Medical/ART laboratory of general hospital Okpoga.Sample size was calculated using Fisher's formula: $N=Z^2 pq/d^2$,

Where N= the required sample size+10% Attrition Rate.

Z= the confidence interval at 95% (1.96)

p= estimated prevalence of TB-HIV/AIDS co-infection which is put at 0.23

q= 1 – p

d= margin of error at 5% (0.05)

$N= 1.96^2 * 0.23(1-0.23)/ 0.05^2$

N= 3.8416 * 0.23 (0.77)/0.0025

N= 0.883568(0.77)/0.0025

N= 0.6803473/0.0025

N= 272.1

N= 272+10% Attrition Rate

10% Attrition rate = 10% of 272

= 10/100*272

= 0.1*272

= 27.2

N = 272+27.2

= 299.2/2

= 149.6

≈ 150

Questionnaire administration

Well structure questionnaires wereadministered to the patients at the point of sample collection in order to collect their socio-demographic characteristics. The administered questionnaire consisted of (3) sections;

1. Bio-Demographic Data
2. Socio-Economic Characteristics,
3. Knowledge and Attitudes towards PTB.

Sample collection

Sputum samples were collected from each consented participants on two consecutive days, patients were given sample bottles andinstructed on how to collect the sputum aseptically, i.e. they were asked to cough deeply into a well-labeled sterile, leak-proof, wide-mouthed container, with tight fitting cover. The first sample was collected at spot when the patient comes to the hospital medical laboratory; it is called at spot sputum sample and if the patient was unable to produce sputum at the spot, two specimen containers will be given to him/her, one for

early morning sputum the next day before brushing the teeth, and eating and the other after brushing and eating or at the spot on arrival at the laboratory.

Laboratory procedures

The sputum samples were first examined macroscopically and microscopically using Ziehl-Nielsen technique and then analyzed through molecular method for *Mycobacterium tuberculosis* using the Genexpert MTB/RIF machine.

Macroscopic examination

Sputum specimens were examined macroscopically for presence of recently-discharged material from the bronchial tube and satisfactory quality implies the presence of mucoid or mucopurulent material and is of greater significance than volume. Poor quality specimens are thin and watery or composed largely of saliva and bubbles and if the quality of the sputum was deemed inadequate, the specimens were rejected and the TB suspect asked to provide a new specimen.

Sputum microscopy using Ziehl-Nielsen acid-fast technique

Method

1. A short broom stick was used to make a smear of sputum sample on the central area of the slide in an oval shade of 20mm by 10mm.
2. The slide was placed on dryer with the smear surface upward and was air dried for 30 minutes.
3. Bunsen burner was used to heat fixed the dried smeared on the slides.
4. The smear was covered with carbon fuchsin stain.
5. The smear was heated until vapour began to rise and I made sure it was not overheated. The heated stain was allowed to remain on the slides for 5 minutes.
6. The stain was washed off with clean water using the sink.
7. The smear was covered with 20% of sulphuric acid until the smear was sufficiently decolourised.
8. Clean water was used to wash the slide.

9. The stain was covered with methylene blue for 2 minutes and the stain was washed off with clean water.
10. The back of the slide was wiped clean and it was place on the draining rack to air dry.
11. The smear was examined microscopically using the 100x oil immersion lens.

Interpretation of results

Interpretation of the microscopically viewed result was done using the acid fast stain base on the acid fast bacilli features like red-blue, straight or slightly curved rods, at times having beaded appearance. The background appears blue due to methylene blue.

The definite bacilli that were seen, results were reported as AFB positive. However, the results were better reported quantitatively as follows:

i.	> 10 AFB/high power field	+++
ii.	1-10 AFB/high power field	++
iii.	10-100 AFB/100 high power fields	+
iv.	1-9 AFB/100 high power fields	exact number

However if no AFB is seen, the results are written as 'no AFB seen' and never as negative.

Molecular analysis of specimen using GeneXpert MTB/RIF

Method

1. The patients' details were entered on the Xpert MTB/RIF worksheet to know the number of samples to be run.
2. Sputum sample was collected from the patients using a screw cap leak proof container from the patients.
3. Plastic disposable pipette was used to measure 3ml of sputum sample into a new sterile container.
4. Another separate plastic disposable pipette was used to add the sample reagent at 2:1 to the sputum sample.
5. The lid or cover of sputum container was replaced to avoid leakages.
6. The sputum container was shaken vigorously up to 10-20 times using back and forth movement.
7. The sample was incubated in the safety cabinet for 15 minutes at room temperature.

8. The sputum container was rocked once during the incubation.
9. The maker pen was used to label the front side bottom of the cartridge with patients' laboratory number.
10. The test started within 30 minutes of adding the sample to the cartridge.
11. The sterile graduated pipette in the Xpert/RIF kit was used to transfer the sample into the cartridge.
12. The pipette wrapper was open at the bulb-end of pipette and was taken out carefully and avoid touching the tip.
13. The lid of the cartridge was opened and the sample was transfer into the open port of the cartridge.
14. The pipette was carefully discarded into the bio-hazard waste bin.
15. The cartridge lid was close. The remaining sample was kept for repeat testing for up to 12 hours under 2-8°C.
16. The cartridge was loaded into the GeneXpert DX machine for MTB molecular analysis and the result was ready after 90 minutes.

Interpretation of results

The results were interpreted by the GeneXpertDx system from measured fluorescent signals and embedded calculation algorithms and were displayed in the **"View Results"** window. Lower Ct values represent a higher starting concentration of DNA template; higher Ct values represent a lower concentration of DNA template.

MTB detected

If MTB target DNA was detected- the MTB result will be displayed at High, Medium, Low or Very Low depending on the Ct value of the MTB target present in the sputum sample. Beloware the list of Ct value ranges for the displayed MTB results that were analyzed:

MTB result	Ct range
High	<16
Medium	16-22
Low	22-28
Very Low	>28

MTB NOT DETECTED

MTB NOT DETECTED-MTB target DNA was not detected

Probe Check- PASS: all probe check results pass.

INVALID

Presence or absence of MTB cannot be determined, repeat test with extra specimen.

Analysis of data

The data generated were analyzed statistically using SPSS software version 17.0. Results were presented in tables and charts, student T test was used to compare continuous variables while the Chi square test was used to compare categorical variables on the prevalence of PTB and HIV related tuberculosis. P value < 0.05 was taken to be statistically significant.

RESULTS

A total of 150 patients comprising of 66 males and 84 females were examined for pulmonary tuberculosis, out of them 23 (15.33%) were infected. Prevalence in relation to sex was 13 (15.48%) among females and 10 (15.15%) among males with a p-value of 0.38. The overall Prevalence of PTB among HIV Patients attending General Hospital Okpoga with respect to age and sex had a P-value 0.38 which means there is no significant difference among the age group and sex since the P-value is not less than 0.05 (P-value<0.05) as shown in Figure 1 and 2 respectively.According to occupation the P-value is 0.01 which mean there is a statistically significant difference since the P-value is less than 0.05 (P-value<0.05) while in respect to educational level the P-value is 0.04 which means there is significant difference between the level of education since the P-value is less than 0.05 (P-value<0.05) as shown in Figure 3 and 4.

The knowledge of patients towards PTB had a P-value 0.89 which means there is no significant difference since the P-value is not less than 0.05 (P-value<0.05) while the knowledge about transmission had a P-value 0.00 which is highly significant between the patients that had the knowledge of transmission and those that had no knowledge about the disease transmission. Cough>3 weeks was the highest associated symptom among the patients followed by weight loss while night sweat was the least associated symptom among patients of PTB in this study as shown in Figure 5 and 6.

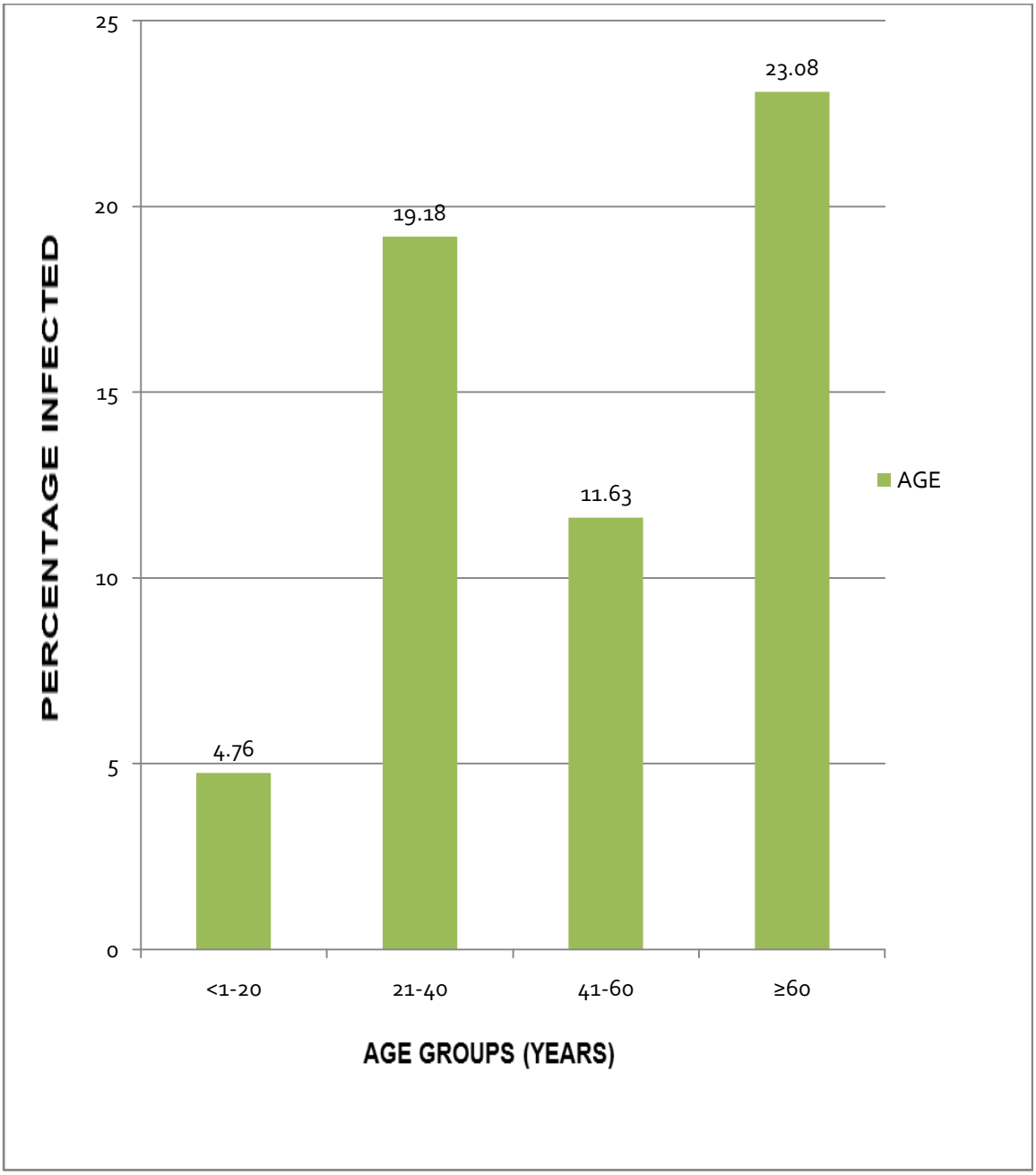

Figure 1. Overall prevalence of PTB among HIV patients attending general hospital Okpoga with respect to age.

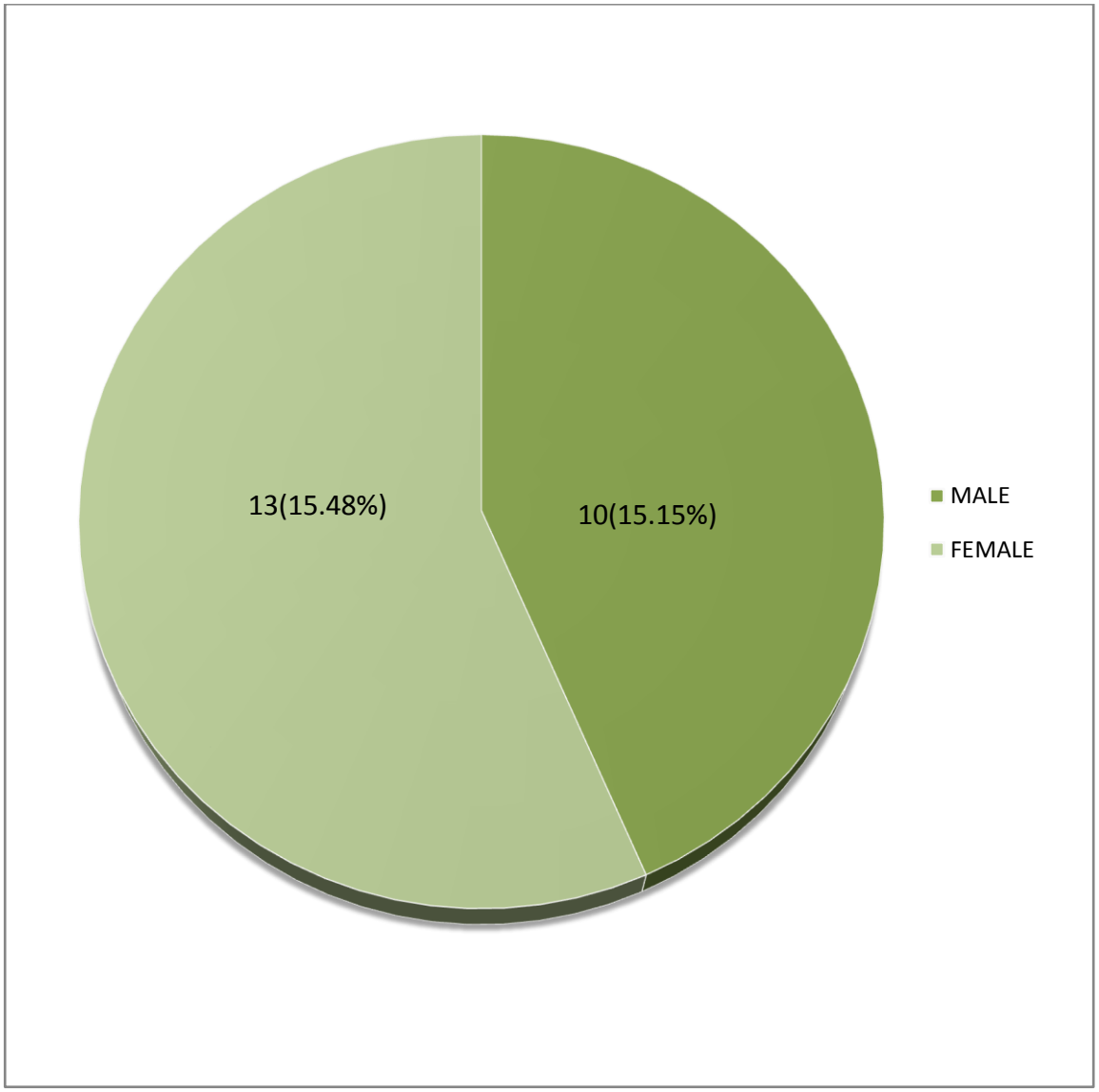

Figure 2. Overall prevalence of PTB among HIV patients attending general hospital Okpoga with respect to Sex.

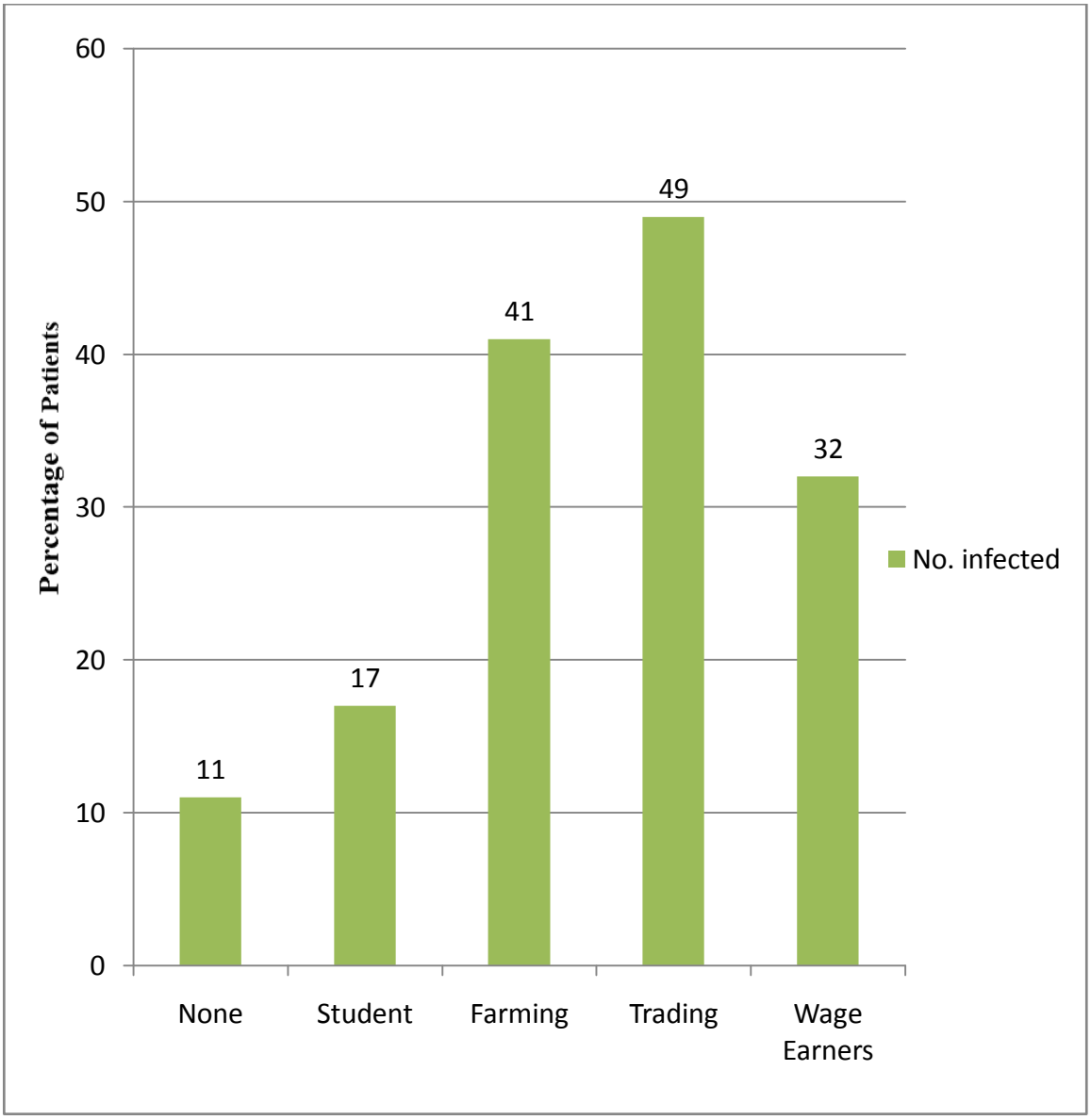

Figure 3: Prevalence of PTB among HIV patients attending general hospital Okpoga in relation to their occupations.

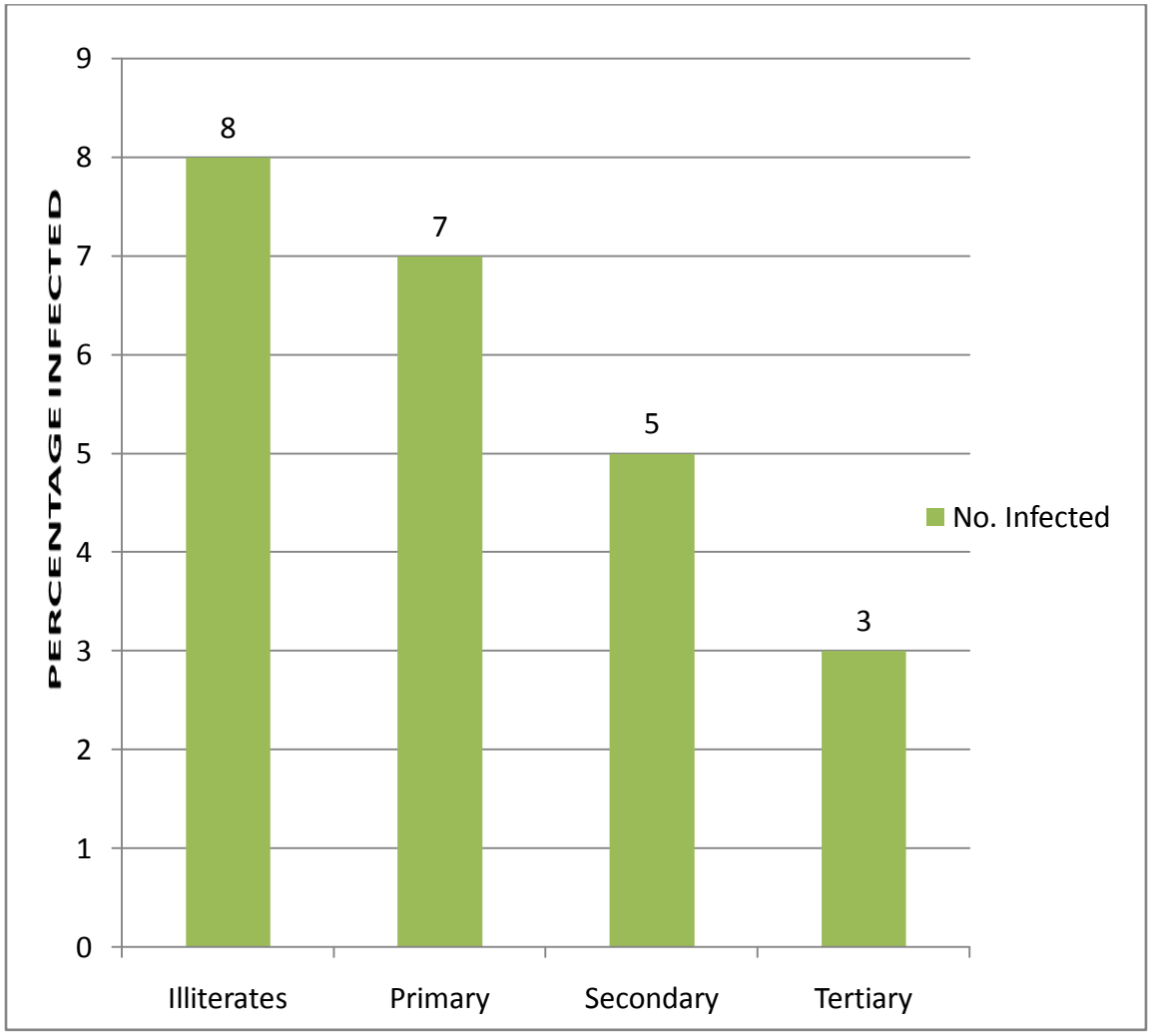

Figure 4: Prevalence of PTB among HIV patients attending general hospital Okpoga in relation to their educational level.

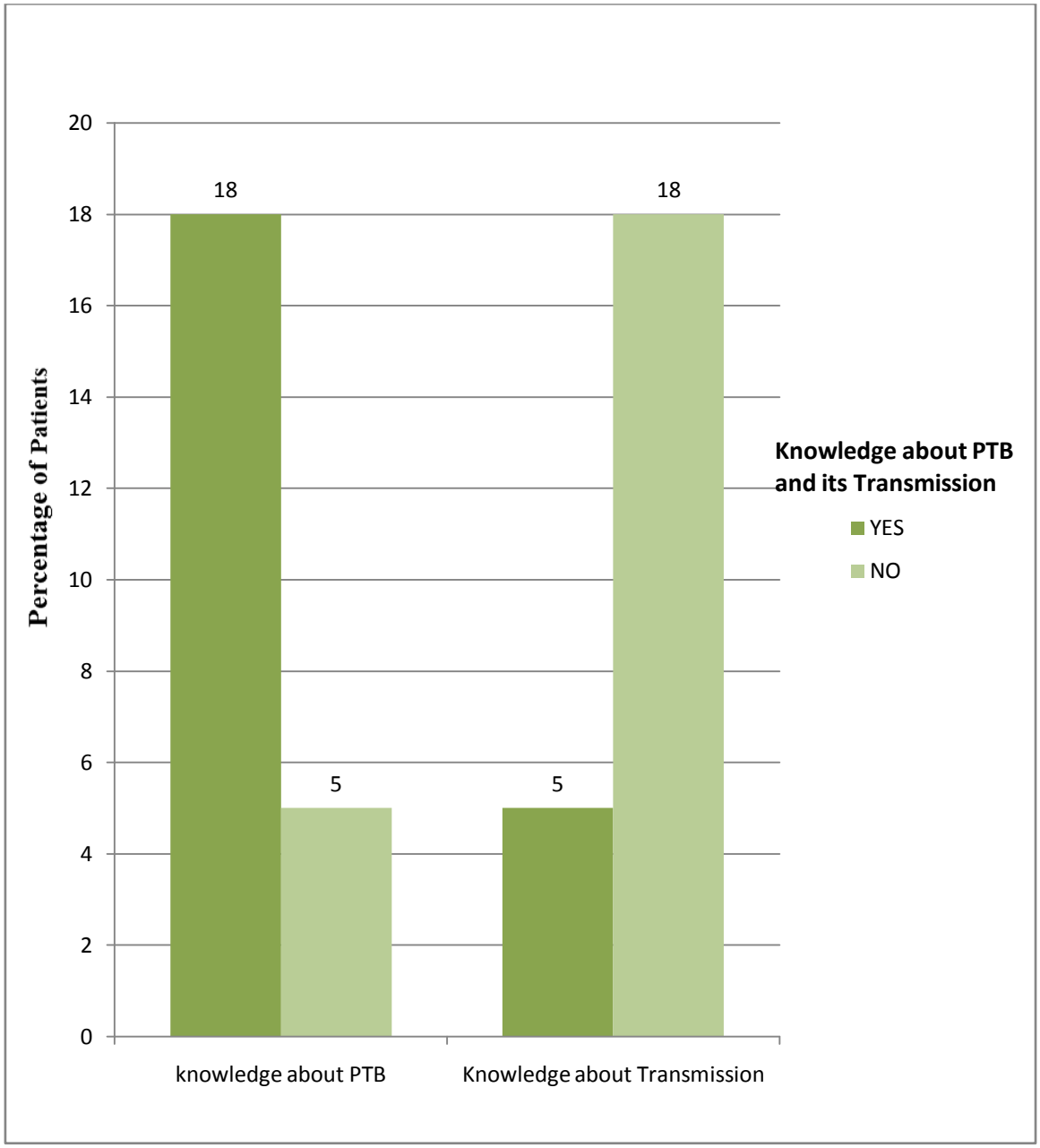

Figure 5: Prevalence of PTB among HIV patients attending general hospital Okpoga with respect to knowledge and transmission.

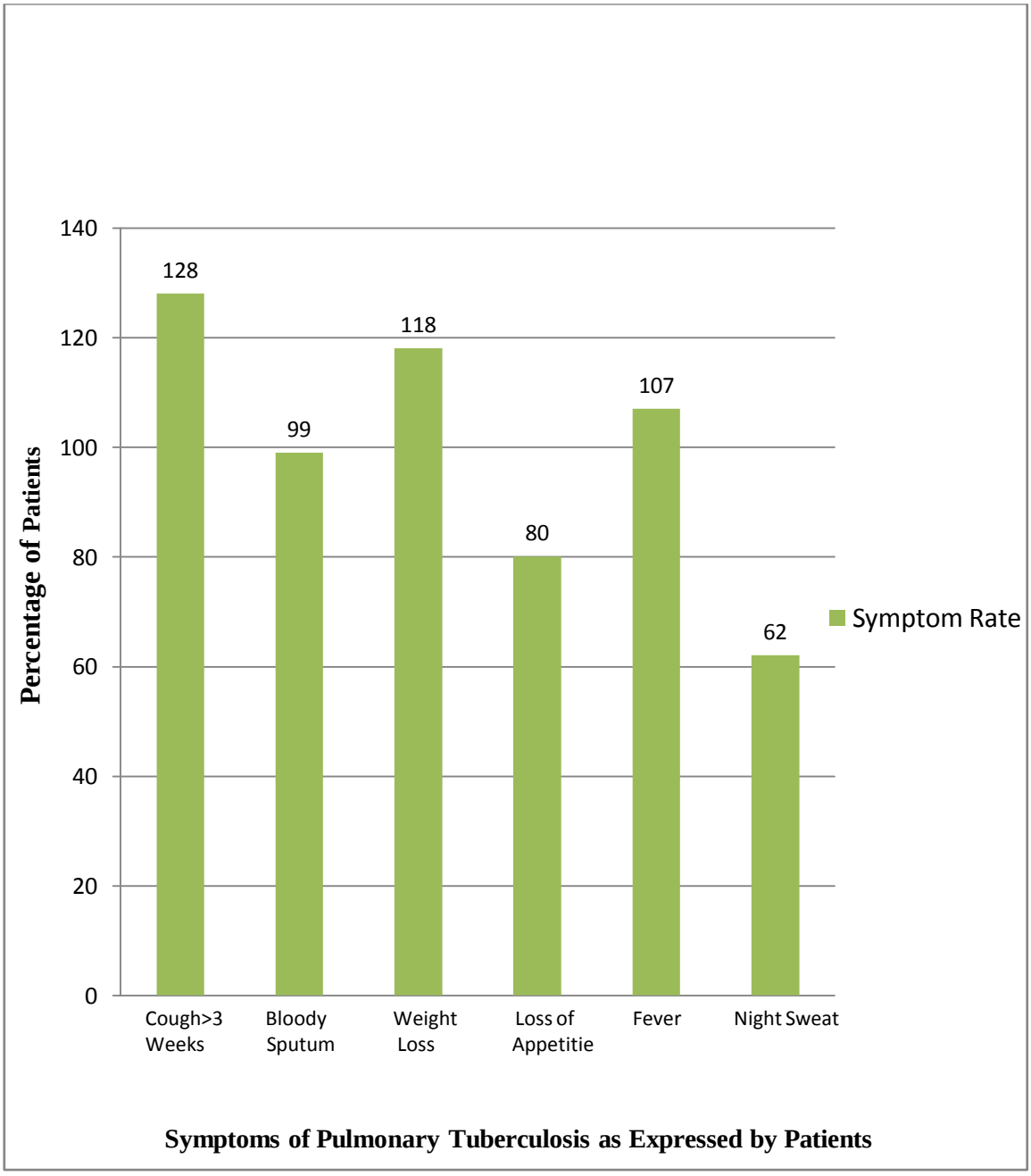

Figure 6.Symptoms of PTB among HIV patients attending general hospital Okpoga.

PTB with HIV has been closely linked since the emergence of HIV/AIDS and is known to be one of the most common opportunistic infection affecting HIV-seropositive individuals worldwide. It also remains a common cause of death in patients with AIDS [12]. The overall prevalence of 15.33% obtained from this study shows that pulmonary tuberculosis is still endemic in

Okpogawhere rate of HIV infection was also high, thus confirming reports that more people in the developing world contract tuberculosis because of compromised immunity, largely due to high rates of HIV infection and the corresponding development of AIDS [13]. Similar rates of 18.80% was reported in Portharcourt[14], 13.80% in Abeokuta [15], and 12.30% in Oyo [16]. However, the results obtained from this study was less than previous prevalence from other studies such as in Gboko, Benue State which was 30.6% co-infection rate by [10] and other states in nigeria, such like Nasarawa State, North Central Nigeria, [17], recorded a 24.2% prevalence rate. The variation in prevalence is consistent with statement by [18] that the prevalence of pulmonary tuberculosis varies depending on the group and region under study. The decrease in prevalence obtained in this present study compared to previous studies in Benue State may be due to the increased awareness of HIV infection and increase in the number of free treatment centres provided by Government and NGOs in the country. More people infected with HIV infection are now increasingly assessing the free treatment program and early initiation of treatment prevents most of them from progressing to AIDS, and in addition most centres commence antiretroviral drugs at higher CD_4 count and adopt isoniazid preventive therapy among HIV infected patients. It is also in agreement with statement by [12] that the incidence of pulmonary tuberculosis associated with HIV was believed to have reach a peak of 1.3 million in 2005 and is now decreasing but however remains the most common cause of death in patients with HIV/AIDS.

Prevalence in relation to sex was higher among females 13(15.48%) than males 10(15.15%) with P-value equal to 0.38 which means there isno significant difference among the sex since the P-value is not less than 0.05 (P-value<0.05). The sex dependent prevalence in this study was consistent with reports by [19] which had 12 (14.10%) females and 10 (13.89%) males, [17] had 13 (16.02%) females and 11 (15.56%) males,[10] had 14 (15.42%) females and 9 (15.10%) males. These higher prevalence reported in the females may be due to their high level of susceptibility to infections, lowered immunity probably because of the stress produced by their biological, economic and cultural roles as care givers [20], it also corroborates reports that more women die of PTB than from all other causes of maternal mortality combined[10].

Distribution of pulmonary tuberculosis among HIV positive patients in relation to age was observed to be highest among age group ≥61years 2(28.57%), followed by age group 21-40years 5(17.86%) while lower prevalence of 3(15.00%) was recorded among age groups 41-60years respectively.The relatively highest rate of pulmonary tuberculosis 28.57% recorded in the age group ≥61years in this present study could be due to the effect of lowered immunity as a result

of ageing and reactivation of tubercle bacilli in later life. On the other hand, high rate of 17.86% in the age group 21-40years which is similar to findings by [16] which was 17.80% in Oyo state[14] had 18.01% in Port Harcourt [21] had 17.76% in Iran and elsewhere is attributed to the fact that individuals in this age group are more sexually active, usually with more than one sexual partner thus increasing their risk of contracting HIV which is a major risk factor for HIV/TB co-infection. The implication of this high rate of 17.86% among age group 21-40years is that individuals in the age group makes up a greater proportion of the workforce in the country, thus the impact of HIV/TB co-infection on the economy of the country will certainly become overwhelming if not controlled with appropriate intervention measures [16]. Low rate of observed in the age group <1-20years was in line with previous national data and indicates less HIV associated acquisition of pulmonary tuberculosis in this age group [22]. Additionally, prevalence in relation to level of education was higher among the illiterates which was 8 (16.67%) and followed by patients that have only primary education which was 7 (16.66%) and the secondary education 5 (14.71%) and patients in the tertiary education level had the least prevalence which was 3 (11.54%). The prevalence in relation to level of education decreased progressively according to their level of education, this is as result of knowledge and awareness of the disease, awareness company on TB are mostly carried out in colleges and few schools. The P-value is equal to 0.04 which means there is significant difference among the level of their education since the P-value is less than 0.05 (P-value<0.05). The decrease progressively in prevalence rate according level of education from tertiary down to the illiterate also correspond with therecent research on the prevalence of pulmonary tuberculosis among HIV patients attending tertiary hospitals in Benue State by [11].

Distribution of pulmonary tuberculosis among HIV positive patients in relation to their occupation was observed to be highest among the traders been 11 (22.45%) followed by farmers 8 (19.51%), wage earners 2 (6.25%), none was 1 (9.10%) and students 1 (5.88). The highest prevalence among the trading occupation was as result on overcrowding and mingling with different people in the market, the occurrence among farmers was as result of some of them had little or no formal education to know about the disease and its transmission. Which had a P-value equal to 0.01 which signified a highly significant difference among the occupations since the P-value is less than 0.05 (P-value<0.05).

The prevalence of pulmonary tuberculosis as of knowledge of respondents about PTB, a total of 119 patients that had knowledge of the disease while 18 (15.21%) out of them are tested to had PTB and 31 patients had no knowledge of the disease while 5 (16.13%) out of them are tested to

had PTB. The patients that had no knowledge of PTB had the highest prevalence because they know nothing about the disease and how it can be transmitted from one person to another and are also ignorant of it preventive measures. TheP-value of knowledge of respondents about PTB iso.89 which means it is not statistically significant since the P-value is not less than 0.05 (P-value<0.05) while the P-value of knowledge about transmission is 0.00 which is highly statistically significant since the P-value is less than 0.05 (P-value<0.05).The most associated and frequent symptoms of pulmonary tuberculosis among HIV/AIDS patients observed from this study was cough>3weeks, in which out of 150 patients examined, 128 (42.67%) had cough>3weeks, followed by weight loss 118 (39.33%), fever 107 (35.67%), bloody sputum 99 (33.00%), loss of appetite 80 (26.67%) and night loss 62 (20.67%).From also the recent research work on the prevalence of pulmonary tuberculosis among HIV patients attending tertiary hospitals in Benue State by [11] had 42.50% rate of cough>3weeks symptom among the patients.Demographic factors like marital status, place of residency, overcrowding measured in terms of number of persons per household and number of persons per room showed serious effect on the rate of pulmonary tuberculosis among the study population, indicating a level of statistical significant difference (P<0.05). Prevalence of infection with respect to marital status was highest among the divorced 20(40.00%), while singles and married had 77(9.10%) and 9(17.00%) respectively, with a statistical significant difference (P=0.00). Prevalence due to number of persons per household was highest among ≥21 that had8(53.33%), while those 11-20 and 1-10 had 12(13.04%) and 3(7.00%) respectively with a significant difference (P=0.00).

CONCLUSION

Prevalence of PTB among HIV/AIDS patients attending general hospital Okpoga north central Nigeria is presented. The findings of the study showed that the overall prevalence of pulmonary tuberculosis among HIV patients attending General Hospital Okpoga was 15.33%. And the prevalence in relation to age was observed to be highest among age group (≥61years)was 2(28.57%), 21-40years 5(17.86%) while lower prevalence of 3(15.00%) was recorded among age groups 41-60years respectively and prevalence in relation to sex was higher among females 13(15.48%) than males 10(15.15%). Demographic information from this study indicated that the divorced had the highest infection rate 8 (40.00%) followed by singles 9 (17.00%) and married patients had 7 (9.10%) under marital status and under place of residence the urban dweller had the highest prevalence 6 (19.35%) and urban 17 (14.26%) and the duration in the community showed patients among <1-10 years had the highest infection rate 11 (22.00%). The number of persons per household and room determined the increased in rate of infection due to

overcrowding. Prevalence in relation to level of education was higher among the illiterates which was 8 (16.67%), primary education 7 (16.66%), secondary education 5 (14.71%) and tertiary education level had the least prevalence 3 (11.54%). Prevalence in relation to occupation was observed to be highest among the traders been 11 (22.45%) followed by farmers 8 (19.51%), wage earners 2(6.25%), none is 1(9.10%) and students 1(5.88). Knowledge of respondents about PTB, we have a total of 119 patients that had knowledge of the disease and 18 (15.21%) out of them are tested to had PTB and 31 patients had no knowledge of the disease and 5(16.13%) out of them are tested to had PTB. The most associated and frequent symptoms of pulmonary tuberculosis among HIV/AIDS patients observed from this study was cough>3weeks.Thus the disease could be a major cause of reduced/low productivity and poverty in Benue state, poverty results when the impaired infected individual can no longer go to farm/offices resulting in a drop in productivity and money is also required for the management and treatment of the infected, this is of great concern especially as it might affect both patient management and public health prospective.

REFERENCES

[1]. World Health Organization, (2013).Global Tuberculosis report. 2013 global report on surveillance and response. Geneva, Switzerland: World Health Organization; pp 1-19

[2]. Konstantinos,A (2010). "Testing for tuberculosis".*Australian Prescriber*33 (1):12–18.

[3]. World Health Organization, (2011).WHO policy on collaborative TB/HIV activities. Geneva, Switzerland: World Health Organization; pp 9-11.

[4]. World Health Organization, (2004). TB/HIV: A Clinical Manual, Second Edition. World Health Organization, 2004.Geneva, Switzerland.

[5]. Pennap, O. U., Hannah, P. E., Abdul, A. (2011). Prevalence of active tuberculosis and progression of HIV infection rural areas of Nasarawa state.*Lancet*.342: 268-72.

[6]. Griffith, D. and Kerr, C (1996). "Tuberculosis: disease of the past, disease of the present". *Journal of Perianesthesia Nursing*11 (4): 240–5.

[7]. Vanzyl, R. N. and Leung, W. S., (2010)."Global lung health: the colliding epidemics of tuberculosis, tobacco smoking, HIV and COPD".*European Respiratory Journal*35 (1): 27–33.

[8]. World Health Organization, (2018).Global Tuberculosis report on surveillance and response. Geneva, Switzerland: World Health Organization.

[9]. National Agency for the Control of Aids (2017). Report on National statistics of HIV/AIDS infection rate in Nigeria; http://naca.gov.ng.

[10]. Aernan, P.T, Akande, T. and Yange, T.S. (2010). TB/HIV Co-infection Rates among Patients attending Secondary Health Centre's in Gboko Metropolis of Benue State, Nigeria. *Journal of Medical and Applied Biosciences*, 2: 67-71.

[11]. Alex, A, (2015).The prevalence of pulmonary tuberculosis among HIV patients attending tertiary hospitals in Benue State.

[12]. Vanzyl, R. N. and Leung, W. S., (2010)."Global lung health: the colliding epidemics of tuberculosis, tobacco smoking, HIV and COPD".*European Respiratory Journal*35 (1): 27–33.

[13]. Lawn, and Zumla, (2011). "Tuberculosis". *Lancet*378 (9785): 57–72.

[14]. Obioma, A, Ramesh, P, Faith, A, Omokaro, O. (2011). Prevalence of Tuberculosis in HIV infected patients. *Journal of Advanced Pharmacy Education & Research*, 1:1-11.

[15]. Ejilude, O, Akinduti, P.A, Oluwadun, A. (2013). Primary Multi-Drug Resistant Tuberculosis among Hiv Seropositive and Seronegative Patients in Abeokuta, Southwestern Nigeria. *American Journal of Research Communication*, 1(10):224-237.
[16]. Georgina, N.O., Prosper, O, Oluwole, M.L, David, O.O. (2013). HIV Infection among Newly Diagnosed TB Patients in Southwestern Nigeria: A Multi-DOTS Center Study. *World Journal of AIDS*. 3: 154-159.
[17]. Teo, S. S. andShingadia, D.V. (June 2006). "Does BCG have a role in tuberculosis control and prevention in the United Kingdom?".*Archives of Disease in Childhood*91 (6): 529–31.
[18]. Jussara, L, Okwera, A, Nsubuga, P. (2006).Efficacy of an unsupervised treatment of pulmonary tuberculosis in HIV infection among children in Brazil.
[19]. Sebsibe, T. and Takele, T. (2013). HIV co-infection among tuberculosis patients in Dabat, northwest Ethiopia.*Journal of Infectious Diseases and Immunity*.5 (3): 29-32.
[20]. Umeh, N. A., Abubakar, I., Fordham, R., Bachmann, M. (2012). Prevalence of pulmonary tuberculosis among patients receiving treatment in chest clinic Nasarawa State, Nigeria.*International Journalof Tuberculosis Lung Diseases*16 (6):835–840.
[21]. Davood, M., Kamyar, A., Arash, A. (2002). Prevalence of Clinical Tuberculosis in HIV Infected Patients from Kermanshah Province, IRAN. *Tanaffos*. 1(2), 27-33.
[22]. O'Brien, C. (1994). Preventive therapy of AIDS and treatment initiation in Abidjan.*A medical Journal of Respiratory Critical Care*. 172:123–127.