IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 12, Issue 4 Ver. IV (Jul – Aug 2017), PP 70-75
www.iosrjournals.org

HIV and TB co-infection among patients who used Directly Observed Treatment Short-course centres in Yenagoa, Nigeria

Omo-Emmanuel Ughweroghene Kingston[1]*, Onuzulike Nonye[2], Ochei Kingsley Chinedu[3], Achu Etta Takim [3], Obeagu, Emmanuel Ifeanyi[4], Udah Donald Chinazor[5], Omorogbe Eloghosa[6], Ojong Ejoh Ojong[7], Odunze, Uche Godswill[8]

[1]*Department of Public Health, Imo State University, Owerri, Imo State, Nigeria.*
[2]*Department of Health Education, Alvan Ikoku Federal College of Education, Owerri, Imo State.*
[3]*FHI360 Country Office, Abuja Nigeria.*
[4]*Department of University Health Services, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.*
[5]*AHNI State Office, Owerri, Imo State, Nigeria.*
[6]*FHI360 State Office, Port Harcourt, Rivers State, Nigeria.*
[7]*FHI360 State Office, Calabar, Cross River State, Nigeria.*
[8]*APIN Office, Lagos, Lagos State, Nigeria.*
Corresponding Author: Omo-Emmanuel Ughweroghene Kingston

Abstract: *Tuberculosis (TB) and Human Immunodeficiency Virus (HIV) co-infection is a major public health challenge, especially in developing countries such as Nigeria. A descriptive, retrospective epidemiological study was conducted to assess TB and HIV co-infection and associated risk factors among patients in two (2) selected Directly Observed Treatment Short Course (DOTS) centres in Yenagoa, Bayelsa State over the course of 4 years (2013 - 2016). Of the 1704 patients, 946 (55.5%) were males and 758 (45.5%) were females. Compared to rural dwellers who were 704 (41.3%) urban dwellers who were 1000 (58.7%) were the majority among the study participants. Majority of the study participants 126 were between 31 and 40 years old. The overall TB and HIV co-infection among TB patient was 21.8%. TB and HIV co-infection among female was significantly higher than among male TB patients as well as among rural dweller than urban dwellers. Furthermore, the highest TB and HIV co-infection of 33.9% was among TB patients of 31 to 40 years old followed by 21 to 30 years old (25.4%). TB and HIV co-infection among TB patients in Yenagoa LGA was high. The co-infection was significantly associated with 31 to 40 age group, female gender and rural dwelling TB patients. There is the urgent need for programmatic revision of ongoing TB intervention strategies, strengthening of health systems infrastructure, targeted capacity building for health personnel and intensified public awareness on TB and HIV targeted interventions for females, unmarried people, people of sexually active and reproductive age group and urban dwellers.*

Keywords*: TB, HIV, DOTS, Co-infection, Gender, Age, Location*

Date of Submission: 19-07-2017 Date of acceptance: 31-07-2017

I. Background

Tuberculosis (TB) is an infectious disease caused by bacterial agent, Mycobacterium tuberculosis. The most important source of infection is an untreated pulmonary TB patient. When such a person coughs, spits or sneezes, tiny droplet nuclei containing the bacilli are released. Transmission is through inhaling these droplet nuclei (FMOH, 2010). Human Immunodeficiency Virus (HIV) is a virus that causes Acquired Immunodeficiency Syndrome (AIDS) if left untreated. The virus attacks and damages the body's immune system, thereby impairing the capacity of the body to fight infectious organisms (Alexander *et al.,* 2010). As the disease progresses and immunity declines, patients become more susceptible to infections such as TB, pneumonia, recurrent fungal infections, etc. which account for most of the ill health associated with the disease (CDC, 2016). A co-infection with TB and HIV in a person forms a very grave public health hazard. The prevalence of tuberculosis infection is higher in persons who are HIV positive than those who are HIV negative. This is due to the reduction in immune level by HIV virus (WHO, 2016).

In 2015 there were about 36.7 million people living with HIV worldwide with 2.1 million new infections and 6.5 million of the 36.7 million living in Western and Central Africa. Also, there were 1.1 million AIDS-related deaths globally in 2015 (Global AIDS Update, 2016). According to the National HIV & AIDS and

Reproductive Health Survey (NARHS Plus) in 2012, the national HIV prevalence rate was 3.4% (FMOH, 2013). Similarly, in 2015, there were an estimated 10.4 million new TB cases worldwide, with about 1.2 million (accounting for 11%) of these being among people also living with HIV (WHO, 2016). The two infections are strongly linked. There were about 1.4 million TB deaths and an additional 0.4 million deaths resulting from TB among people living with HIV in 2015 (WHO, 2016). TB remains the leading killer of people living with HIV globally, with about a third of all HIV deaths attributable to it. Sub-Saharan Africa bears the biggest burden of HIV and TB co-infection by far, with a vast number of persons so infected resident in sub-Saharan African countries (WHO, 2016). Nigeria ranks tenth among the high TB burden countries in the world with a prevalence of 133 per 100,000 (FMOH, 2010). The risk of developing active TB is estimated to be 26 times greater in people living with HIV than in those who are HIV-negative (WHO, 2016).

Justification for the study

Data and reports on TB and HIV coinfection available in Nigerian is limited and the magnitude and nature of the association also varies in different locations and ethnic groups. Data are not available on TB and HIV co-infection in Bayelsa state unlike some other parts of Nigeria. Therefore, TB and HIV co-infection have not yet been exhaustively studied in Nigeria and no study yet in Bayelsa State. The main aim of the study was to determine HIV and TB co-infection among patients who used Directly Observed Treatment Short-course (DOTS) centers in Yenagoa from January 2013 to December 2016.

Objectives

1 To determine TB and HIV co-infection among patients who attended Directly Observed Treatment Short-course (DOTS) centers in Yenagoa from January 2013 to December 2016.
2 To ascertain the difference in TB and HIV co-infection among patients who attended DOTS centers in Yenagoa from January 2013 to December 2016 based on gender.
3 To ascertain the difference in TB and HIV co-infection among patients who attended DOTS centers in Yenagoa from January 2013 to December 2016 based on age.
4 To ascertain the difference in TB and HIV co-infection among patients who attended DOTS centers in Yenagoa from January 2013 to December 2016 based on location.

II. Methods

This study utilized descriptive, retrospective epidemiological survey to assess TB and HIV co-infection and associated risk factors among patients in two selected DOTS centers in Yenagoa, Bayelsa State over the course of 4 years (January 2013 - December 2016). The DOTS centers where the study was carried out are in Federal Medical Centre (FMC) Yenagoa and TB and Leprosy Referral Hospital (TBLRH) Igbogene in Yenagoa Local Government Area, Bayelsa state, Nigeria.

The entire target population consisting of 1704 patients aged 2 to 75 years that were treated in the 2 DOTS centres in Yenagoa LGA from 2013 to 2016 were studied. The sample for this study was the 1704 patients registered in the hospitals' DOTS register from January 2013 to December 2016. There was no sampling because all the patients in the DOTS register were included in the study. The assessed hospitals' DOTS register from January 2013 to December 2016 provided the information for the period under review.

The data such as age, gender and location, HIV and TB status was collected from the DOTS register. The HIV status were determined in the study health institutions following the national HIV testing algorithm in Nigeria where Alere Determine was used for the first screening and positive samples were re-tested with Trinity Biotech Unigold. Those that had discordant results in the two tests (Determine and Unigold) were retested using tie-breaker Stat Pak (Chembio HIV1/2 Stat Pak Assay, USA). The study excluded TB patient having incomplete data on the DOTS register.

III. Results

A total of 1704 TB patients who were all the patients who attended DOTS centers in the 2 facilities where the study was carried out who had complete TB and HIV data were involved in this study. Those with unknown HIV status were excluded from the study. One thousand, two hundred and five (70.7%) and 499 (29.3%) attended DOTS centers at TBLRH Igbogene and FMC Yenagoa respectively. Of the 1704 patients, 946 (55.5%) were males and 758 (45.5%) were females. Majority of the study participants were between 31 and 40 years old 126 (33.9%) followed by 21-30 age group 97 (26.1%). The age group of 1 – 10 had the least no of participants (4.3%). Compared to rural dwellers who were 704 (41.3%) urban dwellers who were 1000 (58.7%) were the majority among the study participants.

Table 1: Frequency distribution of TB and HIV co-infection among patients who attended DOTS centers in Yenagoa from January 2013 to December 2016

Status	Frequency	Percent
TB & HIV Co-infection	372	21.8
TB with no HIV co-infection	1332	78.2
Total Patients	**1704**	**100**

Of the 1704 TB patient tested for HIV, 372 (21.8%) were positive giving an overall TB and HIV co-infection of 21.8% (Table 1).

Table 2: Frequency distribution of TB and HIV co-infection among patients who attended DOTS centers in Yenagoa from January 2013 to December 2016 based on gender

Gender	TB Positive & HIV Positive	TB Positive & HIV Negative	Total
Male	153 (41.1%)	793	946
Female	219 (58.9%)	539	758
Total	**372**	**1332**	**1704**

$\chi^2_{Cal} = 11.4 > \chi^2_{0.05} = 3.84$, df = 1: P < 0.05

Of the 372 TB and HIV co-infected patients, 219 (58.9%) were females and 153 (41.1%) were males (Table 2). The findings of this study show that HIV and TB co-infection was significantly higher in female when compared to male patients who used DOTS centers in Yenagoa from January 2013 to December 2016.

Table 3: Frequency distribution of TB and HIV co-infection among patients who attended DOTS centers in Yenagoa from January 2013 to December 2016 based on age.

Age	TB Positive & HIV Positive	TB Positive & HIV Negative	Total
1-10	7 (1.9%)	13	20
11-20	27 (7.3%)	150	177
21-30	97 (26.1%)	424	521
31-40	126 (33.9%)	320	456
41-50	71 (19.1%)	198	269
51-60	35 (9.4%)	123	158
61 and above	9 (2.4%)	104	113
Total	**372**	**1332**	**1704**

$\chi^2_{Cal} = 101.5 > \chi^2_{0.05} = 10.6$, df = 6: P < 0.05

The highest contribution to TB and HIV co-infection of 33.9% was among TB patients of 31 to 40 years old followed by 21 to 30 years old (26.1%) (Table 3). This study found that the age group 31 to 40, who are the most productive age group, were the age group with the highest HIV and TB co-infection among TB patients. There is significant difference among HIV and TB patients of various ages who used Directly Observed Treatment Short-course (DOTS) centers in Yenagoa from January 2013 to December 2016.

Table 4: Frequency distribution of TB and HIV co-infection among patients who attended Directly Observed Treatment Short-course (DOTS) centers in Yenagoa from January 2013 to December 2016 based on location

Location	TB Positive & HIV Positive	TB Positive & HIV Negative	Total
Urban	154 (41.4%)	846	1000
Rural	218 (58.6%)	486	704
Total	**372**	**1332**	**1704**

$\chi^2_{Cal} = 61.7 > \chi^2_{0.05} = 3.84$; df = 1; P < 0.05

Of the 914 TB and HIV co-infected patients, TB and HIV co-infection was higher among rural dwellers (58.6%) than urban dwellers 357 (41.4%) (Table 4). This study found that HIV and TB co-infection was significantly

higher in rural dwelling patients than urban dwelling TB patients who used Directly Observed Treatment Short-course (DOTS) centers in Yenagoa from January 2013 to December 2016 Conclusion drawn was that there is significant difference between rural and urban dwellers TB and HIV co-infection among patients who used Directly Observed Treatment Short-course (DOTS) centers in Yenagoa from January 2013 to December 2016.

IV. Discussion

Result of this study revealed that the TB and HIV co-infection was 21.8%. Related studies by Zhang *et al*. (2016); Chen *et al*. (2016); Eyasu (2014); Okonkwo *et al.* (2013); Olanrewaju *et al*. (2013) and Jeffrey *et al*. (2015) reported lower values of 15.6%, 13.6%, 17.9%, 11.9%, 14.2% and 18.4% than that found in this study. However, the finding of this study was lower than 24.3%, 33.9%, 25.1%, 48.7% and 34.5% reported in related studies by Daniel *et al.* (2015); Christopher *et al.* (2012); Akinleye *et al*. (2015); Smart & Aleru (2015) and Gyar *et al.* (2014) respectively. The result was expected because of similar findings in neighbouring states with similar socioeconomic status and with the high prevalence of HIV in the state.

TB and HIV co-infection among TB patients in this study was significantly higher in females than in males. Other related studies support this finding (Erhabor *et al*., 2010; Teklu *et al.,* 2012; Christopher *et al.,* 2012; Okonkwo *et al*., 2013; Olanrewaju *et al*., 2013; Eyasu, 2014; Smart and Aleru, 2015), but it is contrary to a report of no significant difference between female and male by Akinleye *et al*. (2015) and those by Houston *et al*. (1994); Mor *et al*. (2014) and Nwachukwu *et al*. (2016) that reported higher prevalence of TB/HIV in males than females. This finding could be as a result of TB and HIV co-infection mirroring the high incidence of HIV infection in females which predisposes them to TB as HIV is known to activate latent TB. Females have a higher susceptibility to HIV infection because they are usually exposed to sexual activities earlier than men mainly for economic reasons. Furthermore, most African women being subservient to their husbands have little or no say in issues relating to sexual relationships (Pefura *et al*., 2012). The greater vulnerability of females to HIV/AIDS is fueled by biological, cultural and socio-economic factors. Biologically, they are four times more at risk of becoming infected with HIV during unprotected vaginal intercourse than men. The vagina's large surface area of susceptible tissue and micro trauma during intercourse makes women more physiologically vulnerable (Nyobi *et al*., 2008). The synergy between HIV and other sexually transmitted infections (STIs) is another biological factor that makes women more vulnerable. Socio economic factors including women's lack of access to education or personal income perpetuate women's lower status. Moreover, widespread poverty drives some women into commercial sex work. Cultural traditions such as forced marriage, female genital mutilation and older men's preference for younger women contribute to increased female vulnerability to HIV and therefore TB (Pieniazek *et al.,* 1999).

The HIV co-infection among TB patients age between 30-41 years old was statistically significant in this study. This finding is in agreement with previous reports from similar studies (Christopher *et al.,* 2012; Esmael *et al*., 2013; Okonkwo *et al*., 2013; Eyasu, 2014; Daniel *et al*., 2015). This high HIV co-infection among TB patients of productive age group probably reflects the age-specific prevalence of HIV in the area. This may be related to the patients' being in a sexually active age group in which both TB and HIV prevail most (Tessema *et al.,* 2009 and Berhe *et al.,* 2012).

This study found that rural dwellers had higher HIV and TB co-infection than urban dwellers. This disagrees with related studies by Esmael *et al*. (2013); Datiko *et al*. (2008); Pefura *et al*. (2012); Houston *et al*. (1994) and Nwabuko *et al*. (2012) that showed higher number of HIV infected TB cases in urban than rural areas. The reason for this might be the fact that Bayelsa state has more rural than urban settings and the presence of high prevalence of HIV infection among rural dwellers than urban dwellers (Seifu, 2004 and Post *et al*., 2014).

V. Conclusion

In conclusion, HIV and TB co-infection among TB patients in Yenagoa LGA was high in this study. The co-infection was significantly associated with urban dweller, the most sexually active and reproductive age group of 31 to 40 and female gender who are TB patients. Thus, there is the urgent need for programmatic revision of ongoing intervention strategies for TB, strengthening of health systems infrastructure, targeted capacity building for health personnel and intensified public awareness on TB and HIV targeted interventions for women, people of sexually active and reproductive age group and urban dwellers. In consistence with principles of primary health care as stated by Alma Ata declaration, and to achieve better disease outcomes, intervention frameworks by the National TB and Leprosy Control Program that address TB and HIV co-infection should not only focus on the medical interventions of diseases, but should also integrate and improve socio-demographic factors that fuel both diseases. Further, health facilities offering DOTS services should ensure strict compliance with national guideline on TB management on offering HIV counselling and testing to all newly diagnosed TB patients.

References

[1]. Akinleye, O.M., Alo, O.G., Salami, O.O., Alaka-Coker, A.A., Idris, M.G. and Onyeoghani, N. (2015).
[2]. Tuberculosis and HIV co-infection among patients attending directly observed treatment short course (DOTS) in Lagos, Nigeria. Archives of Applied Science Research, 7 (7):69-74 (http://scholarsresearchlibrary.com/archive.html)
[3]. Alexander, K., Mirjam, K. and Klaus, K. (2010). Modern infectious disease epidemiology concepts, methods, mathematical models, and public health (on line –ausg. ed) New York: Springer.88.
[4]. Berhe G., Enquselassie F. and Aseffa A (2012). Treatment outcome of smear-positive pulmonary tuberculosis patients in Tigray Region, Northern Ethiopia. BMC Public Health. 12:537.
[5]. Centers for Disease Control and Prevention (2016). Division of HIV/AIDS Prevention, National Center for HIV/AIDS, Viral Hepatitis, Sexual Transmitted Diseases and Tuberculosis Prevention, Centers for Disease Control and Prevention. https://www.cdc.gov/hiv/basics/whatishiv.html. Accessed 21st December, 2016
[6]. Chen, J., Cao, W., Chen, R., Ren, Y. and Li, T. (2016). Prevalence and determinants of HIV in tuberculosis patients in Wuxi City, Jiangsu province, China: a cross-sectional study. Int J STD AIDS. Nov;27(13):1204-1212.
[7]. Christopher, C.A., Emeka, K. and Vivien, O.A. (2012). The Pattern of presentation and prevalence of
[8]. Tuberculosis in HIV-seropositive patients seen at Benin City, Nigeria. International Scholarly Research Network ISRN Pulmonology Volume, Article ID 326572, doi:10.5402/2012/326572
[9]. Daniel, l.M., Awoke, D. and Endalkachew, D. (2015). TB/HIV co‑infections and associated factors among patients on directly observed treatment short course in Northeastern Ethiopia: a 4 years retrospective study. Mekonnen et al. BMC Res Notes (2015) 8:666 DOI 10.1186/s13104-015-1664-0
[10]. Datiko, D.G., Yassin, M.A., Chekol, L.T., Kabeto, L.E. and Lindtjørn, B. (2008) The rate of TB-HIV co- infection depends on the prevalence of HIV infection in a community. BMC Public Health 8: 266.
[11]. Esmael A, Tsegaye G, Wubie M, Endris M. (2013) Tuberculosis and Human Immune Deficiency Virus
[12]. Co-infection in Debre Markos Referral Hospital in Northwest Ethiopia: A Five Years Retrospective
[13]. Study. J AIDS Clin Res 4: 263. doi: 10.4172/2155- 6113.1000263.
[14]. Eyasu E. (2014). HIV co-infection among tuberculosis patients on Directly Observed Treatment Short
[15]. Course in Western Ethiopia. National Science ;12(9):68-72]. (ISSN: 1545-0740). http://www.sciencepub.net/nature.
[16]. Erhabor, O., Jeremiah, Z.A., Adias, T.C. and Okere, C. (2010). The prevalence of human immunodeficiency virus infection among TB patients in Port Harcourt Nigeria. HIV AIDS (Auckl); 2:1-5.
[17]. Federal Ministry of Health (2010). "Department of Public Health National Tuberculosis and Leprosy Control Programme", Worker's Manuel.
[18]. Federal Ministry of Health Nigeria (2013). National HIV & AIDS and reproductive health survey, 2012 (NARHS Plus). Federal Ministry of Health Abuja, Nigeria
[19]. Global AIDS Update (2016). Joint United Nations Programme on HIV/AIDS (UNAIDS)
[20]. Gyar, S.D., Dauda, E. and Reuben, C.R. (2014). Prevalence of Tuberculosis in HIV/AIDS patients in Lafia, Central Nigeria. International Journal of Current Microbiology and Applied Sciences 3(6) 831-83
[21]. Houston, S., Ray, S., Mahari, M., Neill, P., Legg, W., Latif, A.S., Emmanuel, J., Bassett, M., Poznia,k A.,
[22]. Tswana, S., et al (1994). The association of tuberculosis and HIV infection in Harare, Zimbabwe. Tuberculosis and Lung Diseases Jun;75(3): 220-6.
[23]. Jeffrey, J.P., Hazel, G., Gregory, K., Marshall, P., Kelly-Anne, R., Mark, J.F. (2015). HIV testing rates and co-infection among patients with tuberculosis in south-eastern Sydney, 2008–2013. The Medical Journal of Australia 202 (5) · 16 March. doi: 10.5694/mja14.01490
[24]. Mor, Z., Lidji, M., Chemtob, D., Cedar, N., Grotto, I. (2014). HIV prevalence in the Israeli tuberculosis cohort, 1999–2011. BMC Public Health, 14:1090
[25]. Nwabuko, C.O., Ejele, O.A., Chuku, A., Nnonli, M.A., Chuhwunonye, I.I. (2012). Prevalence of
[26]. Tuberculosis-HIV co-infection and relationship between Tuberculosis and CD4+ Count/ESR in HIV patients in Niger Delta Region of Nigeria. IOSR Journals of Dent. and Med. Sci; 2(4): 01-04.
[27]. Nyobi BM, Kristiansen KI, Bjune G, Muller F, Holm-Hansen C (2008). Diversity of human immunodeficiency type 1 subtype in Kegera and Kilimanjaro regions, Tanzania. AIDS Res Hum Retroviruses. 2008; 24(6):761–769.
[28]. Nwachukwu, O.N., Onyeagba, R.A., Owanta, J.I., Okoronkwo, U.C. and Ononiwu, H.A. (2016).
[29]. Prevalence and patterns of multimorbidity of Tuberculosis, Human Immunodeficiency Virus and Diabetes Mellitus in Anambra State, Nigeria. Clinical Biotechnology and Microbiology 1.1: 1-8.
[30]. Okonkwo, R.C., Anyabolu A.E, Ifeanyichukwu M., Kalu S., Onwunzo M.C., Chukwuka C. (2013).
[31]. Prevalence of HIV Infection in Pulmonary Tuberculosis Suspects; Assessing the Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria. Advances in Life Science and Technology. ISSN 2224-7181 (Paper) ISSN 2225-062X (Online) Vol 14, 2013
[32]. Olanrewaju, O., Joshua, O.O., Olusoji, J. D., Mustapha, G., Christopher, A., Kelechi, E.O., Olayinka, A., Temitope, A., Adedayo, D. A., Eltayeb, O., Temitayo, O., Ayodele, A., Oyewole, L., Amos, O., David, M.D., Babatunde, 0.A., Ikeola, A.A., Franklin, C.I., Abiodun, H., Matthew, A.O. (2013). Factors associated with treatment success among pulmonary Tuberculosis and HIV co-infected patients in Oyo State, South West-Nigeria. The Nigerian Health Journal, Vol. 13, No 2, April -June.
[33]. Pefura Yone EW, Kuaban C, Kengne AP. (2012 HIV testing, HIV status and outcomes of treatment for tuberculosis in a major diagnosis and treatment centre in Yaounde, Cameroon: a retrospective cohort study. BMC Infect Dis 12: 190.
[34]. Pieniazek, D., Ellenberger, L.M., Janini, A.C. Ramos, J., Nkengasong, M., Sassan-Morokro, D.J., Hu, I.M., Coulibally, E., Ekpini, C., Bandea, A., Tanuri, A.E., Greenberg, S.Z., Wiktor, M. and Rayfield M.A. (1999). Predominance of human immunodeficiency virus type 2 subtype in Abidjan, Ivory Coast. AIDS Res Hum Retroviruses ;15(6):603–608.
[35]. Post, F.A., Grint, D., Werlinrud, A.M., Panteleev, A., Riekstina, V., Malashenkov, E.A., Skrahina, A.,
[36]. Duiculescu, D., Podlekareva, D., Karpov, I., Bondarenko, V., Chentsova, N., Lundgren, J., Mocroft, A., Kirk, O., Miro, J.M. (2014). HIV-TB Study Group (2014). Multi-drug-resistant tuberculosis in HIV positive patients in Eastern Europe. J Infect; 68: 259–263.
[37]. Seifu L. (2004). Socio-demographic and clinical profile of AIDS patients in Jimma Referral Hospital, Southwest Ethiopia. Ethiop J Health Dev 18(3):203– 207.
[38]. Smart, E.A. and Constancy P.A. (2015). Prevalence of Human Immunodeficiency Virus (HIV) among

[39]. Tuberculosis patients attending Directly Observed Treatment Short-Course (DOTS) Clinic in Port Harcourt, Nigeria. International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391
[40]. Teklu, T., Belyhun, Y., Tesfaye, S., Medhin, G. (2012). Trends of tuberculosis and HIV infections between 2004 and 2008 in Wolaita Sodo, Southern Ethiopia. Ethiop Med Journal Jan; 50(1):1-11.
[41]. Tessema B., Muche A., Bekele A., Reissig D., Emmrich F. and Sack U. (2009). Treatment outcome of tuberculosis patients at Gondar University Teaching Hospital, Northwest Ethiopia: a five-year retrospective study. BMC Public Health. 9:371.
[42]. World Health Organization (2016) 'Global Tuberculosis Report 2016'
[43]. Zhang, C., Li, X., Liu, Y., Qiao, S., Chen, Y., Zhou, Y., Shen, Z. (2016). Co-infections of tuberculosis, hepatitis B or C viruses in a cohort of people living with HIV/AIDS in China: predictors and sequelae. AIDS Care 21:1-4. doi: 10.1080/09540121.2016.1271388.

Omo-Emmanuel Ughweroghene Kingston. "HIV and TB co-infection among patients who used Directly Observed Treatment Short-course centres in Yenagoa, Nigeria ." IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) 12.4 (2017): 70-75.