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INFLUENCE OF ENVIRONMENTAL FACTORS ON INCIDENCE OF TUBERCULOSIS AMONG PATIENTS OF DIRECTLY OBSERVED TREATMENT SHORT-COURSE CENTRES IN IBADAN METROPOLIS, OYO STATE, NIGERIA

By

Odelola, J.O. & Lateef, K.O.
Dept of Human Kinetics and Health Education,
University of Ibadan, Ibadan.

Abstract
Tuberculosis is one of the major diseases causing prolong ill health conditions especially in the developing countries of which Nigeria is one. It is a disease that is associated with poor environment. In other words, filthy environment can pave way for the disease. The study examined environmental factors influencing incidence of tuberculosis among patients in Directly Observed Treatment Short – Course Centres in Ibadan Metropolis, Oyo State, Nigeria. Descriptive survey research design was employed. Proportionate and simple random sampling techniques were used to select 206 respondents as sample for the study. Three research hypotheses were tested. Self – developed and validated sets of questionnaire were used to collect data. The descriptive statistics of frequency counts and percentages were used to analyse the demographic data, while chi – square (X^2) and t – test were used to test the hypotheses at 0.05 alpha level. The finding showed that incidence of pulmonary tuberculosis was influenced by poor sanitary environment among patients of DOTS Centres in Ibadan Metropolis. It was also shown that there was no significant gender difference in factors that influenced among the patients. It was suggested that the State's Ministry of Health, non-governmental organisations and other stakeholders should intensify effort on public health education on environmental sanitation through symposia, seminars and conferences. State and Local Government Areas should strengthen the enforcement of environmental law and edit in Oyo State.

Introduction

Tuberculosis (TB) has become a public health problem. It has impacted negatively on the health of people of the world, most especially, in developing countries. Martin (2002) described TB as a leading cause of death in the world from a single infectious disease. An epidemiological study also revealed that an estimated amount of 4,700 victims die every day due to TB infection (World Health Organization, 2010). Similarly, studies have shown that the prevalence of TB is on the increase in developing countries (WHO, 2010;

Bermajo, Veeken and Berra, 2010). Bermajo, Veeken & Berra, (2010) cautioned that unless actions are taken, TB incidence in developing countries will double as the prevalence of HIV infection reaches 13 per hundred adults , in which 95% of the TB cases occur in developing countries.

TB is described as an infectious disease of humans and animals caused by the tubercle bacillus and characterized by the formation of tubercles on the lung and other tissues of the body, often developing long after the initial infection (American Heritage Dictionary, 2009). It spreads through the air when people who have an active mycobacterium tuberculosis infection cough, sneeze or otherwise transmit their saliva through the air. Crofton, Horne & Miller (1999) said that TB is caused by bacilli. There are types of bacilli, but tubercle bacillus (mycobacterium tuberculosis) is the main cause of TB all over the world. Other bacilli include, mycobacterium Africanum, bovine tubercle bacillus (mycobacterium) and non-tuberculous mycobacteria. Tuberculosis affects the lungs in 80% of cases, but it can affect any organ in the body. In 25% of the active cases, the infection moves from the lungs to cause other kind of tuberculosis collectively denoted as Extra Pulmonary Tuberculosis (EPTB). Tuberculosis of the lung is regarded as Pulmonary Tuberculosis (PTB), while Tuberculosis affecting other organs is referred to as Extra Pulmonary Tuberculosis. EPTB can affect vatebral spine, kidney and urinary tract, Upper respiratory tract (larynx), meninges of the brain (meningitis), lymph node and skin (National Tuberculosis and Leprosy Control Programme (NTBLCP) Worker's Manual, 2004).

It has been established that mycobacterium tuberculosis is the main cause of TB all over the world; however, there are factors that contribute to increase in the risk of tubercle bacillus, the risk of progression from infection to disease and risk of death among TB patients. Mohsin, Hafiz, Waqaz, Razia and Nazeer (2011) classified risk factors for TB into host- related and environmental factors. Host- related factors are conditions modifying the balance established in the body between the tubercle bacilli and the host immune defences. These include, immunosupression (that is, use of oral/ injectable steroids and HIV infection; co-morbids (diabetes, hepatitis, asthma and host of others); age; sex; alcoholism; smoking and malnutrition; while environmental factors include overcrowding, close contact with infected person, unemployment and homelessness.

Lienhardt (2001) found in a study that TB is a multifactorial disorder in which environment interacts with host-related factors. In the same study, he classified host-related factors as intrinsic and environmental factors as extrinsic to susceptible host. Environmental factors may have an impact on the incidence of tuberculosis in a given population as a result of their effect on both the risk of infection and the risk of disease once a person is infected. Smith, (1994) stated that persons exposed to an infectious tuberculosis

case in a limited or closed environment may experience an increased risk of infection as compared with persons living in non crowded quarters. Poor sanitary environment continue to play major role in TB infection.

TB is a disease that continues to ravage the health of the people in an increased magnitude. In the recent times, Oyo State was ranked 3rd among the states that have the highest TB prevalence rate in Nigeria, with 46.5% increase between year 2008 and 2010 (United States Embassy in Nigeria, 2012).

In an effort to control this trend, Oyo State Ministry of Health is putting effort to treat tuberculosis patients, scouts for suspect and treat defaulters through Tuberculosis and Leprosy Control (TBL) Unit, yet, the quarterly case findings in recent times revealed that there is no stability in number of newly diagnosed cases of TB in the State. Specifically, the findings showed that there is increase in the number of reported cases in the DOTS centres in Ibadan, most especially in the 3rd quarters between year 2010 and 2012 (Oyo State Tuberculosis and Leprosy Control Unit, 2012).

Pulmonary Tuberculosis is a contagious bacterial infection caused by mycobacterium tuberculosis (Martin, 2002).The disease primarily affects lung thereby causing pulmonary tuberculosis. The disease can be contracted by breathing in air droplets from a cough or sneeze of an infected person. The causative organism is a small aerobic, nonmotile bacilus. It can withstand weak disinfectants and survive in a dry state for weeks and can flow only within the cells of a host organism.

Generally, the symptoms of TB depend on the site where TB bacteria are growing in the body. Mycobacterium tuberculosis may cause disease in any part of the body but the lung is the usual site where the bacterium slowly destroys the tissue of the lungs. Common symptoms of pulmonary tuberculosis include a cough that lasts for more than three weeks; loss of weight for no obvious reason; fever, production of blood-stained sputum, heavy night sweats; a general and unusual sense of tiredness as well as loss of appetite.

Tuberculosis has for centuries, continued to remain a public health problem of great importance, particularly in the developing countries; taking a heavy toll on those at their prime of life. TB is still a major public health problem in Nigeria, with the country ranking 4th among the 22 high TB burden countries which collectively bear 80% of the global burden of TB (WHO 2012). WHO (2012) documented that the number of TB cases notified in the country increased from 31,264 in 2002 to 90,307 in 2008, with more than 450,000 TB cases treated in the past 5 years in the country. WHO further said that TB burden in Nigeria is compounded by the ongoing HIV/ AIDS epidemic and the emergence of Multi-Drug Resistant Tuberculosis (MDR-TB) (WHO, 2012). According to USAID (2012) 93,050 cases of tuberculosis TB were notified in Nigeria in 2011. The TB burden in Nigeria is

on the high side. Despite the nations rising TB detection rates and programme coverage, many TB cases are still undetected. The high rates of TB/HIV co-infection result is a significant health challenge in the HIV/AIDS response.

Predisposing factors to Tuberculosis

I. *HIV infection and tuberculosis:* The combined burden and effect of TB and HIV/AIDS co-infection is immense. The global burden of TB is increasing, largely due to the spread of HIV/AIDS. HIV-infected persons are far more susceptible to TB, are more difficult to diagnose and in addition are more difficult to treat, therefore, HIV is a major risk factor of TB. HIV infected people have a much higher mortality in the period following TB treatment with 30% dying within a year of diagnosis and treatment (Nutrition Information Centre of the University of Stellenbosch, 2011),

Bartoloni and Strohmeyer (2003) affirmed that about one-third of people infected with HIV were also infected with TB, of which 70% were in Africa, 20% in Asia and 8% in Latin America. According to United States Embassy in Nigeria (2012) the TB burden is compounded by a high prevalence of HIV in the country which stands at about 4.1% in general population. The prevalence of HIV among TB patients increased from 2.2% in 1991 to 19.1% in 2001 and 25% in 2011. This indicates that the TB situation in Nigeria is HIV-driven.

II. *Environmental condition and tuberculosis:* TB has been linked with environmental factors. Environmental mycobacteria are emerging pathogens causing opportunistic infections in humans and animals. The health impacts of human –mycobacteria interactions are complex. Environmental micobacteria preferentially survive chlorination in municipal water, using it as a vector to infects human (Primm, Lucero and Falkinham, 2004).

Poor environment as a result of exposure to dust and chemical fume under working condition are associated with adult pulmonary tuberculosis (Dong, Ge and Liu, 2001). By the same token, it could be said that filthy environment can pave way for tuberculosis infection.

III. *Overcrowding and Tuberculosis*: Aidan (2012) found that crowded conditions (measured in term of the number of people per household) are associated with increased incidence of cold, asthma influenza, TB and host of other diseases. In the same study it was revealed that risk factors for tuberculosis rates were significantly higher in households with more than one person per room. Liendhart (2001) reported that a greater degree of

shared airspace increases exposure to mycobacterium tuberculosis infections.

The control of Tuberculosis: Tuberculosis control is the attainment of reduced incidence and prevalence of disease in a given community. TB control is said to have been achieved according to WHO when the prevalence of natural infection in the age group 0-14 years is in order of 1 percent (Park, 2009). The control measures for TB being an infectious disease should generally include prevention, case finding and treatment.

World Health Organization in 2006 initiated stop TB Programme which has short term aim of reducing the incidence of new TB cases to 50% by 2013 and the long term goal of reducing annual TB incidence to less than 1 case per 1 million people by 2050. Directly Observed Treatment Short-Course (DOTS) is the cornerstone strategy of stop TB Programme. It is a strategy to ensure cure by providing the most effective procedure and ensuring through close monitoring that it is taken by the patient. Oyo State has forty-four DOTS centres spread across the six health zones in the state.

Ibadan is the capital of Oyo State in Nigeria and is also regarded as the largest city in West Africa. Ibadan Metropolis comprise five (5) Local Government areas, namely, Ibadan North, Ibadan North West, Ibadan North East, Ibadan South West and Ibadan South East Local Government Areas of Oyo State. Directly Observed Treatment Short-Course (DOTS) Chemotherapy is a strategy to ensure cure by providing the most effective medicine and provide adequate supervision of patients' compliance to treatment regimen. In line with the DOTS' guidelines, Oyo State Ministry of Health in collaboration with other stakeholders inaugurated a committee in 2010. The committee was saddled with the responsibility of controlling TB and HIV/AIDS within the state. Effort was made to treat TB patients; scout for suspects and trace defaulters through tuberculosis and Leprosy Control (TBL) unit. However, the quarterly case findings in recent times (2010 to 2012) revealed that there is increase in the number reported cases (Owolabi, 2010 and Oyo State TBL Unit, 2012). Oyo State was ranked 3rd among the states that have the highest TB prevalence rate in Nigeria with 46.5% increase between 2008 and 2010 (United States Embassy in Nigeria, 2012). The TB infection continues to increase in an alarming rate, especially in Oyo State. The situation no doubt requires an urgent attention.

Smith (1994) and WHO (2010) established that predisposing factors increase the risk of Mycobacterium Tuberculosis. Lienhardt (2001) reported that few studies investigated the association of TB with overcrowding and socioeconomic status as well as possible reasons for the rise in the TB epidemic in Africa. The prevention of TB requires a broad based approach

(including investigation into the influential factors). Therefore, the study was set to examine influence of environmental factors on incidence of tuberculosis among patients of Directly Observed Treatment Short-Course Centres in Ibadan Metropolis, Oyo State, Nigeria.

Methodology

Descriptive survey design was used for the study. According to Thomas and Nelson (2001), a descriptive research identifies problem, makes comparison, evaluates and collects factual detailed information that describes the existing phenomena. The population comprised PTB patients of DOTS Centres in Ibadan Metropolis, Oyo State, Nigeria. Proportionate sampling technique was used to determine 30% of the respondents drawn from each of the five (5) selected DOTS Centres across the LGAs in the Metropolis based on 2011 3rd quarter case finding of PTB in Oyo State. Thus, 206 respondents were sampled. Simple random sampling technique was employed to give each of the respondents in the selected DOTS Centres an equal and independent chance of being included.

In order to examine influence of environmental factors on incidence of TB among patients of DOTS centres in Ibadan, Oyo State, Nigeria, a self developed instrument was used. It was named Environmental Factors Influencing Tuberculosis Questionnaire (EFITBQ). Section A of the questionnaire recorded demographic characteristics of the respondents' gender, age, marital status, tribe, religion, occupation, educational background and Local Government Area. EFITBQ (15 items) was in a 4-point modified Likert format using 1: Strongly Agree (SA) and 4: Strongly Disagree (SD). The questionnaire was validated by experts in the field of Health Education as the reliability was also tested. The reliability value of the instrument was .85.

Result and Discussion

Hypothesis 1: Poor sanitary environment will not significantly influence the incidence of TB among patients of DOTS Centres in Ibadan Metropolis.

Table 1: Chi- square analysis of pulmonary tuberculosis patients' responses on poor sanitary environment

	Poor sanitary environment				Total	X^2 Crit.	X^2 Cal.	Df	P
	SA	A	D	SD					
Q1	51 24.8%	48 23.3%	78 37.9%	29 14.1%	206 100.0 %				
Q2	49 23.8%	41 19.9%	77 37.4 %	39 18.9%	206 100.0 %				
Q3	98 47.6%	28 13.6%	62 30.1%	18 8.7 %	206 100.0 %	16.9	40.95	9	.000
Q4	68 33.0%	48 23.3%	66 32.0%	24 11.7%	206 100.0 %				
Total	266 32.3%	165 20.0%	283 34.3%	110 13.3%	206 100.0 %				

From the above table, the chi-square (X^2) result indicates that the calculated value of 40.95 was greater than the table value of 16.9 at df 9 and 0.05 level of significance. This indicated that poor sanitary environment significantly influenced the incidence of TB among patients of DOTS Centres in Ibadan Metropolis. The null hypothesis is hereby rejected. This might be connected with indiscriminate dumping of wastes which is noticed to be prevalent in the affected Local Government Areas. The finding is in line with study of Dong, Ge and Liu (2001) which revealed that poor environment and exposure to dust and chemical fumes under working condition combined with smoking were the risk factors of adult PTB. They also found that living space, degree of darkness and moisture are strongly associated with PTB infection in Chengdu, China.

Hypothesis 2: Overcrowding will not significantly influence the incidence of TB among patients of DOTS Centres in Ibadan Metropolis.

Table 2: Chi- square analysis of pulmonary tuberculosis (PTB) patients' responses on overcrowding

	Overcrowding				Total	X^2 Crit.	X^2 Cal.	Df	P
	SA	A	D	SD					
Q1	44 2.4%	25 12.1%	106 51.5%	31 15.04%	206 100.0 %				
Q2	37 18.0%	29 14.1%	103 50.0 %	37 18.0%	206 100.0 %				
Q3	46 22.3%	39 18.9%	93 45.1%	28 13.6 %	206 100.0 %	12 59	6.64	6	355
Total	127 20.6%	93 15.0%	302 48.9%	96 15.5%	206 100.0 %				

In table 2, it was revealed that the X^2 calculated value of 6.64 was less than the table value of 12.59 at df 6 and 0.05 level of significance. This shows that overcrowding had no significant influence on progression from infection

to disease (PTB) among patients of DOTS Centres in Ibadan Metropolis. The null hypothesis is hereby accepted. Insignificance of overcrowding as an influential factor of PTB infection among patients might be connected with noncrowded apartment which most of the respondents live in.

Hypothesis 3: There will be no significant difference in influential factors of TB between male and female patients of DOTS Centres in Ibadan Metropolis.

Table 3: Analysis of t-test showing difference in factors influencing incidence of tuberculosis based on gender

Gender	N	Crit. – t	Cal – t	Df	P
Male Female	118 88	1.96	.092	204	.927

From the above table, the t-test result indicates that the calculated value (cal.-t) of 0.92 was less than the table value (crit.-t) of 1.96 at df 204 and 0.05 level of significance. This indicated that there was no significant difference in influential factors of PTB between male and female patients of DOTS Centres in Ibadan Metropolis. The null hypothesis is hereby accepted.

Conclusion

The role of environmental factors in the susceptibility and development of tuberculosis was found significant. Male and female of the sample used for the study were unanimous in their attitudinal response to the role of environmental factors in the causation of TB.

Environmental related diseases of which TB is one continue to ravage the health of the people in an unacceptable magnitude. There is the need to curb human activities that are implicated in environmental pollution. It is along this line that the following recommendations are made:

i. Health education incorporating environmental education as well as disease education should be intensified in institutions of learning in Nigeria.

ii. Inspectorate division of state Ministry of Health should ensure sanitation of the environment through proper disposal of wastes. Provision must be made for wastes disposal equipment and facilities by government.

iii. Public health education on TB causes, prevention and control through seminars, symposia, conferences, radio and television programmes should be provided by government and non-governmental organizations.

iv. People who have been infected with TB should be encouraged by friends, family, community to seek for early treatment.

v. Proper planning for urban areas in terms of building specifications drainage systems and infrastructures should be provided by relevant government agencies.

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