Science Arena Publications
Specialty Journal of Medical Research and Health Science
ISSN:2521-3172
Available online at www.sciarena.com
2019, Vol, 4 (4):71-79

Correlation Assessment and Social determinants of Tuberculosis disease and Attributable Death rate Surveillance in Nigeria, 2010-2016

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Abstract: *Introduction: Nigeria is one of the countries with highest burdens of tuberculosis (TB) in the world with estimated incidence of 158 per 100,000 populations. Tuberculosis (TB) spread pattern is influenced by geographic and social factors. Nowadays Integrated Disease Surveillance and Response (IDSR), technical procedure is one of the most important epidemiological instrumentation identifying high-risk population groups and geographic areas of TB. The aim of this study was to determine the correlation between the prevalence of TB and Attributable Death in different climate condition in Nigeria during 1990-2016.Method:Through an ecological study, sample size of 18,011was randomly selected by systematic random sampling and 14743 for the prevalence of TB incidence and 3268 was selected for the attributable death rate in the country.Data were analysed through SPSS software. Independent t-test, ANOVA, Linear regression, Pearson and Eta correlation coefficient with a significance level of less than 5% were used for the statistical analysis. Result: The highest mean of TB cumulative incidence was recorded between the age range (50-69) years and Attributable death rate was observed between the age range (15-49) years. There was a significant inverse correlation between prevalence of TB and Attributable death rate incidence rate. The lowest prevalence of TB and attributable death rate incidence was shown from the graphbetween the ages (under 5) years. Conclusion: The study shows that the risk of TB disease has a strong relationship with climate condition especially with age range between (50-69) years. Moreso, this study suggests that additional efforts are still needed to ensure that Nigeria is not left behind in the current global strategy to end TB disease.Reducing TB disease incidence in the country will require a multipronged approach that includes increased funding, health system strengthening and improved TB surveillance, as well as preventive efforts for alcohol use and smoking in the country. Recommendations were made for future research and development.*

Keywords: *Prevalence of Tuberculosis, Attributable of Death rate, Climatic condition, Integrated Disease Surveillance and Response*

INTRODUCTION

Tuberculosis (TB) is a contagious disease caused by *Mycobacterium tuberculosis*. It spreads from one person to another through inhalation of air droplets(Ahmad et al., 2018). The disease is primarily transmitted

through the respiratory route by coughing or sneezing (Amani et al., 2007). The disease mostly attacks the lungs but can also affect other organs such as kidney and brain (Aruna et al., 2018). It can promote the course of human immunodeficiency virus (HIV) infection into acquired immune deficiency syndrome (AIDS) (Balogun et al., 2015). According to the World Health Organization (WHO) global TB report, it is estimated that 10.4 million incident cases in 2016 developed the disease, of which almost 1.7 million patients died (Cadmus et al., 2018). This agency has ranked TB as the leading cause of death among HIV patients, the most common killer from a single infectious agent, and the 9th leading cause of death, worldwide.

According to the statistics by theWHO Tuberculosis (TB) disease remained one of the prevalent communicable diseases globally. Its significant rate in developing countries like Nigeria has remains a fascinating global public health concern. Therefore, this study is done to provide a direction for future research and development. The research paper examines the epidemiology, surveillance status, policy, practices, guidelines, laws and challenges of tuberculosis (TB) in the country. There are many factors that influence the spatial distribution of TB, which has made the disease a multidimensional and complex public health problem (Cantwell et al., 1998; Ghalavandi and Sayemiri, 2014) Previous researches from different parts of the world have demonstrated that TB transmission is related with various individual factors, for example, age, gender, education level, race, migration, drinking alcohol, and presence of diseases (such as HIV and diabetes) (Harling and Castro, 2014; Health Protection Agency). Moreover, at the ecological level, factors such as climate, altitude, air pollution, economic level, unemployment rate, and poverty have found significant on TB occurrence (Ibrahim et al., 2015; Jia et al., 2008). The global burden of disease in terms of disability adjusted life years (DALY) is in the 10th rank. It is expected that TB remains in this position until 2020 or clime up to 7th rank. More than 90% of TB occurs in developing countries.(Dorman *et al* 2010)

Approximately 75% of TB in mentioned countries belongs to economically active age group (15-54-year-old) (Kistemann et al., 2002). TB incidence varies in different parts of the world, so that TB incidence in Africa is 365 per 100,000 (Krieger et al., 2003), in London 5 per 100,000 (Kuyinu et al., 2016), about 21 per 100,000 I n Spain, 4.5 per 100,000 in America andthe average in the world is 13 cases per 100,000 (Lalvani et al., 2001). TB incidence is 25 per 100,000 in Nigeria (Lasebikan and Ige, 2016). According to WHO reports, 9.6 million people are estimated to have fallen ill with TB in 2018: 5.4 million men, 3.2 million women and 1.0 million children. An estimated 1.2 million people live with HIV developed TB in 2016(Mahara et al., 2018). Most of TB new cases was in Asia (55%) and in Africa (30%) and the lowest TB cases was related to the East Mediterranean region (7%), Europe (4%) and in America (3%) in 2010 (Medecins Sans Frontieres, 2017). TB based on effective geographic and social factors has a particular pattern. Understanding this pattern is effective to plan TB control and can be useful for health managers (Ogbo et al., 2018). One of the main applications of epidemiology is facilitate the identification of geographic regions and vulnerable groups that are at greater risk of morbidity and mortality of TB. Identification of geographic areas and high-risk groups contribute to selection proper social and health measures in other to reduce risk factors.(Dye *et al* 1999)

The factors mentioned are common in Nigeria. As a result of no proper health care from the Ministry of Health and nonchalant attitude from the affected people in the country (Sh, 2007),stated that Nigeria was rated fourth among the countries with the highest burden of TB. Similarly (Smith et al., 2003), reported prevalence trends of TB in Nigeria to be 158 per 100,000 people in Nigeria, and the total number of TB attributable deaths was 39,933 in 2016.

World Health Organisation (WHO) statistics of 2018 indicates that out of ten (10) million infected with TB globally, 1.6 million mortality from the disease was recorded in 2018 (Sreeramareddy et al., 2013). More so, an estimated number of 104,904 cases of the disease was reported in 2018, with 102,387 new relapsed cases of the disease in Nigeria. (Hawker et al, 1999)

Control of TB in Nigeria is under the coordination of Nigeria's National Tuberculosis and Leprosy Control Program (NTBLCP). The agency targets to eliminate TB in the country to less than 1 case per 1,000000 population by the year 2050. This target could be achieved but for the many hitches hindering the agency's

success (Sun et al., 2015), reported that over 80% of TB cases are not detected in the country as of 2018. This is an indication that the 2050 target may perhaps be a mirage if the current problems are not adequately addressed. An active surveillance system will be a vital tool in addressing these problems generally in Public health. Surveillance is non-stop, orderly collection, investigation, and interpretation of the outbreaks of diseases and the disease-related factors (Ukwaja et al., 2017). The findings are then used in the eradication of diseases like TB cases and surveillance is therefore vital in helping nations monitor and assess emerging patterns and trend of the diseases, and thus, contributes to better prevention andmanagement of diseases.

Challenges to effective Tuberculosis Surveillance in Nigeria

Fear of stigmatization and inadequate awarenessonTuberculosis: Lack of people's awareness of early signs and diagnosis of TB has led to many mortality incidences. TB patients are mostly diagnosed at the critical stages, which consequently led to the non-survival of many. This perhaps, could be due to fear of being labelled as TB carrier. Stigmatisation is identified to be one of the significant problems of detection, prevention and control of the disease in Nigeria (Weizhong and Li, 2017). Over 80% of Tuberculosis cases are undetected due to lack of knowledge about disease and fears of stigma (Sun et al., 2015). Furthermore, significant similarities of TB with HIV/AIDs can also be attributed as misconception factor influencing population nonparticipation in testing. Most critical of the stigma is the non-confidentiality of TB patient's data and identity (Whalen et al., 1995), also noted that many of the TB patients are facing unfriendly attitudes from health personnel. In Nigeria, there is an increase in the TB surveillance with technological advancements and tightening efforts of syndromic notification of disease in the country. There is a high proportion of undiagnosed TB patients in the country, which is a considerable obstacle for achievement target of less than one TB case per one million population in the country by the year 2050. The central government have an ethical obligation to implement services and ensure confidentiality with patient's privacy and data protection based on the WHO policy of handling TB endemic (WHO, 2018). Moreover, compliances with the standard relate to loopho, les, as many patient's inability to communicate in the clinics and overcrowding of patients due to inadequate facilities especially in rural health care centres (WHO2017).

The end TB initiative initiated new diagnostic testing. This placed emphasis on the accuracy of rapid growth detection, simplicity and reliability of possible TB detection globally (Aruna et al., 2018). The test is done by the collection of three sputum samples for testing diagnosis and two for follow-up diagnostic confirmation, furthermore HIV patients are subjected to Extra-pulmonary TB (WHO, 2017).The strategy used for surveillance of Tuberculosis disease in Nigeria is the Integrated Disease Surveillance and Response (IDSR), it was established and implemented in 1998 for Sub-Saharan Africa as the comprehensive regional public health approach.The country approved the IDSRTechnical Procedures, which showcased operations and procedures for reporting significant diseases, as well as improving universal access toTB diagnosis and treatment through the strategic increase of facilities (Wubuli et al., 2015). However, the system is used for the surveillance of TB together with 40communicable and non-communicable diseases (Wubuli et al., 2015). Despite the effort of the federal Ministry of Health (FMOH) the TB patients faces indirect expenses from loss of income, considerable out-of-pocket expenses for transport and nutritional supplementation(Zaragoza Bastida et al., 2012).

Materials and Methods

Location of study

This ecological study in the field of environmental epidemiology was conducted in Nigeria, officially known as Federal Republic of Nigeria, is a country that is located on the western coast of Africa. The country features 36 States and 774 Local Government Area with an estimated population of 178.5 million, ranking 7th in the world with TB incidence. The total surface area of the country is approximately 923,768 Square kilometres,

the density of Nigeria is around 212.04 individuals per sq km. This country also has the highest population of any African nation, and much of this population resides in the south and south western areas.

TB information

DataonallreportedTBcasesin Nigeria between1990and2016wereobtainedfromthe paper (Smith, 2003). In the Tropical Medicine and Health, Journal of Preventive Medicine. Statistics and required data (address of resident, year of incidence and age of patients) were gathered from the paper. The prevalence trends of TB in Nigeria were 102,387 and the total number of TB attributable deaths was 39,933 in 2016, since the beginning of 1990 until the end of 2016. Presently thousands of new patients have been diagnosed with TBthrough the 36 States and 774 Local Government Area in the country.

GIS maps

The GIS maps of TB incidence in 2017, for countries including Nigeria with scale of 1:1000000 include: political boundaries map (Country) and climate conditions map, was elicited from Forest and Rangeland through the Countries.

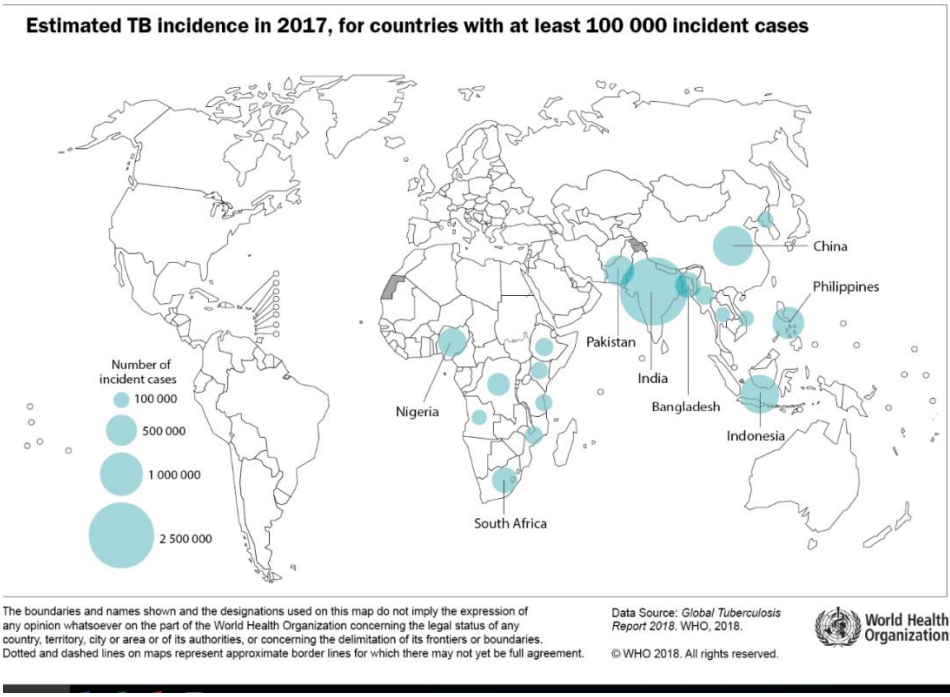

Figure 1:Estimated TB incidence in 2017, for countries with no less than 100 000 incident cases.

Sample size, and Data analysis

To data analysis, SPSS ver. 16and R version 3.3.2 were used. Relationship between the prevalence of Tuberculosis and death rate in different parts of the country (Nigeria) and environmental parameters including climate conditions and was determined by Means plot, Scatter plot, Independent t-test, and one-way ANOVA, Pearson and correlation coefficient. The TB cumulative prevalence of Tuberculosis and attributable death rate was calculated with use of information data gathered between 1990 and 2016. We calculated sample size using a power of 90% and 95% confidence interval. The highest cure rate of 63.5% achieved in 2016 was used as the proportion of interest with degree of precision of 0.05. Using a sample size of 18011. The TB central register which contained names of all patients diagnosed and registered for treatment was used to determine the sampling frame. Of the 1,440,229 patients eligible for the study, 14,743 were selected for prevalence of TB incidence and out of the 39,933 attributable death for the study, 3268were selected by

systematic random sampling. We performed descriptive, bivariate, and multivariate analysis and odds ratios were used to compare categorical variables at 95% confidence intervals.

Table 1: Central measures frequency (%) of TB Prevalence incidence and attributable Death rate in difference climate conditions in Nigeria between the years (1990-2016).

Age group in years	Sex		Total Frequency (%)
	Prevalence of TB Frequency (%)	Death Frequency (%)	
Under 5	829 (5.6)	72 (2.2)	901 (5.0)
5 – 14	1,530 (10.4)	183 (5.6)	1,713 (9.5)
15 – 49	3,659 (24.8)	1,088 (33.3)	4,747 (26.4)
50 – 69	4,745 (32.2)	1,016 (31.1)	5,761 (32.0)
70 above	3,980 (27.0)	909 (27.8)	4,889 (27.1)
Total	14,743 (81.8)	3,268 (18.2)	18,011 (100)

Discussion

In Nigeria, the prevalence of TB incidence people was 81.8%, theTB incidence rate was 158 per 100,000 population, and the total number of TB mortality was 39,933 in 2016. From 2000 to 2016, the age-standardised prevalence, incidence and mortality rates dropped considerably, with variations across the age groups. The number of TB incidence in Nigerians varied across the age groups; highest in those aged 50–69 years, followed by people aged 15–49 years and children under 5 years in 2016.

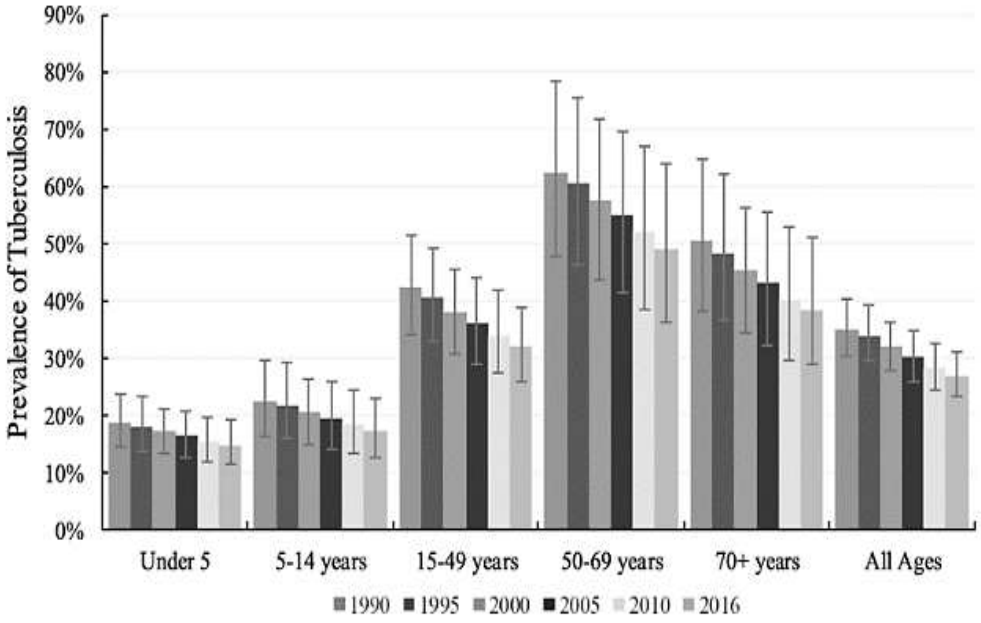

Figure 2: Annual prevalence of TB incidence age groups in Nigeria between 1990 and 2016

The graph above displays the highest prevalence among the people aged between 50 to 69 years and lowest among the children below five years of birth. Perhaps, the 50 to 69 age group could be the stage where the accumulation of behaviour manifests as TB.

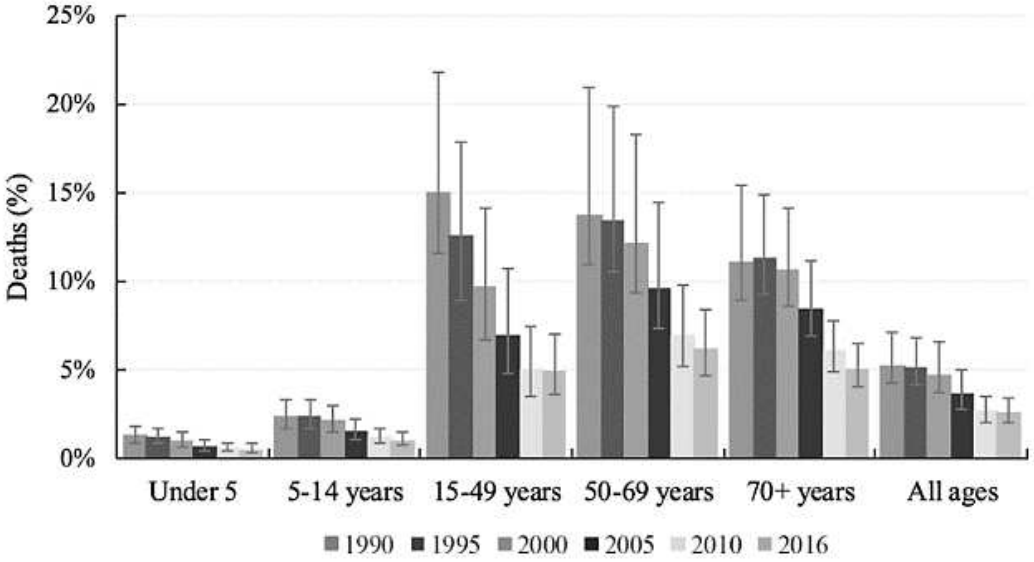

Figure 3: Annual deaths rate from TB by age groups in Nigeria Between 1990 and 2016.

Figure 3 shows the decrease in TB prevalence and mortality from 1990 to 2016 in Nigeria even with fluctuations in years. The incidence of tuberculosis in Nigeria is significanthaving 5% of overall global incidences.Across the age groups; highest in those aged 15–49 years, followed by people aged 50–69 years and children under 5 years in 2016. Alcohol use accounted for the highest number of deaths attributed to TB incidence in 2016,

Results

Total sample sizes of 18,011 were randomly selected using systematic sampling, 14,743 (81.8%) were prevalence of TB with the mean age of 39.3 ±18 yr and median age of 35 ±6.5 yr were evaluated. 3,268 (18.8%) were attributable death rate of TB with mean age of 36.8 ±16.7 yr and median age of 34 ±6.2 yr were evaluated.The mean age of prevalence of TB was 2.5 yr more thanattributable death rate and this difference was statistically significant (P= 0.005). Based on our findings, there was high TB incidence rate between the range of (50-69)years followed bythe age range between (15-49) years and the TB incidence rate (under 5) have the least TB cases in the country. More so, the results of our findings showed that there was high death rate between the age of (15-49) years followed by the age range between (50- 69) years and the least TB incidence death rate is within the age under 5 years. The results revealed a statistically significant relationship between the prevalence of TBand attributable death rate and the climate conditions. The prevalence trends of TB in Nigeria were 158 in 100,000 people, and the total number of TB attributable deaths was 39,933 in 2016 (Smith, 2003). This study further shows decreases in prevalence and death cases from 2000 to 2016 in the country, but disease resurgence is also shown in figure 2. This could be due to factors such as population growth, urbanisation, improper management, changes in the weather and climate due to the climate change and socio-economic inequalities as these are TB determinants and are also high in Nigeria. Also, the same pattern of decreasing burden is observed in the mortality trends is shown in Figure 4

Conclusion

Even with the efforts put in eradicating TB, Nigeria is among the countries with the high rate of tuberculosis cases globally and most of the TB cases are not detected in the country due to the challenges hindering the success of the current disease surveillance and notification in the country.

Recommendations for Further Study

Education and Awareness: Government need to develop robust and sustainable platforms for educating, enlightening the populace on tuberculosis. Additionally, create a platform for training and retraining of health workers on their professional ethics through symposiums, exhibitions, seminars as well and retraining of health workers at all levels.

Research and Development Priorities

Research and development innovations will pave the way for the policymaker to evaluate, review and improve sustainable surveillance, prevention and control of TB in the country. However, should be per socio economic factors of geopolitical zones of the country.

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