PAMJ One Health
Pan African Medical Journal

Research

Epidemiology of pulmonary tuberculosis in Maiduguri Metropolis, Northeastern Nigeria: a hospital-based retrospective study (2003-2012)

Fraideh Brisibe[1], Saleh Mohammed Jajere[1,&], Rilwanu Salihu Isah[1]

[1]Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria

[&]Corresponding author: Saleh Mohammed Jajere, Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria

Received: 30 Mar 2020 - Accepted: 23 Apr 2020 - Published: 01 May 2020

Domain: Infectious diseases epidemiology, Public health, Respiratory diseases

Keywords: Maiduguri Metropolis, Northeastern Nigeria, pulmonary tuberculosis, retrospective study

Abstract

Introduction: tuberculosis is ranked alongside HIV as a leading killer disease worldwide. In 2018 alone, World Health Organization estimated that 1.5 million people died of TB-including 251 000 people with HIV-and a further 10 million TB cases globally. This study is aimed at determining the prevalence of pulmonary tuberculosis (PTB) among patients attending chest clinic located within the Maiduguri Metropolis council, Northeastern Nigeria from 2003 through 2012. **Methods:** this study is conducted retrospectively, utilizing hospital records from patients attending Borno state chest clinic referral centre. Data on age and sex of patients were also recorded during data collection and retrieval from the hospital records. **Results:** a total of 13,886 patients were registered and attended the referral clinic for tuberculosis examination during the study period (2003-2012), of which 58.4% were males and 25% patients aged ≤15 years. The mean age of patients was 35.5 ± 10.3. Out of these patients, 3,150 patients were confirmed positives, given an overall prevalence of 22.7% (95% CI: 22.0 - 23.4). Compared with other age groups, patients aged between 26 - 35 years had three times the risk of PTB (RR = 3.0; 95% CI: 2.05 - 4.00; $p < 0.0001$). Similarly, male patients were 1.3 times as likely to develop the disease as compared with the female patients during the study period (RR = 1.3; 95% CI: 1.22 - 1.39; $p < 0.0001$). **Conclusion:** despite its limitations, this study like other similar studies reveals that PTB still remains an important public health threat in the study area. It is further recommended that a review of the current government policy on the prevention and control of tuberculosis be carried out.

Research | Volume 2, Article 1, 01 May 2020 | 10.11604/pamj-oh.2020.2.1.22570

Available online at: https://www.one-health.panafrican-med-journal.com/content/article/2/1/full

Introduction

Tuberculosis (TB) caused by *Mycobacterium tuberculosis*, a member of mycobacterium complex, is one of the leading infectious diseases responsible for nearly two million deaths each year mostly seen amongst adults worldwide. TB is transmitted through air (airborne), making it difficult to be controlled. The disease is characterized by the formation of granulomas and cell - mediated hypersensitivity reaction [1]. It still remains a major public health threat particularly endemic in developing countries [2] and is ranked alongside Human Immunodeficiency Virus (HIV) as a leading killer infectious disease worldwide. Most cases of TB occur in developing countries of the world, with an estimated 88 million and 30 million respectively for the incidence and mortality rates for the years 1990 - 1999 [3]. In 2011 alone, there were an estimated 8.7 million new cases of TB and 1.4 million deaths attributable to TB amongst which almost one million deaths occurred in HIV - negative and 430,000 in HIV - positive people [3].

The risk of developing active TB is significantly increased following co-infection with HIV. Infection with HIV is a major risk factor for TB and this promotes quick progression from latent infection with *Mycobacterium tuberculosis* to active disease as well as increases the rate of TB recurrence [4,5]. Thus, due to the HIV upsurge and burden, the incidence of TB in Africa has increased over the past decade. The emergence of Multi-Drug Resistant TB (MDR-TB), which is resistance to two or more drugs in the first line standard TB treatment regimen, has lead to a major public health concern as it can easily circulate and spread among human populations, difficult to treat and hence, increased treatment costs and mortality rates [6]. The MDR-TB results from misuse, poor delivery and adherence of TB treatment worldwide [6]. The World Health Organization (WHO) classified Nigeria as a high MDR-TB burden country, because about 2.9% of all TB cases in the country have MDR-TB [3].

In terms of the number of new TB cases, Nigeria is currently ranked third, behind china and India among the 22 high TB burden countries globally. Recently, WHO reported that 590,000 new TB cases occurred in 2013 alone and of these figures, about 140,000 were HIV - positive [3]. It is estimated that about 25,000 people die from TB every year, of which 85,000 are HIV - positive. Thus, TB accounts for > 10% of all deaths in Nigeria [3]. The annual incidence rate of TB has significantly increased in the country, between 1990 and 2007 from about 174 to 352 per 100,000 populations [7]. The HIV prevalence among TB patients increased from 2.2% in 1991 to about 27% in 2008, further suggesting that HIV remains a powerful risk factor for developing TB.

In Nigeria, as in most developing countries, there are inadequate facilities and ill-equipped laboratories makes it difficult for the bacteriological isolation of *Mycobacterium tuberculosis* [8]. This is further complicated by the poor implementation of TB control programmes and the presence of porous borders allowing the easy movements of humans and their livestocks especially along the Republics of Chad, Niger and Cameroon-all with endemic TB status-in Nigeria. Currently, there is paucity of epidemiological data regarding Pulmonary TB (PTB) in Maiduguri, Northeastern Nigeria [9,10]. Therefore, this study was undertaken with the main aim of determining the annual prevalence of PTB retrospectively using hospital records for a period of ten years (2003 - 2012). The association of factors such as age and sex with PTB were also determined. It is also expected that the information on the current status of PTB obtained from the present study may serve as a reference point for embarking on a further robust epidemiological study.

Methods

Study area: Maiduguri is located in the Sahel Savannah region of North - Eastern Nigeria at 11°50^{l} - 11.83° north latitude and 13°09^{l} - 13.15° east longitude. Its altitude is about 350 metres above sea level. It is estimated to have a population of about 1,907,600 as at 2007. It has dominant muslim residents and a considerable christian population from southern part of the state. Ethnic groups comprise majority of Kanuri, Hausa, Shuwa, Bura, Marghi and Fulani tribes. The climate is favourable, with a mean annual rainfall and temperature of about 650mm and 32°C respectively. The months of March and April are the hottest periods of the year with temperatures ranging between 30°C and 40°C. Borno State Chest Clinic is a private owned hospital/clinic located in Jere Local Government Area of Borno state, which is part of the Maiduguri Metropolis council, the Chest clinic is located at the Sir Kashim Ibrahim road within Maiduguri Metropolis council of Borno state. Alongside University of Maiduguri Teaching Hospital, Federal Neuro-Psychiatric Hospital, State Specialist Hospital of Maiduguri and other few private owned hospitals all located within the Metropolis council, serve over 1.9 million population of Borno state for chest and other respiratory-related diseases.

Data retrieval and collation: a retrospective study was employed based on review of existing hospital records on sputum examination results, chest X - ray and tuberculin tests results for patients who had registered and attended Borno State Chest Clinic for tuberculosis examination from 2003 through 2012 periods. The data for the study were obtained from the Borno State Government Chest Clinic in Maiduguri, which routinely examines and treats patients with tuberculosis and other respiratory-related ailments. It is a referral centre for tuberculosis and other respiratory/lung-related ailments. Data records on sputum smear, chest X - ray and tuberculin tests were obtained from relevant hospital record books as accurately as possible. All the data were collected for only patients attending the referral chest clinic from 2003 through 2012 study period. Data records on the number of patients attending the clinic during the study period and number of patients with pulmonary tuberculosis (PTB) were collected. Also, data on sex and age groups of all these patients were retrieved.

Inclusion criteria: the eligible subjects included in the study were patients who attended the clinic for examination and treatment mainly of tuberculosis and other related chest problems on an outpatient basis; patients referred from various hospitals and clinics throughout the state as well as entrants into tertiary institutions who need clinical examination, tuberculin test and chest X - ray to rule out the presence of TB, as a prerequisite for enrolment in the schools.

Ethical approval: the Institutional Research and Ethical committee of the University of Maiduguri, Nigeria approved the study. The data collection process was conducted after submitting the ethical approval letter to the relevant administrative authority of the Borno State Chest Clinic. Information on the name and residential addresses of the patients were deleted.

Data analysis: data were cleaned and imported into Microsoft Excel version 2007 for obtaining simple percentages, frequencies and proportions of the disease. The data was later imported into SPSS software version 22.0 (IBM Corp, Armonk, N.Y, USA) for all other statistical analyses. Results obtained over a period of ten years (2003 - 2012) using various diagnostic procedures, with a total of 13,886 patients in attendance were analysed to evaluate the prevalence of pulmonary tuberculosis in the study area. The association between the independent variables (annual

variation, age and sex) and the proportions of PTB positivity was determined using chi-square test at a probability value (p) < 0.05 regarded as statistically significant. The strength of association between the independent variables (age and sex) and the proportion of PTB positivity was determined by computing the risk ratio (RR) and its 95% confidence interval (CI).

Results

A total of 13,886 patients were registered for TB examination and treatment during the study period (2003 - 2012) (Table 1). Of these, 58.4% and 41.6% of the study population were respectively males and females and about 25% and 20% were patients aged ≤15 years and 16 - 25 years respectively (Table 1). The mean age of the patients was 35.5 ± 10.3. A total of 3150 (22.7%; 95% CI: 22.0 - 23.40) cases were recorded of all the registered patients (Table 2). The highest numbers of PTB cases were recorded in the year 2007 and 2012, with 380 and 372 cases respectively (Table 2). The highest annual prevalence of 31.7% (28.81 - 34.59) and 27.3% (24.80 - 29.60) occurred in 2006 and 2010 respectively, while the least annual frequency of 16.6% (14.73 - 18.47) occurred in the year 2004 (Table 2). Patients aged 26 - 35 years had the highest prevalence of PTB compared with other age groups during the study period.

Compared with other age groups, patients aged between 26 - 35 years had three times the risk of PTB (RR = 3.0; 95% CI: 2.05 - 4.00; p < 0.0001) (Table 3). Therefore, this age group has a significantly higher risk of acquiring PTB, than the rest of the age groups. The likelihood of the disease occurring in the age groups 16-25 years and 36-45 was found to be 0.86 (0.52 - 1.20) and 1.3 (0.80 - 1.80) respectively, and this was not statistically significant (p > 0.05) (Table 3). Individuals below the age of 15 years and those above the age of 56 years seem to have less likelihood of developing the disease (p > 0.05) (Table 3). Clinical disease occurring in the different sexes was determined to be 25.1% in males and 19.3% in females. Males accounted for 64.6% of the total 3,150 cases during the ten-year study period compared to 35.4% by the females (Table 4). Male individuals had a significantly higher risk of acquiring TB (χ^2 (df=1) = 64.7; p < 0.0001) than females (Table 4).

Thus, male patients had 1.3 times the risk of acquiring the disease as compared with the female patients during the study period (RR = 1.3; 95% CI: 1.22 - 1.39; p < 0.0001). Acid-fast bacillus (AFB) smear examination detected 2,136 cases (15.4%) out of the total13,886 individuals in attendance, while chest X - ray detected 3,150 cases (22.7%). All patients who were positive in the sputum examination were also positive in the chest X - ray examination and were therefore, diagnosed clinically as PTB. Tuberculin test detected 4,536 (32.7%) individuals to be positive. It is difficult to make any definitive statement regarding results obtained from the tuberculin tests. This is because of the common non-specific reactions in the population due to infection with other mycobacteria.

Discussion

The WHO has declared TB alongside HIV among the killer infectious diseases responsible for thousands of deaths worldwide. Globally, most of the TB burden occurs in the Africa and Asia, causing high morbidity and mortality rates in these countries. Of the 22 countries bearing about 80% of the global TB burden, 17 of these countries were classified as low-income countries by the World Bank [3]. In these low-income countries, the poorest have least access to the TB treatment. The current study found a statically significant

association between PTB and being a male patient as well as patients aged between 26 - 35 years, during the study period (2003 - 2012). An overall period prevalence of 22.7% was obtained during the study period. This is by far lower than a similar study that examines the prevalence of PTB among patients attending select hospitals, which reported a period prevalence of 81.8% [9]. However, it is higher than a prevalence of 14.7% reported in Kano [11].

Although, the reported prevalence of 22.7% appears low, there is high risk of infecting other susceptible people due to its airborne nature particularly seen in densely populated areas like Maiduguri Metropolis council. It should be borne in mind that, dense and crowded populations are major risk factors aiding in ease transmission of TB. A higher proportion of the PTB cases were detected using chest X - Ray than by sputa examination. This is because viable Mycobacteria are found only in the sputa of individuals with liquefied caseous lung lesions and the organism may be too few for detection by the smear microscopy, while foci of destroyed lung tissues are revealed by the X-ray examination. The pattern of distribution of PTB cases over the study period (2003 - 2013) appeared fluctuating. The frequency of the disease being highest in the age group 26 - 35 years is in agreement with the existing epidemiological information that in developing countries, the morbidity and mortality rates of TB are significantly high in the economically most productive age group of the population (Table 3).

This agrees with previous epidemiological studies [11]. Plausible reasons for this finding could be due to the fact that people within this age bracket are involved in manual jobs like farming, hunting, abattoir work and other kinds of high - risk jobs thereby exposing them more to the TB infection. Most cases of PTB in children under 5 years usually result in death due to the tuberculous meningitis and military tuberculosis. The younger age group 0 - 15 years, had Bacillus Calmette Guerrin (BCG) vaccination due to the increased public awareness of healthcare in addition to protection conferred by natural infection. Due to the chronic nature of the disease, cases are more likely to be identified after some years of infection. The older age groups ≥56 years, are less likely affected by the disease probably because, most of the time they remain indoors and are thus, less exposed to infection with viable bacilli or air droplets (Table 3).

The prevalence of the PTB being higher in males than females is consistent with findings of Brisibe and Ahmed [10]. However, other studies reported a non - significant association between gender and PTB [11]. The male patients had 1.3 times risk of developing PTB compared with the female patients (Table 4). In other words, being male patient is associated with about 30% increased risk of developing PTB compared with the females. This is plausible because males are always outdoors involve with one occupational hazard or the other thereby exposing them to higher risk-practices such as smoking and drinking alcohol exacerbates TB infection-of coming in contact with the tubercle bacilli in air or aerosol aiding transmission of the disease [11]. While the females most often stay indoors as housewives thereby protecting or reducing their risk of contacting an infectious person or infectious air droplets with viable bacilli.

Conclusion

In conclusion, the control of tuberculosis in Borno state and Nigeria at large will be more effective if enlightenment campaign is intensified to educate the public of its importance and mode of transmission, when there is closer monitoring and follow-up of patients on chemotherapy in order to ensure judicious compliance, prompt reporting of

cases and placement of concurrent bovine TB control programs in livestock settings. Thus, it is recommended that the government should adopt the principle of screening tests, sero-surveillance, vaccination of both humans and animals against the disease, restriction of cattle movement especially from the neighbouring countries with TB endemic status like Republics of Niger, Cameroon and Chad through placement of adequate quarantine procedures at the borders as well as improvement in the welfare and standards of living of the populace. Furthermore, enlightenment campaign to educate livestock farmers, butchers and the general public on the economic and public health implications of the disease as well as training of meat inspectors in modern meat inspection techniques for better detection of tuberculosis lesions at post - mortem examination of cattle, among others, are imperative.

What is known about this topic

- The prevalence of TB/PTB has been described by previous studies;
- The sex and age distribution of TB/PTB have also been documented.

What this study adds

- Provide epidemiological insights into the distribution of pulmonary tuberculosis among individuals attending a referral chest health facility for a period of 10 years in the study area;
- The present study also provides the annual trend of the pulmonary tuberculosis describing years with high frequency as well as the years with low frequency of cases.
- The epidemiological data provided here would be used as a baseline data in future robust epidemiological studies in the study area.

Competing interests

The authors declare no competing interests.

Authors' contributions

FB conceived and designed the study; SMJ conduct and revised the study; RSI retrieved the data from case files and analysed the data; FB and SMJ revised the manuscript. All the authors have read and agreed to the final manuscript.

Acknowledgments

The authors are grateful to all the staff of Borno state chest clinic especially the data record department for their cooperation and understanding during the data collection process.

Tables

Table 1: baseline characteristics of study subjects attending the referral chest clinic in Maiduguri, Nigeria (2003 - 2013)

Table 2: annual distribution of pulmonary tuberculosis in Maiduguri, Northeastern Nigeria (2003 - 2012)

Table 3: age distribution of pulmonary tuberculosis in Maiduguri, Northeastern Nigeria (2003 - 2012)

Table 4: sex distribution of pulmonary tuberculosis in Maiduguri, Northeastern Nigeria (2003 - 2012)

References

1. Campos ML, Cipriano ZM, Stamm AMNF, Tratsk KS. Tuberculose. Rev Bras Med. 2000;(57):505-518.

2. de Faria Gomes NM, da Mota Bastos MC, Marins RM, Barbosa AA, Soares LC, de Oliveira Wilken de Abreu AM *et al*. Differences between risk factors associated with tuberculosis treatment abandonment and mortality. Pulm Med. 2015;2015:546106. **PubMed** | **Google Scholar**

3. WHO. Global tuberculosis report 2014. 2014. Accessed on 2019/12/08.

4. Mohammed Y, Azeez-Akande O, Yusha'u M. HIV sero prevalence among adult with newly diagnosed pulmonary tuberculosis in Kano, Nigeria. J Med Trop. 2013;15(2):140-143. **Google Scholar**

5. Nwachukwu E, Peter Aguziendu Godwin. Prevalence of mycobacterium tuberculosis and human immunodeficiency virus (HIV) infections in Umuahia, Abia state, Nigeria. African J Microbiol Res. 2010;4(14):1486-1490. **Google Scholar**

6. Dye C, Williams BG. Criteria for the control of drug - resistant tuberculosis. Proceedings of the National Academy of Sciences of the United States of America. 2000 Jul 5;97(14):8180-5. **PubMed** | **Google Scholar**

7. Togerson PR, Togerson DJ. Public health and bovine tuberculosis: what´s all the fuss about. Trends Microbiol. 22010 Feb;18(2):67-72. **PubMed** | **Google Scholar**

8. Igbokwe IO, Madaki IY, Danburam S, Ameh JA, Aliyu MM, Nwosu CO. Prevalence of pulmonary tuberculous lesions in cattle slaughtered in abattoirs in Northeastern Nigeria. Rev Elev Med Vet Pays Trop. 2001;54(3-4):191-195. **Google Scholar**

9. Bello HS, Isa MA, Bintube M, Hassan Z. Prevalence of pulmonary tuberculosis among patient attending some selected hospitals at Maiduguri Metropolis, Borno State, Nigeria. Basic Res J Med Clin Sci. 2014;3:127-130.

10. Brisibe F, Ahmed MI. Prevalence of pulmonary tuberculosis in Maiduguri: a six year retrospective study (1986 - 1991). Niger Med J. 1994;(29):90-94.

11. Imam TS, Oyeyi TI. A retrospective study of pulmonary tuberculosis (PTB) prevalence among patients attending Infectious Disease Hospital (IDH) in Kano, Nigeria. Bayero J Pure Appl Sci. 2008;1(1):10-15. **Google Scholar**

Table 1: baseline characteristics of study subjects attending the referral chest clinic in Maiduguri, Nigeria (2003 - 2013)			
Variables	**Categories**	**Frequency**	**Percentage (%)**
Sex	Male	8106	58.4
	Female	5780	41.6
Age (years)*	≤15	3471	25.0
	16-25	2777	20.0
	26-35	1237	8.9
	36-45	2002	14.4
	46-55	2085	15.0
	≥56	2314	16.7
Overall		13886	100
* Mean age of study subjects, 35.5 ± 10.3			

Table 2: annual distribution of pulmonary tuberculosis in Maiduguri, Northeastern Nigeria (2003 - 2012)			
Years	**Number in attendance**	**No. of Patients with PTB**	**Prevalence [% (95% CI)*]**
2003	1571	262	16.7 (14.86 - 18.54)
2004	1527	254	16.6 (14.73 - 18.47)
2005	1174	311	26.5 (23.98 - 29.02)
2006	996	316	31.7 (28.81 - 34.59)
2007	1443	380	26.3 (24.03 - 28.57)
2008	1388	291	21.0 (18.86 - 23.14)
2009	1416	263	18.6 (16.57 - 20.63)
2010	1324	362	27.3 (24.80 - 29.60)
2011	1478	341	23.1 (20.95 - 25.25)
2012	1569	372	23.7 (21.60 - 25.80)
All years	13886	3150	22.7 (22.00 - 23.40)
* CI, Confidence Interval			

Table 3: age distribution of and its association with pulmonary tuberculosis in Maiduguri, Northeastern Nigeria (2003 - 2012)				
Age (Years)	**No. of Patients with PTB**	**RR (95% CI) ***	**Attributable Risk**	**p-value**
≤ 15	486	0.54 (0.30 - 0.78)	- 0.12	ns
16-25	547	0.86 (0.52 - 1.20)	- 0.03	ns
26-35	712	3.00 (2.05 - 4.00)	0.39	<0.0001
36-45	552	1.30 (0.80 - 1.80)	0.056	ns
46-55	477	0	0.0	
≥ 56	376	0.70 (0.36 - 1.04)	- 0.078	ns
All age	3150			
* RR, Risk Ratio; CI, Confidence Interval; (df = 5) = 1103.1; ns, not significant at P < 0.05				

Table 4: sex distribution of and its association with pulmonary tuberculosis in Maiduguri, Northeastern Nigeria (2003 - 2012)				
Sex	**No. of Patients with TB**	**RR (95% CI)***	**Attributable Risk**	**p-value**
Male	2036	1.30 (1.22 - 1.39)	0.058	<0.0001
Female	1114	-		
Overall	3150			
* RR, Risk Ratio; CI, Confidence Interval; (df = 1) = 64.7				