ORIGINAL ARTICLE

Trends of tuberculosis prevalence and treatment outcome in an under-resourced setting: The case of Enugu state, South East Nigeria

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ABSTRACT

Background: The burden of tuberculosis (TB) in Nigeria is high. Unfortunately, the data from the TB programme of the States' ministries of health are usually unpublished, which possibly contribute to the prevailing ignorance and poor attitude of Nigerians to the disease. This study determined the trends of TB burden and treatment outcome in Enugu state, Nigeria; and relate the State's disease burden to that of the Nation. **Materials and Methods:** A descriptive study of secondary data from the TB control programme, Ministry of Health, Enugu state, the National annual report of 2008, and World Health Organisation (WHO) TB database for the 10-year period of 2000-2009. **Results:** The number of female TB cases was higher than males within the 0-14 age group only. The annual number of all TB cases showed a rising trend from 914 cases in the year 2000 to 1684 in 2009; but the proportion of new sputum smear (ss+) pulmonary tuberculosis (PTB) cases declined (Trend $X^2 = 7.37$, $P = 0.007$). The average number of extra-pulmonary TB cases increased fourfold from 2000-2004 to 2005-2009 (36 versus 150 cases). The median treatment success rate was 82% (range: 78-85). For the period 2004-2008, 2.0% of all new ss + PBT cases reported in Nigeria, originated from Enugu state. The proportion of new ss + PTB reported in Enugu state was significantly higher than national value (59.6% versus 52.6%) [$P < 0.001$, OR = 1.33 (95% CI: 1.26, 1.40)]. **Conclusion:** The burden of TB in Enugu state of Nigeria had increased over the period reviewed. However, the State's contribution to the disease burden in Nigeria was low.

Key words: Burden, Enugu state, Nigeria, tuberculosis

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INTRODUCTION

Tuberculosis (TB) is an infectious disease and it is endemic in Nigeria. The control of the disease in Nigeria is coordinated by the National tuberculosis and leprosy control programme (NTBLCP) in line with the 'Stop TB Partnership' initiatives whose ultimate target is to eliminate TB as a public health problem (less than 1 case per million population) by the year 2050.[1] However, Nigeria is a setting where several healthcare options (medical pluralism),[2] including orthodox medicine (public, private, or drug stores), traditional medicine, spiritual healers etc., operate freely; the public health facilities within which the TB control programme operates is "distanced" from the people and are often not the first choice during health seeking decisions. Therefore, for the above target to be achievable in Nigeria using the current passive detection strategy, the people at the community level should be empowered with adequate knowledge of the growing burden of the disease and accessible potentials for cure. Furthermore, Nigeria is a very populous nation that is divided into several administrative units (States) with varying ethnicity, socio-economic and health indices. Unfortunately, the public rarely knows the TB burdens from the States of Nigeria, and this may be contributing to the prevailing inappropriate care seeking behaviour and poor awareness of the disease in Nigeria.[3] It thus seems that the TB data of various States' ministries of health are meant only for generating national estimates and reports such that the general public as well as most health workers are not aware of the disease burden and accessibility of effective treatment. It is our believe that if information on the magnitude of TB burden generated from

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directly observed treatment, short-course (DOTS) centres in Nigeria are fed back to the people through the existing community structures such as women meetings etc., detection rate of TB in Nigeria will increase remarkably. This belief is supported by a study which showed that the average delay by patients in southern Nigeria (including Enugu state) before presenting to DOTS centres was 3 months, and the main reason for the poor use of DOTS facilities was ignorance.[3]

Hence, it became important to articulate the reported burden and treatment outcomes of TB in Enugu State in relation to the national burden so as to equip health workers in the state and beyond with the information that will help them to inform their clients and the general public. Furthermore, to protect the vulnerable population of the State from tuberculosis, as stipulated in the 'Stop TB Strategy',[1] it is hoped that Enugu State's ministry of health will be motivated to adapt this study results for use in community partnership towards TB control.

MATERIALS AND METHODS

The study was a retrospective and quantitative study of all available secondary data on TB cases registered annually (cohorts) by the TB control programme of the Ministry of Health, Enugu state, Nigeria for the period 2000 to 2009. The data source was the annual registration for TB from all the DOTS centres in the State. Information on the number of TB cases of all categories, the treatment outcome for the cohorts of new sputum smear positive (ss+) cases, as well as the age and sex distribution of incident ss+ cohorts were included in the study. Supplementary data for the national TB prevalence and new ss+ TB for 2004-2008 were retrieved from the World Health Organisation (WHO) online global TB database,[4] and the 2008 annual report of the NTBLCP.[5] Because DOTS became nationwide in 2004,[5] retrieval of national data was restricted to 2004.

Microsoft Excel 2003 computer software was used for data analysis. Data presentation was essentially descriptive. However, Epi Info software version 3.5.1 was used where applicable for inferential statistics at 95% confidence level; trends of TB cases were analysed using chi-square for trends.

The definitions for categories of registered sputum smear positive TB patients in Nigeria as well as the structure of the NTBLCP in Nigeria are described in a related publication.[6]

Enugu state is one of the five Igbo speaking states that constitute the Southeast zone of the Nigeria. Tuberculosis control in the state is coordinated by the State's tuberculosis and leprosy control programme. DOTS services were introduced in the state in 1994 and scaled-up in 1995. The state has DOTS services in all the 17 local government areas (LGAs) and currently, there are 116 DOTS centres. Information on the Human immunodeficiency virus (HIV) prevalence per cohort of TB cases in Enugu state, and further description of the study area are shown in a recent study.[7]

RESULTS

Age and sex distribution of new sputum smear + pulmonary tuberculosis, 2005-2009

The modal age group for new ss + TB cases in Enugu state was 25-34 years (29.8%), followed by 35-44 years (20.0%) while 0-14 years contributed the least (1.4%). With exception of the 0-14 age group, the total number of male cases registered per age group for the 5-year period was higher than that of females. Details of the age and sex distributions of the new ss + PTB in Enugu state, Nigeria are shown in Table 1.

Trends of tuberculosis case finding in Enugu State, 2000–2009

The reported annual number of all TB cases increased progressively from 914 cases in the year 2000 to 1684 in 2009 except in 2001 and 2004 when for each year, it was less than that of the preceding year [Table 2]. From 2004 to 2009, all cases of TB increased at a mean rate of 7.4% per annum (median 5.2%); the least annual increase of 1.2%

Table 1: Sex and age group distribution of new ss+TB cases in Enugu state, 2005-2009

Year	Sex (M, F)	Age group (years)							Sub-total (%)*	Total new ss+TB
		0-14	15-24	25-34	35–44	45-54	55-64	65+		
2005	M	0	52	131	90	87	43	34	437 (58.7)	745
	F	4	72	104	53	32	31	12	308 (41.3)	
2006	M	0	65	131	83	71	31	29	410 (56.8)	722
	F	8	74	107	65	33	20	5	312 (43.2)	
2007	M	4	62	110	88	78	54	30	426 (57.0)	748
	F	5	58	94	67	55	31	12	322 (43.0)	
2008	M	5	56	151	114	113	58	35	532 (55.1)	965
	F	8	65	141	69	79	46	25	433 (44.9)	
2009	M	8	69	130	109	81	57	24	478 (53.0)	902
	F	13	64	117	77	78	57	18	424 (47.0)	
Total (%)**	All sexes	55 (1.4)	637 (15.6)	1216 (29.8)	815 (20.0)	707 (17.3)	428 (10.5)	224 (5.5)	4082	4082 (100.0)

* – Denominator=total new ss+TB for the corresponding year; ** – Denominator=sum total of ss+TB for 2005-2009; M – Male; F – Female

Table 2: Trends of TB case findings in Enugu state, 2000–2009

Year	New PTB		Other PTB				Extra-pulmonary (%)	All cases
	New* ss + (%)	Smear negative (%)	Relapsed (%)	Failure (%)	Return after default (%)	Others		
2000	626 (68.5)	187 (20.5)	42 (4.6)	16 (1.8)	16 (1.8)	0 (0.0)	27 (3.0)	914
2001	583 (67.2)	172 (19.8)	44 (5.1)	9 (1.0)	25 (2.8)	0 (0.0)	34 (3.9)	867
2002	675 (62.9)	248 (23.1)	62 (5.8)	7 (0.7)	43 (4.0)	0 (0.0)	38 (3.5)	1073
2003	769 (63.5)	285 (23.5)	60 (5.0)	7 (0.6)	45 (3.7)	0 (0.0)	46 (3.8)	1212
2004	765 (64.5)	321 (27.0)	28 (2.4)	7 (0.6)	25 (2.1)	0 (0.0)	36 (3.0)	1187
2005	745 (62.0)	235 (19.6)	34 (2.8)	11 (0.9)	36 (3.0)	0 (0.0)	126 (10.5)	1201
2006	722 (57.6)	289 (23.1)	63 (5.0)	17 (1.4)	57 (4.6)	0 (0.0)	150 (12.0)	1253
2007	748 (54.2)	342 (24.8)	52 (3.8)	10 (0.8)	38 (2.8)	13 (0.9)	177 (12.8)	1380
2008	965 (60.2)	415 (25.9)	38 (2.4)	5 (0.3)	21 (1.3)	36 (2.3)	122 (7.6)	1602
2009	902 (53.6)	515 (30.6)	39 (2.3)	4 (0.2)	16 (1.0)	0 (0.0)	164 (9.8)	1684

*Trend X^2=7.37; P=0.007; PTB – Pulmonary tuberculosis

occurred from 2004 to 2005 while the highest (16.1%) was reported from 2007 to 2008.

The least and highest number of annually reported new ss + TB cases over the period were 583 cases in 2001 and 965 cases in 2008, respectively [Table 2]. Unlike the pattern of all TB cases which generally showed a rising trend (except the declines in 2001 and 2004), that of the new ss + TB cases declined significantly (Trend $X^2 = 7.37$; $P = 0.007$). The highest annual increase for new ss + TB was observed from 2007 to 2008. There were increased reports for all TB and smear negative (-ve) TB cases in 2009 while registered new ss + TB cases showed a decline [Table 2, Figure 1]. On the other hand, the proportion of ss + among the new PTB cases showed a consistent downward trend from 76% in 2005 to 63% in 2009 (Trend $X^2 = 37.83$; $P < 0.001$). Similar pattern also applied to the proportions of new ss + of all TB cases [Figure 1].

After 2004, the number of reported extra-pulmonary TB cases increased markedly [Table 2]. The median number of extra-pulmonary TB cases detected over a 5-year period of 2000-2004 was 36 while that for 2005-2009 was 150, which represents a four-fold rise (Trend $X^2 = 51.43$; $P < 0.001$).

The annual number of relapsed cases fluctuated across a narrow range of 28-63 over the period with a median of 43 cases [Table 2]. Likewise, the median number of treatment failure cases was 8 (range: 4-17). The lowest treatment failure was reported in 2009 while the highest was in 2006.

Treatment outcome for new sputum smear + pulmonary tuberculosis in Enugu State, 2000–2008

The summary of treatment outcomes (in percent) for the new ss + PTB cohorts registered at the DOTS centres in Enugu from 2000 to 2008 is shown in Table 3. The treatment success rate ranged from 78% in 2006 (and 2007) to 85% in 2001 with a median of 82%. Also, the median cure rate was 65% (range: 57-72). Both treatment success and cure rate showed remarkable increase in

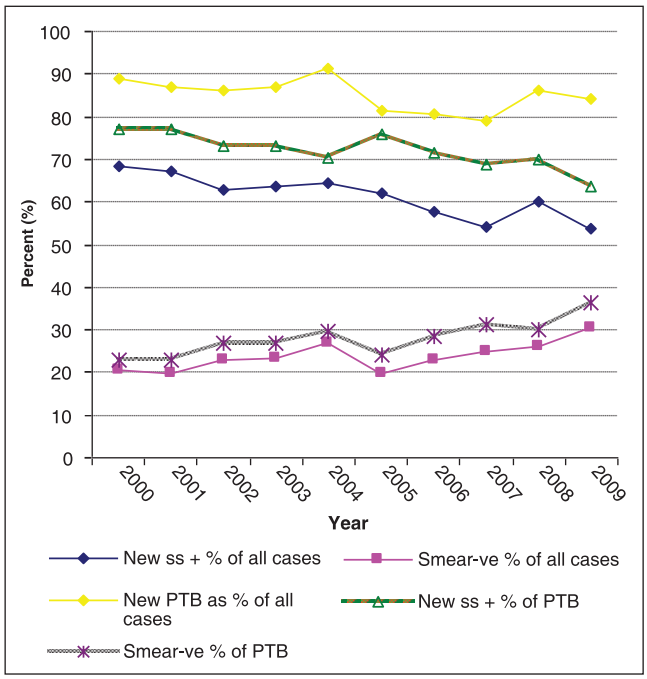

Figure 1: Trends of PTB detection in Enugu state, 2000-2009

2008 compared to the values of the preceding year. The difference between the treatment success rate and cure rate, which represents treatment completed, showed a near consistent downward trend from 2001 to 2008 (Trend $X^2 = 17.03$; $P < 0.001$).

The trends of the proportion of new ss + PTB cases that died, defaulted, or failed treatment are shown in Figure 2. Generally, both treatment failure rates and death rates were consistently below 10% of the registered new ss + PTB cases throughout the period. From year 2006 to 2007, the death rates reduced remarkably while the failure rates increased by a similar margin; but in 2008, both parameters declined with varied magnitudes. On the other hand, the pattern of default rates among cohorts of new ss + PTB cases appeared to be in the upward direction with occasional declines [Figure 2]. The median default rate

Table 3: Treatment outcome (per cent) of new ss+PTB cases in Enugu state

Year	Treatment success %	Cured %	Failure %	Died %	Defaulted %	Transferred out %
2000	84	68	2	5	7	3
2001	85	57	2	4	7	3
2002	83	58	0	6	8	3
2003	83	60	0.6	5	9	3
2004	82	66	1	6	9	1
2005	80	63	0.9	5	12	2
2006	78	65	1	7	10	3
2007	78	65	8	1	9	3
2008	82	72	5	0.8	11	2

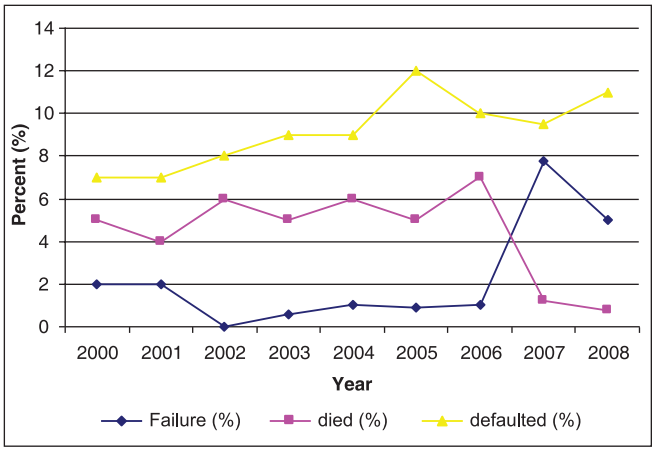

Figure 2: Trends of unfavourable treatment outcome for new ss + PTB cases in Enugu state

was 9% (range: 7-12). The highest default rate of 12% was recorded in 2005; incidentally, reduction in both failure and death rates also occurred in the same year.

Trend of tuberculosis in Enugu state in relation to National figures, 2004-2008

The proportion of all TB cases reported from Enugu state varied from 1.60% in 2007 to 1.97% in 2004 with a median of 1.77% [Table 4]. Likewise, the median proportion of new ss + PTB cases reported from the state was 2.10%; the lowest value (1.70%) was in 2007 while the highest (2.27%) was in 2004. Generally, the trends of the proportions of new ss + PTB and all TB cases reported from the state declined significantly despite the slight increase in proportions observed in 2008 [Table 4, $P < 0.05$]. Over the 5-year period of 2004-2008, 3,945 (59.6%) cases of new ss + PTB were reported in Enugu state as against 1,98,748 (52.6%) from the whole nation. The observed difference was statistically significant [$P < 0.001$, OR = 1.33 (95% CI: 1.26, 1.40)].

Table 4: Percentages of National TB cases reported from Enugu state

Year	All TB		New ss + PTB	
	Nigeria	Enugu state* (%)	Nigeria	Enugu state** (%)
2004	60,290	1,187 (1.97)	33,755	765 (2.27)
2005	66,848	1,201 (1.80)	35,048	745 (2.13)
2006	74,225	1,253 (1.69)	39,903	722 (1.81)
2007	86,241	1,380 (1.60)	44,016	748 (1.70)
2008	90,311	1,602 (1.77)	46,026	965 (2.10)
Total (2004–08)	3,77,915	6,623 (1.75)	1,98,748	3,945 (1.99)

Per cent (%)=Proportion of National TB cases reported from Enugu state per category;*Trend X^2=11.57, P=0.001; **Trend X^2=9.03, P=0.003

DISCUSSION

The findings of this study with respect to sex and age patterns of new ss + PTB, are consistent with the documented global epidemiology of the disease.[8-10] Also, the observed modal age group of 25-34 years is consistent with the report of a related study from a neighbouring state,[11] and the 2008 National report of Nigeria.[5] The study's findings are in line with the belief that TB is a disease of adults and that the burden of the disease lies more with the male sex.[10-12] Male to female ratio among the new ss + PTB cases may be associated with the HIV prevalence in the general population and it has been shown that more female than male cases of TB are detected in countries with HIV prevalence of above 1%.[8] Nevertheless, considering the HIV prevalence in the study area, it is obvious that Enugu State of Nigeria is a deviation from that general assertion; this deviation is also applicable to the neighbouring Ebonyi state,[11] and indeed the whole country.[5] Currently, there are no clear explanations for the higher notification of TB in males than females;[8] the confusion must have been compounded by the female TB case preponderance observed in this study within the 0-14 year age group.

Furthermore, the number of all TB cases reported annually in Enugu state showed a rising trend but the proportion of new ss + PTB cases was declining [Figure 2]. Though, these trends were also observed in the annual national reports[4,5] and a related study from Ebonyi state,[13] it should, however, stimulate further research especially as regards the quality of the microscopic centres within the DOTS services of the State and Nigeria. In contrast to this study finding, a report from Northwest Turkey where both active and passive TB case finding were practised, showed that TB case notification decreased over the period reviewed;[14] it is most likely that the active case detection strategy might have been responsible for the observed TB case detection rate decline. Thus, there may be need for the TB programme in Nigeria to consider incorporating this strategy. The 4-fold increase in the detection of extra-pulmonary TB cases, which started in 2005, is very remarkable but there is no clear explanation, and similar pattern was not observed in related studies.[11,13-15] It could be that the prevalence of this category of TB increased in the State.

The proportion of registered TB patients that were failure or relapse cases declined from 2006 [Table 2]. This trend may suggest an improved TB management at the DOTS centres which may be consistent with the reported TB programme's operational changes that followed the multi-drug-resistant (MDR)-TB study in Enugu.[16] These operational changes include the creation of awareness among national TB programme personnel on the mechanism of TB drug resistance and its prevention, the introduction of "dosage-friendly" fixed-dose combination (FDC) anti-TB packs, addition of the regimens 2RHEZ/4RH for category I treatment.[16] However, it is equally likely that the number of the patients registered, did not represent the true picture of these categories of patients in the community. Noting that health-seeking behaviour is related to treatment experience by patients and community among other determinants; it is likely that patients who relapsed or failed treatment may lose confidence in the DOTS services and seek alternative care from other sectors.

According to the 2006 census, the population of Enugu state residents contributes 2.3% of the national population,[17] which is higher than the proportions of all TB and new ss + PTB from the state [Table 4]. This may suggest a low TB prevalence in the state or inadequate case detection. However, this study's finding that a TB case reported from Enugu state within the period reviewed was 1.3 times more likely to be new ss + PTB when compared to the whole nation may support low TB prevalence in the state.

Though the State's median treatment success rate of 82% falls short of the national target of 85%, it is still higher than 80% in Ebonyi state,[13] national value of 78%,[8] and 80% in Southern Ethiopia.[15] The higher treatment success rate shown in this study may therefore suggest good performance by the State's TB programme. However, treatment success rate for years 2000-2003 were consistently higher than those of 2004-2008 and a similar picture was also observed with the treatment default rate [Table 3], which may imply a reduction in patients' compliance within that period. The reasons for the disparity should be explored by the State TB programme so as to improve the disease control. On the other hand, the disparity between treatment success rate and the cure rate may suggest inadequate laboratory support, which appeared to have improved in 2008 when the lowest disparity (10%) was recorded. It is recommended that 1 microscopy centre should serve 100,000 population.[8] Therefore, assuming that the State's 2006 census figure of 3,367,837 million and the 2010 estimate of 3,757,159 were correct (annual population growth rate of 2.83%);[18] then, Enugu state should have at least 38 microscopy centres instead of the 30 recorded in the annual report.[5] Treatment of TB in Nigeria is standardised for each patient category. Therefore, since under dosing and risk of monotherapy must have been minimised by the introduction of FDC drugs, it is possible that misclassification of category two patients as category one in the DOTS centres, as noted in Southern Nigeria,[16] may be the major contributing factor to treatment failures in Enugu state. It takes repeated sputum microscopy at specified treatment interval to declare a TB case as a treatment failure and during this "waiting period", s/he is a risk to the community. So, proper patient categorisation should be viewed as important as quality control of microscopy centres and a mechanism for the routine monitoring of the performance of TB health staff should be developed and enforced.

The study has limitations — secondary data from the State's TB programme was used for the study, therefore, minimal errors could have occurred during data entry and computations but would not have affected the study's results. Most importantly, the disease trends identified in the study only represent cases managed in DOTS centres, which cannot be the true situation in a population where a lot of treatment options exist. The assumption is in line with United Nation's opinion that the TB data reported by ministries in developing countries were usually only a fraction of the real population figures.[19] Also, the periods of years reviewed for all study objectives were not uniform because of incomplete data, which limited trend assessments for some variables.

Nevertheless, since the study is essentially the first formal effort at articulating and publishing the TB burden in the State, it is hoped that the study will stimulate and direct policy relevant researches in the subject area. It is also hoped that the study will motivate researchers in other regions of the country to articulate and publicise TB burden and trends in their environment.

CONCLUSION

In conclusion, the study has demonstrated an increasing trend of TB cases in Enugu state of Nigeria for the 10-year period reviewed. All TB cases and proportion of new smear negative PTB showed a near consistent rising trend, while that of the new ss + PTB was declining. The annual number of extra-pulmonary TB increased by 4-folds in 2005 and persisted thereafter.

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