

Tuberculosis Treatment Outcomes In State Hospital, Osogbo, Southwestern Nigeria: A Four Year Review

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Abstract

Background: A retrospective review of all cases of tuberculosis (TB) enrolled in the directly observed treatment-short course chemotherapy (DOT-SCC) between June 2000 and June 2004 at a General Hospital in Southwestern Nigeria was undertaken. The aim is to determine treatment outcomes and ascertain the effectiveness of the programme for TB control.

Methodology: Case registers of all TB patients enrolled were reviewed and data obtained analyzed by statistical methods.

Results: A total of 879 TB patients (467 males, 412 females; M: F ratio 1.13:1) aged 1 to 80 years (mean age 33.0±14.0 years) were enrolled. The disease was pulmonary in 98.4% and extrapulmonary in 1.6%. Seven hundred and thirty four (83.6%) patients complied with the DOTS-SCC regimen, 127 (14.4%) defaulted while 18 (2%) transferred out. The overall treatment success rate was 76.3% while 3.8% had treatment failures. Outcome was not significantly affected by types of TB lesion ($P=0.1103$), patient category ($P=0.4968$), age ($P=0.7198$), gender ($P=0.1726$) or smear positivity ($P=0.5497$).

Conclusion: Although the currently advocated DOT-SCC regimen achieved a high success rate in this locality, it fell below the 85% recommended target. There is need to step up health education campaign on compliance with therapy and aggressively follow up defaulters to forestall the emergence of multidrug resistant *M. tuberculosis*.

Keywords: TB, DOTS, Outcome

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INTRODUCTION

At the end of the 20th century, tuberculosis (TB) remains the greatest killer of all the infectious diseases despite the fact that when diagnosed quickly and treated appropriately, it is curable in most cases. The World Health Organization (WHO) has declared TB a global emergency since 1993,¹ with an estimated one third of the world population infected, resulting in 9 million cases of

active disease each year and 3 million deaths,² most cases occurring in the developing world.

Many studies in Nigeria, mainly hospital-based, have reported increasing incidence of TB.^{3,4} The TB burden has become enormous with average annual case notification put at 259,000⁵ and presently, an estimated incidence rate of 304 per 100,000 population of all cases of tuberculosis reported, out of which an estimated 89 per 100,000 population die of TB.⁶ The TB situation has been compounded by the emergence of multi-drug resistant strains (MDR-TB) and the HIV epidemic, with the national seroprevalence rate of HIV among TB patients in Nigeria in the year 2000 put at 17%.⁷

In the past, the diagnosis of TB in Nigeria was largely dependent on a high degree of clinical suspicion, which is usually made at an advanced stage.⁸ But in recent times, sputum smear examination by microscopy for acid fast bacilli (AFB) has become the cornerstone of pulmonary tuberculosis case-finding/diagnosis in low-income countries including Nigeria.⁹ Also, the full regimen for the treatment of pulmonary TB adopted by National Tuberculosis and Leprosy Control Programme (NTBLCP)¹⁰ and being implemented in about half of the 774 Local Government Areas of Nigeria as at year 2003, is the standard WHO recommended⁶ directly observed treatment scheme (DOTS) of rifampicin/isoniazid (combined tablet), pyrazinamide and ethambutol daily for 2 months initial phase and isoniazid plus thiacetazone (thiazinal) or ethambutol daily for 6 months continuation phase. This treatment scheme has been so recommended because of the high compliant rate due to its short course and hence its effectiveness in achieving cure and shortening the duration of infectivity and spread in the community. Some researchers in Nigeria have also reported this regimen to be highly effective with greater than 85% success rate.^{11,12}

The Damien Foundation of Belgium has been providing facilities for free diagnosis of TB by acid fast staining and free treatment of TB patients attending the State Hospital, Asubiaro, Osogbo, Osun State of Nigeria since 1999 under the DOTS regimen using the short course chemotherapy (SCC). The hospital subserves the populace in 'Olorunda-Igbonna' and other local government areas of the State in Southwest Nigeria.

In this study, we reviewed the register and case records of all the TB patients treated over a four year period under the DOTS scheme. Our aim is to determine the outcomes in all categories of patients treated with this regimen, which will enable us ascertain the effectiveness or otherwise of this regimen and possible emergence of resistance to anti-tuberculous drugs in this environment.

MATERIALS AND METHOD

Study area

This study was conducted in Osogbo, the capital of Osun State, made up of two local government areas; Olorunda-Igbonna and Osogbo-Oja-Oba. The city is centrally located and accessible by road from any part of the State. It is a city of culture that is well recognized by UNESCO as the center of activities for the famous Osun-Osogbo annual festival.

The State Hospital alongside the Ladoke Akintola University Teaching Hospital provides tertiary health care services to the people of Osogbo and its environs. The Damien foundation of Belgium provides facility for free diagnosis of TB by sputum AFB microscopy and free drug treatment.

Materials

Case registers of all TB patients attending the Hospital between June 2000 and June 2004 were retrieved and analyzed. The format of the TB register used is that designed by the NTBLCP^{5,10} and contains amongst other information; bio-data, name, age, sex, and address of each patient. Approval for the retrospective review of the case records of all patients enrolled in the DOTS regimen was given by the Ethical Committee of the hospital.

Subjects/diagnosis

Patients are seen in the hospital on presentation or on referral from private clinics or other hospitals within or outside the Local Government. Smear positive pulmonary TB was diagnosed when there are cardinal clinical features such as chronic cough, recurrent fever, weight loss, night sweats, haemoptysis etc and at least two out of three sputum smears are positive for acid fast

bacilli (AFB) by the modified Ziehl Neelsen (ZN) staining technique in line with the WHO recommendation.⁶ Smear negative pulmonary TB was diagnosed when there are cardinal clinical features and chest X-ray abnormalities but at least three sputum smears are negative for AFB on ZN stain. Extra-pulmonary TB was diagnosed when there are clinical and/or histological/radiological evidence consistent with active TB outside the Lungs.

Drug treatment and follow up

The standard anti-TB regimen adopted in the State hospital is the directly observed treatment, short-course scheme (DOTS-SCC) combination therapy that is used by the NTBLCP^{5,10} in Nigeria and recommended by the World Health Organization (WHO) and International Union Against Tuberculosis and Lung Disease (IUATLD).

- i. For a newly diagnosed pulmonary TB patient, the regimen is 2 months intensive phase with daily dose of INH (H), rifampicin (R), pyrazinamide (P) and ethambutol (E) and 6 months continuation phase with daily dose of INH and ethambutol.
 - ii. For patients with smear positive relapse or treatment failure or return after default, the regimen is 3 months intensive phase first with 1 month daily dose of streptomycin, INH, rifampicin, pyrazinamide and ethambutol, followed by 2 months daily dose of INH, rifampicin, pyrazinamide and ethambutol; and then 5 months continuation phase of daily doses of INH, rifampicin and pyrazinamide.
- Each patient was monitored on treatment with clinical evaluation and sputum AFB microscopy at 2 months, 5 months and 7 months or at completion of treatment.

Treatment Outcome

The treatment outcome was defined as (i) "Cure" a patient who is smear negative one month prior to completion of treatment and on at least one previous occasion (ii) "Treatment Completed" as a patient who has completed treatment but in whom smear result is not available at end of 7th month. (iii) "Treatment Success" when there is a "Cure" or "Treatment Completed" as described above; (iv) "Relapse" when a TB patient who has been declared "Cured" has again developed sputum positive TB; (v) "Treatment Failure" when a TB patient who is still sputum positive 5 months or more after starting treatment; (vi) "Default" when a TB

patient who completed at least one month of standard treatment but had at least 2 months interruption of treatment; (vii) "Transfer Out" when a TB patient on treatment has moved out of the catchment areas of the hospital whose treatment results are not known and (viii) "Death" from any cause whatsoever during the course of treatment.

Data analysis

Data were fed into IBM ThinkPad Computer with SPSS 11.0 software package for analysis. Chi square or Fisher Exact test was used to establish significant differences between variables and $P < 0.05$ was considered

significant.

RESULTS

Demographic characteristics

A total of 879 TB patients aged 1 to 80 years were seen at the State Hospital, Asubiaro, Osogbo, Nigeria between June 2000 and June 2004. Four hundred and sixty seven (53.1%) were males while 412 (46.9%) were females giving a male to female ratio of 1.13 to 1. The mean age for male patients is 35.2 ± 15.0 years while that of female patients is 30.7 ± 12.4 years and total mean age is 33.0 ± 14.0 years (Table I).

Table I: Sex and age group distribution of patients with tuberculosis in Osun State, Nigeria (2000-2004)

Age group/Sex	Male	Female	Total (%)
1-10	11	6	17 (1.9)
11-20	44	83	127 (14.4)
21-30	171	167	338 (38.5)
31-40	116	81	197 (22.4)
41-50	45	49	94 (10.7)
51-60	45	17	62 (7.0)
61-70	27	7	34 (3.9)
71-80	8	2	10 (1.1)
Total	467 (53.1%)	412 (46.9%)	879 (100)

Types/Category of TB disease

The disease was pulmonary in 865 (98.4%) patients and extrapulmonary in 14 (1.6%). Seven hundred and forty eight (86.1%) cases were registered as 'new', 30 (3.4%) as 'relapse', 12 (1.4%) as 'return after default', 3 (0.3%) as 'transferred in' and 86 (9.8%) were not categorized into any of the above and tagged 'others' (Table II). Five

hundred and eighty nine (67.0%) patients were positive for AFB by ZN stain at diagnosis, while 290 (33.0%) were smear-negative. Of the smear positive cases, 493 (83.7%) were 'new', 18 (3.1%) were 'relapse', 10 (1.7%) were 'treatment after default' and 68 (11.5%) were categorized as 'others'.

Table II: Distribution of patients with tuberculosis in Osun State, Nigeria in relation to AFB smear result (2000-2004)

Category of patient	Smear positive	Smear negative	Total (%)
New cases	493	255	748 (85.1)
Relapse	18	12	30 (3.4)
Treatment after default	10	2	12 (1.4)
Transfer in	0	3	3 (0.3)
Others	68	18	86 (9.8)
Total	589 (67.0)	290 (33.0)	879 (100)

Outcomes of treatment

Overall

Of the 879 patients seen, 734 (83.6%) complied with the DOTS regimen, 127 (14.4%) defaulted while 18 (2%) transferred out (Table III). Excluding the 18 patients who transferred out, 657 of 861 patients (490 cured and 167

completed treatment) had successful treatment outcome giving an overall treatment success rate of 76.3%; 55 (6.4%) died and 127 (14.8%) defaulted. Twenty two (3.8%) of the 581 smear positive cases (after excluding 8 who were smear positive but transferred out) had treatment failures.

Table III: Overall outcome of treatment of patients with tuberculosis in Osun State, Nigeria (2000-2004)

Categories of Patient	Cured	Treatment completed	Failure of treatment	Died	Defaulted	Transfer out
New cases						
N=748	412	146	17	44	116	13
Relapse						
N= 30	21	1	1	4	2	1
Treatment after default N= 12	4	4	1	0	3	0
Transfer in N=3	1	0	0	0	1	1
Others						
N=86	52	16	3	7	5	3
Total = 879	490	167	22	55	127	18
Pulmonary N=865	490	159	22	50	126	18
Extrapulmonary N=14	0	8	0	5	1	0

New cases

Five hundred and fifty eight of the 748 "new cases" (412 cured and 146 treatment completed) had successful treatment outcome giving a treatment success rate of 75.9%; 44 (6.0%) died and 116 (15.8%) defaulted. Seventeen (3.5%) of the 486 smear positive 'new cases' had treatment failure.

Relapse/Return after default (Retreatment)

Amongst the 42 patients who were 'relapse' or 'returned after default' (placed on re-treatment therapy) cases, 30 (25 cured and 5 completed treatment) had successful treatment outcome giving a treatment success rate of 73.1%; 4 (9.8%) died and 5 (12.2%) defaulted. Two (7.4%) of the 27 smear positive 're-treatment cases' had treatment failure.

Other groups (Transfer-in/others)

Amongst the remaining 89 patients ('transfer-in/'others'), 69 (53 cured and 16 completed treatment) had successful outcome giving a treatment success rate of 81.1%; 7 (8.3%) died and 6 (7.0%) defaulted. Three (4.4%) of 68 smear positive cases in this group had treatment failure.

Smear conversion rate

Smear conversion rate after the 2nd month for all patients was 93.9%; for new cases it was 94.4%, re-treatment cases 88.9% and other groups 92.6%. Smear conversion rate after the 7th month for all patients was 96.2%; for new cases 96.5%, re-treatment cases 92.6% and other groups 95.6% (Table IV).

Table IV: Smear conversion rate among smear positive patients with tuberculosis in Osun State, Nigeria (2000-2004)

Patient/treatment category	New cases		No of smear positive cases		Total
		Relapse	Return After default	Uncategorized	
Pre-treatment	493	18			589
	*486	*17	10	68	*581
End of 2 nd month	27	2	1	5	35
End of 5 th & 7 th month	17	1	1	3	22

*Of 589 smear positive patients, 8 (7 new and 1 relapse) transferred out to another area in the 1st month of treatment and were excluded from analysis

Smear conversion rate after the 2nd month for all patients is 93.9%, for new cases 94.4%, re-treatment cases 88.9% and other groups 92.6%.

Smear conversion rate after the 5th/7th month for all patients is 96.2%, for new cases 96.5%, re-treatment cases 92.6% and other groups 95.6%.

Factors influencing treatment outcome

The type of TB lesion (whether pulmonary or extrapulmonary) was not significantly associated (OR=2.458, P=0.1103) with treatment outcome and factors such as age ($X^2=4.507$, P=0.7198), gender (OR=0.7975, P=0.1726) and smear positivity (OR=1.112, P=0.5497) did not significantly influence outcome (Tables

V and VI). Similarly, the treatment success rate among the 'new cases' was not significantly different from the cases of 'relapse' and 'returned after default' or from other groups ($X^2=1.399$, P=0.4968). The default rate of 15.8% among the new cases was also not significantly different from 12.2% among the re-treatment cases (OR=1.349, P=0.6618).

Table V: Factors associated with treatment outcomes of tuberculosis in Osun State, Nigeria (2000-2004)

Factors	Successful Outcome	Poor outcome	X^2	OR	95%CI	P value
Mean age (N=861):	33.323±14.389	32.564±13.321	4.507 (df7)			0.7198
Sex (N=861):						
Male	340	117		0.7975	0.5809-1.095	0.1726
Female	317	87				
Cases (N=861):						
New	558	177	1.399 (df2)			0.4968
Re-treatment	30	11				
Transfer-in/ Uncategorized	69	16				
TB lesion (N=861):						
Pulmonary	649	198		2.458	0.8427-7.172	0.1103
Extrapulmonary	8	6				
AFB smear (N=861):						
Positive	447 (76.9)	134 (23.1)		1.112	0.7975-1.550	0.5495
Negative	210 (75.0)	70 (25.0)				

Successful outcome = cure + treatment completed

Poor outcome = death + treatment failure + default

X^2 = Chi square value

OR = Odd Ratio

CI = Confidence Interval

Table VI: Age group distribution and outcome of TB treatment in Osun State, Nigeria (2000-2004)

Age group (years)	Successful outcome	Poor outcome	Total
1-10	13	4	17
11-20	89	32	121
21-30	253	77	330
31-40	151	42	193
41-50	67	26	93
51-60	52	10	62
61-70	25	10	35
71-80	7	3	10
Total	657 (76.3%)	204 (23.7%)	861 (100%)
Mean age	33.323±14.3899	32.564±13.321	

$X^2=4.507$, $df=7$, $P=0.7198$

DISCUSSION

TB remains an endemic disease in this environment with peak age prevalence within the second and third decades of life, the same age group that is generally affected in developing countries^{13, 14} and recently in the developed world as a result of the HIV/AIDS pandemic.¹³ Although, the overall treatment success rates recorded for both the new (75.9%) and re-treatment cases (73.1%) in this study were high, they fell below the recommended WHO target of 85%. One factor responsible for this may be the default rate of 15.8% and 12.2% among the new and re-treatment cases respectively. When those who defaulted were removed from statistical analysis, 90.1% of the new cases and 83.3% of those on re-treatment therapy had a successful outcome. Reasons for the high default rate in our review could not be easily explained as diagnosis and treatment were free but we suspect that a lot of these patients are illiterates who still seek help from alternative medical practitioners who have flourishing business in Osun State. Some patients may also have defaulted due to side effects of some of these drugs or seemingly slow response to therapy. There is a need to intensify health education and follow up of these patients.

Smear conversion rates were high for all categories of patients with overall rates of 93.9% and 96.2% after the second and fifth/seventh month of therapy respectively. This implies that the current directly observed short course chemotherapy (SCC) regimen for both new and re-treatment cases appear effective in Osun State, but there is need to aggressively pursue the defaulters, as they constitute reservoirs of resistant tubercles in the community, which may result in a high incidence of

primary resistance to DOTS chemotherapy among newly diagnosed patients.

Some studies in Nigeria have reported the effectiveness of short course chemotherapy (SCC) for pulmonary TB. Ige *et al*¹¹ reported 90% seroconversion rate at the second month among 97 patients in Ibadan with no relapse after 18 months follow up and Erhabor *et al*¹² reported 86.1% success and 93.8% compliance rates in Ife. The SCC appeared slightly more effective in these centers than ours because of the high default rates in our center. However, directly observed SCC in our center was very effective when compared to a study from Ilorin, North central Nigeria¹⁵, which reported only 43.7% cure and high default rate of 44.2% among patients with pulmonary TB managed in the hospital over a 9-year period with long course chemotherapy (LCC). This suggests that the high success rates recorded in the directly observed SCC is as a result of good patient monitoring and short duration of therapy, which ensure good drug compliance.

The findings in this study also compares favourably with reports from other African countries and elsewhere. In Cotonou, Benin Republic¹⁶, 82% and 78% success rates were reported for new and re-treatment cases with 1% and 3% failure rates respectively. In another study, 66.5% (363/546) cure rate was reported after 7 months SCC therapy among smear positive Rwandan and Burundian refugees.¹⁷ Similarly, 77.2% and 68.3% cure rates respectively were reported among smear positive and negative TB patients in Sudan,¹⁸ and in Italy,¹⁹ 83% success rate was reported among 1162 TB patients.

While some studies have found strong association between poor TB treatment outcome and male gender,^{15,16} increasing age,^{15,20} extra-pulmonary/smear negative TB,²¹ and relapse/previous defaulters,²⁰ our study did not show any such association between gender, age, smear positivity, type of TB lesion, new or re-treatment cases. In some of these studies^{15,16} outcome was measured without considering defaulters or those who transferred out while in others,²⁰ non-compliance was the major factor responsible for poor outcome. In our review, outcome appears highly dependent on compliance with therapy and level of monitoring by the community workers than on types of lesion, age, gender or smear positivity - this is similar to a report from Saudi Arabia.²¹

Although treatment outcome has also been reported to be poorer among TB patients with HIV infection in areas with high prevalence of TB/HIV co-infection,²²⁻²⁶ TB patients in our center are not routinely screened for HIV because of cost consideration- most of the patients are of low socio-economic status who can not afford the current cost of screening and confirmatory tests for HIV. Infact, their patronage of the hospital is highly attributable to the free diagnosis and treatment given by the Damien Foundation. Furthermore, a countrywide survey in Nigeria reveal that HIV prevalence rate among TB patients is about 17%,^{7, 27} which has made some researchers²⁸ opine that routine HIV testing among TB patients who are generally poor, may not be cost effective.

The high success rate recorded in this study may be attributable to the fact that; (i) NTBLCP in Osun State is functioning well, (ii) TB diagnosis by sputum AFB and drug treatment is freely provided by Damien Foundation of Belgium, (iii) drug intakes are strictly supervised by community workers and (iv) health education and counseling of patients are correctly done. However, there is a need to step up health education campaigns on compliance with therapy and aggressively follow up defaulters to forestall the emergence of multidrug resistant *M. tuberculosis*.

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REFERENCES

1. World Health Organization. Tuberculosis- a global emergency. WHO report on the TB epidemics. Geneva-27, 1211, Switzerland, 1994: 1-12
2. Dye C, Scheeles S, Dolin P, Pathania V, Raviglone MC. Global burden of tuberculosis. Estimated incidence, prevalence and mortality by country. *JAMA*. 1999; **282(7)**: 677-685
3. Idigbe EO, Sofola TO, John EKO, Okoye R, Onubogu C, Begg O, Giwa-Amu J. The trend of pulmonary TB in Lagos, Nigeria. *Biomedical Letters*. 1995; **31**: 99-109
4. Wokoma FS. Trends in case occurrence of pulmonary TB in PortHarcourt Teaching Hospital. A five year analysis of admission. *Nig. Med. Pract.* 1999; **37(3/4)**: 41-46
5. National Tuberculosis and Leprosy Control Programme (NTBLCP) Works Manual. Federal Ministry of Health, Lagos, 1991: 96
6. World Health Organization. WHO Report 2004 on global tuberculosis control Geneva. 2004; 92-95
7. National Tuberculosis and Leprosy Control Programme (NTBLCP). TB situation, 2000. Federal Ministry of Health, Abuja, Nigeria. Unpublished report, 2001
8. Ekweani DM, Onyezili NI, Onitiri AC, Onyezili FN. Pulmonary tuberculosis: incident variations in anthropometric and biochemical indices of nutritional statuses. *West Afr. J. Med.* 1983; **3(4)**: 271-276
9. Yahaya AI, Ipuge, Hans LR, Donald AE. The yield of acid-fast bacilli from serial smears in routine microscopy laboratories in rural Tanzania. *Trans. R. Soc. Trop. Med. Hyg.* 1996; **90**: 258-261
10. National Tuberculosis and Leprosy Control Programme (NTBLCP) Works Manual. Federal Ministry of Health, Abuja, 1998:41, 164
11. Ige OM, Bakare RA, Onadeko BO. Modified short-course chemotherapy of pulmonary tuberculosis in Ibadan: a preliminary report. *Afr. J. Med. Sci.* 2000; **29(1)**: 51-53.
12. Erhabor GE, Adewole O, Adisa AO, Olajolo DA. Directly observed short course therapy for tuberculosis: a preliminary report of a 3-year experience in a teaching hospital. *J. Natl. Med. Assoc.* 2003; **95(11)**: 1082-1088
13. Braun MM, Cote TR, Rabkin CS. Trends in death with tuberculosis during the AIDS era. *JAMA*. 1993; **206(22)**: 2865-2868
14. Antunes JL, Waldman EA. The impact of AIDS, immigration and housing overcrowding on tuberculosis deaths in Sao Paulo, Brazil 1994 - 1998. *Soc. Sci Med.* 2001; **52(7)**: 1071 - 1080.
15. Salami AK, Oluboyo PO. Management outcome of pulmonary tuberculosis; a nine year review in Ilorin. *West Afr. J. Med.* 2003; **22(2)**: 114-119
16. Gninafor M, Tawo L, Kassa F, Monteiro GP, Zellwager JP, Shang H, Lambregts K, Trebucq A. Outcome of tuberculosis re-treatment in routine conditions in Cotonu, Benin. *Int. J. Tuberc. Lung. Dis.* 2004; **8(10)**: 1242-1247
17. Rutta E, Kipingili R, Lukonge H, Assefa S, Mitsilale E, Rwechungura S. Treatment outcome among Rwandan and Burundian refugees with smear positive tuberculosis in Ngara, Tanzania. *Int. J. Tuberc. Lung. Dis.* 2001; **5(7)**: 628-632
18. El-Sony AI, Khamis AH, Enarson DA, Baraka O, Mustafa SA, Bjune G. Treatment results of DOTS in 1797 Sudanese tuberculosis patients with or without HIV co-infection. *Int. J. Tuberc. Lung. Dis.* 2002; **6(12)**: 1058-1066

19. Centis R, Ianni A, Migliori GB. Evaluation of tuberculosis treatment results in Italy, report 1998. Tuberculosis section of the National AIPO Study Group on Infectious Diseases and the SMIRA Group. *Monaldi Arch. Chest. Dis.* 2000; **55(4)**: 293-298
20. Lawn SD, Acheampong JW. Pulmonary tuberculosis in adults: factors associated with mortality at a Ghanaian teaching hospital. *West Afr. J. Med.* 1999; **18(4)**: 270-274
21. Samman Y, Krayem A, Haidar M, Mimesh S, Osoba A, Al-Mowaallad A, Abdelaziz M, Wali S. Treatment outcome of tuberculosis among Saudi nationals: role of drug resistance and compliance. *Clin. Microbiol. Infect.* 2003; **9(4)**: 289-294.
22. Kang'ombe CT, Harries AD, Ito K, Clark T, Nyirenda TE, Alois W, Nunn P, Semba RD, Salaniponi FM. Long-term outcome in patients registered with tuberculosis in Zomba, Malawi: mortality at 7 years according to initial HIV status and type of tuberculosis. *Int. J. Tuberc. Lung Dis.* 2004; **8(7)**: 829-836
23. Hargreaves NJ, Kadzakumanja O, Whitty CJ, Salaniponi FM, Harries AD, Squire SB. Smear negative pulmonary tuberculosis in DOTS programme: poor outcome in an area of HIV seroprevalence. *Int. J. Tuberc. Lung Dis.* 2001; **5(9)**: 847-854
24. Karstaedt AS, Jones N, Khoosal M, Grewe-Brown HH. The bacteriology of pulmonary tuberculosis in a population with high Human Immunodeficiency virus seroprevalence. *Int. J. Tuberc. Lung Dis.* 1998; **2(4)**: 312-316
25. Schoch OD, Reider H. Characteristics of sputum smear positive tuberculosis patients with or without HIV infection in a hospital in Zimbabwe. *Eur. Respir. J.* 1996; **9(2)**: 284-287
26. Harlir DU, Barnes PF. Tuberculosis in patients with Human Immunodeficiency virus infection. *N. Engl. J. Med.* 1999; **340(5)**: 367-373
27. HIV/AIDS in Nigeria overview of the epidemic. Federal Ministry of Health, March 2002
28. Okoro EO. Mandatory HIV testing in pulmonary tuberculosis (PTB)? *Nigerian Journal of Genitourinary Medicine.* 2004; **3&4 (1&2)**: 66-67