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Evaluation of directly observed treatment short courses at a secondary health institution in Ibadan, Oyo State, Southwestern Nigeria

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ABSTRACT

Objective: To evaluate the success rate of tuberculosis intervention programme at a specialist hospital in Ibadan, Nigeria through a retrospective study as well as carry out physicochemical evaluation of anti-tuberculous agents as a way of eliminating drug-related failure. **Methods:** The retrospective study involved the use of quarterly tuberculosis central register at the Government Chest Hospital, Ibadan between 1st quarter (2003) to 4th quarter (2009). Relevant data were extracted from these register with the aid of data collection forms. The basic physicochemical analyses of the drugs given to the patients were also carried out using the International Pharmacopoeia methods. **Results:** All the drugs examined for their physicochemical properties passed the International Pharmacopeia recommended tests. A total number of 1 260 patients enrolled at the hospital were assessed through case notes. This comprises of 59.4% males of which 69.23% new cases were also males. There was a significant ($P<0.05$) patient enrollment across the quarters for the seven years. An overall 80.24% cure rate over the 7-period was obtained which is less than the WHO target of 85%. Cure rates were better in females than males. Failure treatment outcomes such as positive (1.51%), deaths (8.73%), defaulted (3.33%) and transferred out (5.95%) were recorded though not statistically significant ($P>0.05$). Failure rates in all categories were higher in males than females ($P>0.05$). **Conclusions:** More enlightenment and counseling is still required to meet up with the target for TB control.

1. Introduction

Tuberculosis (TB) is a chronic infectious disease caused by *Mycobacterium tuberculosis* (*M. tuberculosis*), and occasionally by *Mycobacterium bovis* (*M. bovis*) and *Mycobacterium africanum* (*M. africanum*). It is a preventable, treatable and curable disease yet it causes more death than any other infectious agents in the world. Tuberculosis was for very many decades a global problem. Tuberculosis (TB) is a significant problem, infecting nearly 9 million new patients per year and killing about 2 million a year. The primary means with which to affect TB globally are to decrease transmission locally, mainly by effective identification, diagnosis, and treatment of infectious TB patients[1]. Breakthrough in the fight against TB came in 1943. There was a remarkable decline of tuberculosis disease until the mid 1980's when an upsurge in cases of tuberculosis was observed. This has been attributed to increase in high risk, immuno-compromised individuals especially those infected with HIV, and the emergence of drug resistant strains. Tuberculosis alongside malaria and HIV/AIDS are 3 major global public health threats and they cause substantial morbidity, mortality, negative socioeconomic impact, and human suffering. Despite the significant increase in financial support and recent progress in addressing these 3 diseases, important obstacles and unmet priorities remain. Disease-specific interventions

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have had a considerable impact on improving health systems. However, despite considerable investment, weak health systems, inadequate human resources, and poor laboratory infrastructure continue to be major obstacles to expanding health services[2]. Although progress has been made to reduce global incidence of drug-susceptible tuberculosis, the emergence of multidrug-resistant (MDR) and extensively drug-resistant (XDR) tuberculosis during the past decade threatens to undermine these advances. However, countries are responding far too slowly. Of the estimated 440 000 cases of MDR tuberculosis that occurred in 2008, only 7% were identified and reported to the WHO. Of these, only a fifth of the cases were treated according to WHO standards. Although treatment of MDR and XDR tuberculosis is possible with currently available diagnostic techniques and drugs, the treatment course is substantially more costly and laborious than for drug-susceptible tuberculosis, with higher rates of treatment failure and mortality[3].

A proven strategy to ensure patients' adherence to anti-tuberculosis medication is the use of Directly Observed Treatment Short course (DOTS) therapy. In DOTS, a health care provider observes the patient or other responsible person as the patient ingest the anti-tuberculosis medication. The DOTS provides the opportunity for patient education and also enables early detection of adverse effects[4]. Other key components of DOTS as specified by WHO are: political commitment with increased and sustained financing, legislation, planning, human resources, management, training; case detection through quality-assured bacteriology, strengthening TB laboratories, drug resistance surveillance; standardized treatment with supervision and patient support TB treatment and programme management guidelines; an effective drug supply and management system through availability of TB drugs, TB drug management as well as monitoring and evaluation system and impact measurement[4].

Tuberculosis has emerged as the single leading cause of death from any single infectious agent[5]. Despite being the world's leading bacterial cause of death, 95% of infection is believed to exist in an asymptomatic 'latent' form that is defined not by the identification of bacteria, but by the host immune response in the form of reactivity to tuberculosis proteins in the tuberculin skin test. It seems likely that clinically defined latent tuberculosis actually represents a spectrum that runs from elimination of live bacilli to subclinical disease[6]. In addition, the recent figures put the DOTS detection rate of new sputum smear positive to be below 20% while the treatment success of new sputum smear positive still falls below the WHO target of 85%[7]. Thus, there is need to carry out field study on DOTS in order to evaluate its treatment success rate.

In Ibadan, Southwestern Nigeria, a government-owned secondary health care hospital is charged with the responsibility of ensuring adequate provision of the DOTS programme as a strategy towards combating the spread of TB in the populace. The main objective of this study was centered at improving the overall pharmaceutical care received by tuberculosis patients at the Government Chest hospital, Jericho, Ibadan, which is a specialist hospital. The specific objectives were aimed at evaluating the impact of DOTS intervention on tuberculosis patients in achieving total control and to provide a platform for the pursuit of high quality DOTS expansion and enhancement. Physicochemical evaluations of the drugs utilized at the centre were also carried out in order to eliminate drug quality-related failures.

2. Materials and methods

2.1. Study design

The nature of the study of evaluation of Directly Observed Treatment short courses (DOTS) was descriptive and this entailed retrospective study of case files of positive TB cases. The retrospective study involved the use of quarterly tuberculosis central register at the Government Chest Hospital, Ibadan between 1st quarter (2003) to 4th quarter (2009). Relevant data were extracted from these register with the aid of data collection forms.

The basic physical and chemical analyses of the drugs given to the patients were also carried out in order to ascertain the quality of the drugs and eliminate drug-quality related cause of failure.

2.2. Ethical approval

The ethical approval to examine patients' case files was given by the Director of Medical Services, Hospital Management Board, Ibadan, Oyo State. The names of the patients were not adopted for the study.

2.3. Parameters assessed

The parameters that were measured from the quarterly tuberculosis register are the following; the number of patient that attended the clinic, the category of patient that attended the clinic (which could be; new patient: never previously treated for as much as 1 month, relapse: previously treated and declared cured returns smear positive, failure: positive smear 5 or more months after starting treatment put on retirement, RAD: Return after default and transfer in: registered and started treatment in another district), the number of female patients and male patients that attended the clinic and the treatment outcomes for each patient

(which could be; cured: negative smear at last month of treatment and on one previous occasion, positive *i. e.* failure: positive smear at 5 months or later during treatment, died: died from any cause during treatment, defaulted: failed to collect medications for more than 2 month after date last seen, transferred out: sent to another district for continuation of treatment).

2.4. Estimation of cure rates

The cure rate for each quarter was estimated by the number of negative smears as a fraction of the total patients recorded for the quarter from the expression:

$$\text{The percentage of patient cured for the quarter} = \frac{\text{Total number of negative smear (cured)}}{\text{Total number of patients for the quarter}} \times 100$$

Summary tables were prepared for the twenty eight quarters taking into consideration the above parameters and comparing their results.

2.5. Physicochemical analyses of anti-tuberculous agents

Basic chemical and physical tests were carried out on the anti-tuberculosis drugs given to patients as specified in the International Pharmacopoeia[8]. This was done in order to ensure that treatment failures were not due to poor quality drugs. The drugs analyzed include; rifampicin capsule, pyrazinamide tablet, ethambutol hydrochloride tablet, isoniazid tablet and streptomycin sulfate for injection.

2.5.1. Identification tests for rifampicin

A 0.392 5 g quantity of powdered tablet equivalent to 50 mg of rifampicin was dissolved in methanol and 1 mL of the solution was diluted to 50 mL with phosphate buffer, pH 7.4. The absorption spectrum of the resulting solution, when observed between 220 nm and 500 nm, would exhibit 4 maxima at about 237 nm, 254 nm, 334 nm and 475 nm; the ratio of the absorbance of a 1 cm layer at the maximum at about 334 nm to that at the maximum at about 475 nm was assessed.

2.5.2. Test for pyrazinamide

For test A, 0.157g of the powdered tablets equivalent to 0.05 g of pyrazinamide was dissolved in 50 mL of water and filtered. 1 mL of the filtrate was diluted to 100 mL with water. The absorption spectrum of this solution, when observed between 230 nm and 350 nm, would exhibit two maxima. The ratio of the absorbance of a 1 cm layer at 268 nm to that at 310 nm was determined.

For test B, 0.189 g of the powdered tablets equivalent to 0.06 g of pyrazinamide, 5 mL of sodium hydroxide (80 g/L) was added and heated on water bath; vapours were evolved. The colour of moistened pH-indicator paper inserted into the vapours was noted.

2.5.3. Test for ethambutol hydrochloride

Ten mL of methanol was added to 0.165 g of powdered tablet equivalent 0.1 g of ethambutol and shaken. The extract was filtered and evaporated to dryness. The residue was the acidified with nitric acid (130 g/L) and silver nitrate (40 g/L) was added. The result was noted.

2.5.4. Test for isoniazid

Twenty mL of water was added to 0.439 g of the powdered tablet equivalent to about 0.1 g of isoniazid, it was shaken and filtered. A mixture composed of 1.0 mL of silver nitrate (40 g/L) and 1.0 mL ammonia (100 g/L) was added. The results were noted.

2.5.5. Test for streptomycin sulfate

For test A, 0.136 g streptomycin powder for injection equivalent to 0.1 g of streptomycin sulfate was dissolved in 2 mL of water, and 1 mL of 1-naphthol was added and 2 mL of a mixture of equal volumes of sodium hypochlorite (40 g/L) and water was also added. The colour produced was recorded.

For test B, 0.068 g of streptomycin powder for injection equivalent to 50 mg of streptomycin sulfate was dissolved in water. Barium chloride (50 g/L) was added. The precipitate formed was noted, and its solubility in hydrochloric acid (250 g/L) was observed.

For test C, the clarity and colour of solution was observed using 3.4 g of streptomycin powder for injections which is equivalent to 2.5 g of streptomycin sulfate. The sample was dissolved in 10 mL of carbon-dioxide-free water. The clarity and colour were noted.

For test D, the pH value of the solution prepared above for the test of clarity and colour was taken.

2.6. Statistical analysis

The data collected for the retrospective study were analyzed using percentages as the descriptive statistics. The Levene's test for equality of variances was done for treatment outcomes within each quarter. ANOVA was adopted to study the observed responses for all the quarters with Duncan's multiple comparison test for significant differences between each year, $P<0.05$ were taken as significant.

3. Results

All the drugs sourced which are currently being used for

Table 1
Overall quarterly summary of patient enrollment and treatment outcomes for 2003–2009.

Parameters	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Number of patients	325	197	128	307	185	122	297	168	129	331	199	132
Category of patients												
New	271	159	112	256	153	103	256	144	112	283	170	113
Relapse	7	6	1	7	5	2	8	7	1	14	8	6
Failure	2	1	1	4	4	0	3	1	2	5	5	0
Return after default (RAD)	11	7	4	2	2	0	0	0	0	3	2	1
Transferred in	21	13	8	21	16	5	19	10	9	20	13	7
Others	13	11	2	15	9	6	11	6	5	9	4	5
Results of treatment												
Negative (Cured)	269	162	107	232	133	99	243	137	106	267	155	112
Positive (Failure)	2	1	1	8	6	2	4	0	4	5	5	0
Died	24	16	8	33	22	11	30	19	11	23	14	9
De-faulted	11	9	2	14	13	1	9	5	4	8	7	1
Transferred out	19	9	10	20	11	9	9	5	4	27	17	10
Percentage cure rate (%)	82.77	82.23	83.60	75.57	71.89	81.15	81.82	81.55	82.17	80.66	77.89	84.85

Table 2
Typical yearly report for patients' inventory and treatment outcomes (Year 2008).

Parameters	Quarter 1			Quarter 2			Quarter 3			Quarter 4		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Number of patients	53	29	24	55	33	22	57	38	19	56	38	18
Category of patients												
New	48	26	27	43	27	16	53	35	18	46	32	14
Relapse	Nil	Nil	Nil	4	3	1	2	1	1	3	2	1
Failure	1	Nil	1	1	1	Nil	Nil	Nil	Nil	1	1	Nil
Return after default (RAD)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	2	1	1
Transferred in	2	2	Nil	1	1	Nil	2	2	Nil	2	1	1
Others	2	1	1	6	1	5	Nil	Nil	Nil	2	1	1
Results of treatment												
Negative (Cured)	44	24	20	38	22	16	53	35	18	50	34	16
Positive (Failure)	Nil	Nil	Nil	2	2	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Died	3	2	1	6	2	4	3	2	1	3	2	1
De-faulted	1	1	–	3	3	Nil	1	1	Nil	3	2	1
Transferred out	5	2	3	6	4	2	Nil	Nil	Nil	Nil	NIL	Nil
Percentage cure rate (%)	91.7	82.8	83.3	69.1	66.7	72.7	93.0	92.0	94.7	89.3	89.5	88.9

the directly observed treatment short course of tuberculosis passed all the tests specified in the International Pharmacopoeia. This has eliminated any reason for failure of therapy as being due to poor-quality drugs. At least, the drugs contain the stated medicaments. The assays of the drugs were not carried out due to the inability to source enough drugs from the secondary health care centre. The samples obtained were just used for the identification test. The spectra of rifampicin and pyrazinamide are presented in Figures 1 and 2, respectively.

The overall summary of the treatment courses for the seven-year retrospective study is presented in Table 1 while Table 2 presents a typical yearly report sheet with 2008 used as a model in the table. Table 3 presents the overall percentage summary for the total patients in each three categories (number of patients, category of patients and results of treatments) studied. From Tables 1 & 3, the total number of patients recruited into the treatment for the period was 1 260 of which 59.4% were males and 40.6% were females. Thus a higher number of male subjects reported for the treatment during the period. The tables also show the category of the patients as new, relapse, failure, return after default, transferred and others who do not fall into any of the aforementioned category. For the 28 quarters studied, the % new case relative to the total of patients was 84.6% of which males constitute 69.23% and females 30.77%. Thus a higher number of males were registered as new cases. Studying the effects of gender, there was statistical significant difference in the total number of patients registered and among those that transferred in ($P<0.05$). This was anticipated since there was a wide gap between the numbers of males compared to females that enrolled for treatment. Among the males, statistical significant difference exist in "transferred in" ($P=0.001$) and "others" ($P=0.036$) cases. For females there

was no significant difference among the number of patients (P>0.05). The 4th quarter 2006 witnessed the lowest number of new cases and 1st quarter 2006 witnessed a corresponding highest new cases. Among the category of patients were those returning after failure, defaulted and "transferred in" which represent 2.86%, 1.12%, 11.27% and 6.93%, respectively. The cases categorized as "new" show statistical significant difference across the quarters for the seven-year period (P<0.05) while Duncan multiple comparison test shows that 2007 (the lowest) and 2006 (highest) contributed to the significant difference. Statistical significant differences were also observed among transferred in, RAD and others (P<0.05). For RAD, 2003 and 2007 (lowest) and 2009 (highest) contributed to the observed pattern.

The treatment outcomes were categorized as cured (showing negative sputum smear test), positive (showing positive smear test), died, defaulted and transferred out. Cure rates were generally better in female than male patients when weighted as a ratio of the total number of patients by gender. However, on the whole as a ratio of the total patients cure rates were higher in males than female since a higher number of males registered (Table 3, P>0.05). The overall average cure rate of 82.24% was recorded for the seven-year period. The cure rate for male of the total number of male patients was 78.37% while that of female relative to the total female was 82.97%. There thus appears to be a better cure rate among female than male justifying that the female comply better with treatment courses than their male counterparts. The cure rate among each of the quarters for the seven-year period is presented in Figure 3a while Figure 3b shows the positive failure rate for the treatment period. There was no statistical significant difference in all treatment outcomes for the seven-year period (P>0.05). Also there was no significant difference among each group of males and females in all treatment outcomes (P>0.05).

The failure rates for the DOTS programme in the centre studied for the seven-year period is presented in Table 4. The highest failure rate; representing positive smear cases only excluding deaths, defaulters and transferred out, occurred at the 2nd of 2009 and got carried over to 3rd quarter. However, failure rate came to a minimum by 4th quarter. Years 2006 and 2007 as well as 2008 witnessed the lowest failure rates. In particular, there was no record of positive smear cases amongst patients in 1st to 3rd quarter of 2006 and 2007.

The % death recorded from the TB cases for the 2003-2009 period in the centre studied is presented in Table 5. The highest % deaths were recorded in 2nd quarter (for both males and females). Although when related by each quarter and year, 1st quarter 2003 and 4th quarter 2003 had the highest and lowest deaths respectively.

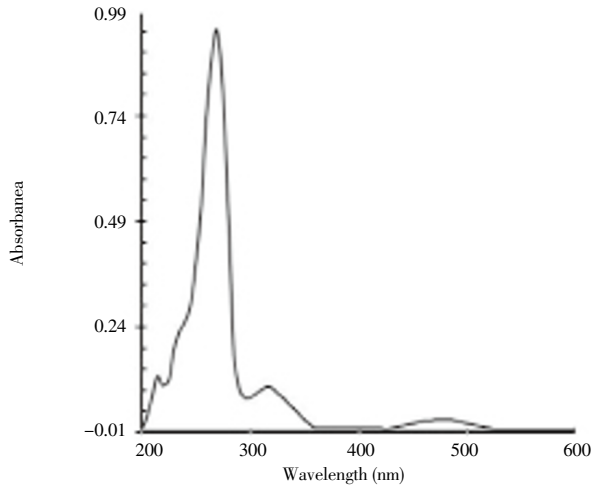

Figure 1. Absorption spectrum of rifampicin.

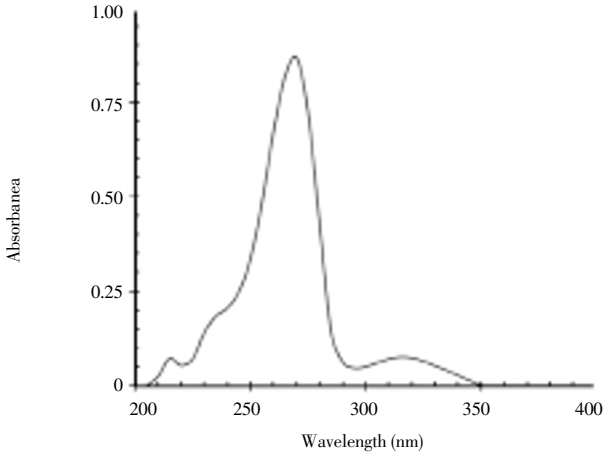

Figure 2. Absorption spectrum of pyrazinamide.

Table 3

Overall Summary for the treatment courses for the seven-year period.

Parameters		Overall percentages (%)		
		Total	Male	Female
Number of patients		100.00	59.40	40.60
Category of patients	New	84.60	89.23	30.33
	Relapse	2.86	72.22	27.78
	Failure	1.12	78.57	21.43
	Return after default	1.27	68.75	31.25
	Transferred in	6.43	64.20	35.80
	Others	3.81	62.50	37.50
Results of treatment	Negative (Cured)	80.24	58.06	41.94
	Positive (Failure)	1.51	63.16	36.84
	Died	8.73	64.55	35.45
	De-faulted	3.33	80.95	19.05
	Transferred out	5.95	56.00	44.00
Percentage cure rate		80.24	78.37*	82.97*

*Weighted as a total for each gender category.

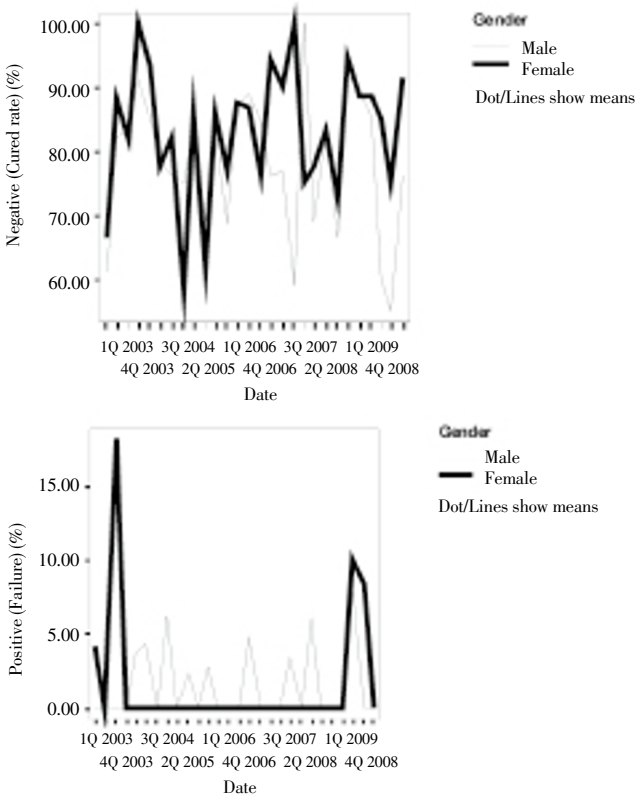

Figure 3. Results of negative (a) and positive (b) cure rates for the years studied.

Table 4

Percentage failure rates for TB treatment at the DOTs centre[a].

Year	Failure rates (%)			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
2003	2.38	0.00	6.90	0.00
2004	2.38	2.44	0.00	3.92
2005	0.00	1.82	0.00	2.08
2006	0.00	0.00	0.00	2.56
2007	0.00	0.00	0.00	2.13
2008	0.00	3.64	0.00	0.00
2009	0.00	8.89	4.45	0.00

[a]Percentage failure rates refer to only positive cases following treatment (deaths, defaulters and transferred out are excluded).

Table 5

% Death recorded from TB patients (2003-2009).

% Death	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Overall[a]	7.38	10.75	10.10	6.95
Male[a]	66.67	66.67	63.33	60.87
Female[a]	33.33	33.33	36.67	39.13
Male[b]	8.12	11.89	11.31	7.04
Female[b]	6.25	9.02	8.53	6.82

[a]Calculated as a function of total deaths recorded and [b]as a function of total patients in each category.

4. Discussion

In this study, the evaluation of DOTS was done retrospectively using the retained quarterly tuberculosis control register at the Government Chest Hospital, Ibadan while basic chemical and physical tests were carried on the anti-tuberculosis drugs given to the patients. The basic tests carried out reveals that all the drugs being used for the treatment courses contain the active ingredients.

In addition to the physicochemical evaluation of the anti-TB drugs as a way of eliminating drug-related factors in DOTS therapy, a retrospective assessment of the case notes of patients attended to for four quarters over a 7-seven period was conducted. To the best of our knowledge this is the first comprehensive retrospective evaluation of the treatment strategy at this specialist treatment centre in Ibadan, Nigeria. Varying results were obtained with respect to the several treatment outcomes envisaged from any DOTS programme. The results should help in improving the care afforded the patients at this secondary health care facility.

From an examination of this study, there appears to be substantial new cases of TB recorded over the study period. The implication of this is that the battle against this disease is long from being won. It will actually require more efforts and better socio-economic considerations to improve the situation. The discovery of other conditions, primarily HIV/AIDS, leading to complications in cases of immuno-compromised patients appears to be increasing the cases of TB. Although, some other underlining factors were not considered in this study, several other factors previously identified may as well be responsible for the incidence of new cases observed in this study. Salami *et al*[9] identified predisposing factors to TB as consisting of low socioeconomic status, overcrowding and poor living conditions. In all, new cases constitute over 80% of patients that reported for treatment at this centre over the 7-year period. This appears alarming on one hand, but on the other hand it appears more people are forsaking the stigma associated with the condition to report at this health provider centre.

Male patients contributed to two-thirds of the new cases of TB observed. This is consonance with the report of Salami *et al*[9] in Ilorin, a north-central state where 55% of the cases considered over a 4-year period were males. Males are known to be at an increased risk of contracting this disease due to several risk factors, occupational hazards, carefree attitudes and some other lifestyle choices

that can compromise immunity. The percentage of new cases recorded across the various 28 quarters studied were statistically significantly different from one another (P=0.013). This is clearly evident from the number of new cases observed in Table 1. Duncan's multiple comparison tests revealed that 2007 has the lowest report of new cases and 2006 has the highest incidences of new cases being enrolled into the DOTS programme.

Among the category of patients studied were those that fall under relapse, failure, return after default and transferred in. Although the percentage of relapse cases are few, contributing 2.86% of the total patients studied, their occurrence suggest lack of compliance to medication or the attitude of missing one clinic visit or another. Patient compliance has been identified as a critical problem early in the provision of treatment courses for TB control[10]. Once again, the males are responsible for greater than two-thirds of the relapse cases. Those returning after failure and default are in the range of 1.12% and 1.27%, respectively with males being responsible for a greater percentage of this category of patients. The percentage of patients that transferred in to the services provided at the Chest clinic studied constitutes 6.43% of which males are 64.2%. That people are transferring in to the DOTS programme suggests awareness of existence of a treatment centre in their new location which portends a good trend for the control of TB. In addition, recent enlightenment on radio and local television stations about the need for people to report to these centres may have had a positive influence on the number of "transferred in" observed. This initiative sponsored by the Federal Ministry of Health of Nigeria in partnership with global fund is highly commendable.

Common classification of treatment outcomes from TB cases are; cured (in which a negative smear test is produced), positive (i.e. failure), died, defaulted and transferred out. In Nigeria, the treatment success rate was 79% in 2002, this increased to 85% in 2003. However, default remain as high as 11% in the 2-year period while death was up to 6.7%[11]. The recommended target cure rate by WHO is 85%. From the result of our retrospective study, the overall cure rate observed over the 7-year period from this TB primary care-giving centre is 80.24%. This is a far cry from the targeted success rate expected from the DOTS programme; hence more efforts are still required to meet up with this target. When each gender category is weighed on each other, females (82.97%) had better cure rates than males (78.37%). The reason adducible for this may be that females show better compliance to medications, may be more regular at hospital visits and females are known to exhibit less care-free attitudes to health conditions than males. Males have been identified in several studies to be at an increased risk of a poor treatment outcome compared to females[12,13]. Other poor treatment outcomes identified in this retrospective study include failure (1.51%), died (8.73%), defaulted (3.33%) and transferred out (5.95%). Third quarter of 2009 had the highest positive (failure) rate while quarter 4 in most of the years recorded substantial failure rates. It appears that most patients seem to be fed up with treatment courses towards the end of the year. This is a factor that care givers must look into and adequate counsel given as such failure rates must not only be perceived as patient failures but also failure of the care-givers themselves[14]. However, TB control in large urban settings poses a unique challenge for many national TB programmes including those in low-income countries. This is attributed to a number of factors including social, operational, economic, managerial constraints and poverty[15-19]. In a longitudinal study involving a cohort of sputum smear-positive patients with pulmonary TB in Ibadan in 2008, Fatiregun *et al*[20] reported the cure rates varying significantly among treatment centres in Ibadan with that in Teaching Hospital and the present centre considered in our study having the highest cure rates. The default rates were as high as 6.6% while a similar study in Ile-Ife, another southwestern Nigerian city, over a ten-year period[21] gave default rate as high as 27%. Many factors have been identified for defaulting in any DOTS programme. Some obvious differences between defaulters and those who completed the treatment have been identified. Defaulters were shown to have the highest rates of those who are not satisfied with the treatment offered. Some were known to stop treatment prematurely because of side effects from medications or the perception that they were cured[22]. This is where the practical aspect of pharmaceutical care will play a major role in educating patients at the outset of therapy that side effects are bound to occur and completion of treatment is the only way to guarding against recurrence and treatment failure.

A not too satisfactory percentage of the patients died during the course of the 7-year retrospective study conducted at this specialist hospital. The deaths recorded are presented in Table 5. Highest number of deaths was recorded in third quarter relative to the other three quarters across the 7-year period. Although there was no statistical significant difference (P>0.05) in the deaths recorded across the

quarters, years and across gender line, the rates still appears too high. Once again, the male patients are responsible for most of the deaths reported. This leaves more to be desired and in essence more advocacy must be done to enlighten the populace that deaths are still recorded from TB cases even in the 21st century.

In conclusion, this retrospective study has established that the target cure rate as stipulated by the WHO has not been accomplished in this health care centre, although quite close to it. More success rate will be observed as enlightenment is increased and better counseling services are provided by care-givers. The current awareness of the disease in public broadcasting stations across the length and breadth of Nigeria is commendable and must be sustained to accomplish the targeted result.

Conflict of interest statement

We declare that we have no conflict of interest.

References

[1] McQuade BK, Smith N, Shirley R, Achieng L, Keiser P. A quality assessment tool for tuberculosis control activities in resource limited settings. *Tuberculosis (Edinb)* 2011; **91**(Suppl 1): S49-S53.

[2] Vitoria M, Granich R, Gilks CF, Gunneberg C, Hosseini M, Were W, et al. The global fight against HIV/AIDS, tuberculosis, and malaria: current status and future perspectives. *Am J Clin Pathol* 2009; **131**: 844-848.

[3] Gandhi NR, Nunn P, Dheda K, Schaaf HS, Zignol M, van Soolingen D, et al. Multidrug-resistant and extensively drug-resistanttuberculosis: a threat to global control of tuberculosis. *Lancet* 2010; **375**: 1830-1843.

[4] World Health Organization. The five elements of DOTS. [Online]. Available from: http://www.who.int/tb/dots/whatisdots/en/index.html. [Accessed on September 10, 2012].

[5] Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *Lancet* 2006; **367**: 1747-1757.

[6] Young DB, Gideon HP, Wilkinson RJ. Eliminating latent tuberculosis. *Trends Microbiol* 2009; **17**: 183-188.

[7] WHO. *Global tuberculosis control*. Geneva: World Health Organization; 2008.

[8] WHO. *The international pharmacopoeia Volume 5*. Geneva: World Health Organization; 2003.

[9] Salami AK, Oluboyo PO. Management of pulmonary tuberculosis: A nine year review in Ilorin. *West Afr J Med* 2003; **52**: 114-119.

[10] Castelnuovo B. Review of compliance to anti tuberculosis treatment and risk factors for defaulting treatment in Sub Saharan Africa. *Afr Health Sci* 2010; **10**: 320-324.

[11] Global Tuberculosis programme. *Global tuberculosis control: Surveillance, planning and financing*. Geneva: World Health Organization; 2005, p. 108-111.

[12] Corbett EL, Bandason T, Cheung YB, Makamure B, Dauya E, Munyati SS, et al. Prevalent infectious tuberculosis in Harare, Zimbabwe: burden, risk factors and implications for control. *Int J Tuberculosis Lung Dis* 2009; **13**: 1231-1237.

[13] Naidoo P, Dick J, Cooper D. Exploring tuberculosis patients' adherence to treatment regimens and prevention programs at a public health site. *Qual Health Res* 2009; **19**: 55-70.

[14] Ruhweza M, Busulwa P, Nakanwagi A, Baluka J, Egaddu C, Lukoye D, et al. Improving TB patient follow-up of a large urban setting in a low-income country: A case study in Kampala Uganda. *Afr Health* 2010; 14-18.

[15] Mauch V, Woods N, Kirubi B, Kipruto H, Sitienei J, Klinkenberg E. Assessing access barriers to tuberculosis care with the tool to estimate patients' Costs: pilot results from two districts in Kenya. *BMC Public Health* 2011; **11**: 43.

[16] Gwatkin D, Rutstein S, Johnson K, Suliman E, Wagstaff A, Amouzou A. *Socio-economic differences in health, nutrition and population within developing countries: An overview*. Washington DC: The World Bank; 2007

[17] Escott S Newell J. The impact of societal issues on a community-based TB programme, Swaziland. *J Health Organiz Manage* 2007; **21**: 506-518.

[18] Newell J, Baral S, Pande S, Bam D, Malla P. Family-member DOTS and community DOTS for tuberculosis control in Nepal: cluster-randomised controlled trial. *Lancet* 2006; **367**: 903-909.

[19] Codecasa L, Migliori G. TB in large cities. WHO [Online]. Available at http://www.euro.who.int/tuberculosis/publications/20071204_12.

[20] Fatiregun AA, Ojo AS, Bamgboye A. Treatment outcomes among pulmonary tuberculosis patients at treatment centres in Ibadan Nigeria. *Ann Afr Med* 2009; **8**: 100-104.

[21] Erhabor GE, Adebayo RA, Omodara JA, Famurewa OC. Ten year review of patterns of presentation and outcome of pulmonary tuberculosis in OAUTHC, Ile-Ife, Nigeria. *J Health Sci* 2003; **3**: 34-39.

[22] Sanneh A, Pollock JI. Comparison of pulmonary TB DOTS clinic medication before and after the introduction of daily DOTS treatment and attitudes of treatment defaulters in the Western Division of the Gambia. *Afr Health Sci* 2010; **10**: 165-171.