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Factors influencing tuberculosis medication adherence: A cognitive intervention in a resource limited setting

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ABSTRACT

Adherence to tuberculosis (TB) treatment is a critical factor in determining treatment success. Knowledge about tuberculosis and the belief in the efficacy of the medication influence whether or not a patient chooses to adhere to the treatment. This study determined the factors that influence tuberculosis medication adherence and assessed the impact of a cognitive intervention. The prospective, cross sectional hospital based survey was carried out in Our Lady of Apostle (OLA) Hospital, Jos, Plateau state, Nigeria from October 2014 to January 2015. Structured, interviewer administered questionnaire was used to collect data from 301 respondents. Data collected was analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. The adherence level was 80.5%. The factors significantly (p<0.05) associated with TB medication adherence were ethnicity, religion, alcohol consumption, knowledge of TB disease and DOTs. TB patients were educated on the cause, mode of transmission of tuberculosis and the objectives of the Directly Observed Therapy short course (DOTs) program, which yielded a significant impact (p<0.01). Adherence monitoring plans like home visits and care should be sustained and home based care should be encouraged.

Keywords: Tuberculosis, Medication Adherence, Directly Observed Therapy, Cognitive Intervention, Resource Limited Setting

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by the bacteria: *Mycobacterium tuberculosis.* Adherence is the extent to which a person's behavior in taking medications corresponds with the agreed recommendations from a health provider [1]. Some investigators have further defined adherence to include data on dose taking (taking the prescribed number of tablets (pills) each day), the timing of doses (taking the pills within prescribed period) and food restriction [2-4]. Rates of adherence for individual patients are usually reported as percentage of the prescribed doses of medication actually taken by the patient over a specific period [5]. Adherence rates are typically higher among patients with acute disease conditions compared with those with chronic conditions [6]. There is no consensual standard for what constitutes adequate adherence [7]. Some trials consider rates greater than 80% to be acceptable whereas others consider a rate of 90% and above to be mandatory for adequate adherence [8-9]. Adherence may be measured using either process-oriented or outcome oriented measures. Outcome oriented measures use the end result of treatment for example, the cure rate is used as an indicator of success while process-oriented indicators make use of intermediate variables such as appointment keeping or pills count to measure adherence [9]. Adherence to TB treatment regimen is a critical factor in determining treatment success [10]. Medication non-adherence is the patient's inability or refusal to take TB drugs as prescribed [11]. When medical treatment is complicated or lasts for a long time like in the treatment of TB disease, patients often do not take their medication as instructed. This behavior often leads to serious consequences such as: patients remaining sick longer or having more severe illness, spread TB to others, development and spread of drug-resistant TB or death [6]. Several factors have been shown to influence TB medication adherence, classified broadly as patient/personal, social, structural and health service [12].

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Stigmatization has been shown to create a lot of self-denial among TB patients; hence most patients fail to adhere to the treatment regimen [9]. Communities with low literacy level believe that merely associating with TB patients may cause them to have the disease and may create resentment by those in the household to providing support to the patients and encourage non-adherence. Discrimination on the basis of the disease at the health facilities sometimes exacerbates the problem with adherence to drug taking behavior [13].

Tuberculosis usually affects people who are hard to reach such as the homeless, the unemployed and the poor and these have been linked as barriers to treatment adherence. Likewise, lack of money for transportation which is a consequence of poverty and unemployment has also been identified as barrier to treatment adherence especially when the clinic is situated at a far distance from the community [9]. However, the proximity to the health facility on the contrary has also been found to affect the follow up attendance and treatment adherence due to stigmatization [14].

Better communication between professionals, particularly dispensers and patients is essential for improving treatment adherence. Conversely, negative attitudes from the health care providers of medication and out of stock drugs discourage the patients from treatment adherence. The inter-relationship between these factors greatly reflects the level of treatment adherence, hence poor patient adherence is responsible for the current TB epidemic because TB patients remain contagious and will continue to infect others [15].

Knowledge about tuberculosis and the belief in the efficacy of the medication influence whether or not a patient chooses to adhere to the treatment. Studies have shown that failure in the adherence to therapy occurs mostly after the intensive phase when the patients feel they have gotten well [16-17]. In spite of the free access to anti-tuberculosis drug, incidence and prevalence of tuberculosis in Nigeria is still high. Adherence levels have been shown to range between 70% - 94% in different states of the country [18-20]. Thus, a full understanding of the factors that prevent people from taking the medicines correctly and those that help them complete their treatment is necessary. This study therefore determined the factors that influence tuberculosis medication adherence and assessed the impact of a cognitive intervention.

METHODS

Study Setting: The study was carried out in Our Lady of Apostle (OLA) Hospital, located at No. 1 Zaria by-pass, Jos, Jos North local government area of Plateau State, North-Central Nigeria. The hospital provides primary and secondary health services such as care for emergencies; infectious diseases like HIV, TB and malaria; surgery; maternal and child health services. The DOTs unit of the hospital is located beside the emergency unit and has two health staff trained to give counseling to TB patients, register TB Patients, dispense TB medication, recommend laboratory tests for TB and HIV after counseling and keep health/medication records of all registered TB patients. The clinic days of the hospital run every Monday to Saturday of the week. The clinic records 5 to 7 new cases weekly and about 40 to 60 follow-up cases weekly. Clinic appointments are given weekly for follow-up to patients on intensive phase of the treatment and monthly follow-up to patients on continuation phase of the treatment.

Study Design: This was a prospective, cross sectional hospital based survey carried out in a secondary health facility in Jos North Local Government area of Plateau Sate, Nigeria.

Population and Sample Size: The study population was all TB adult patients attending the DOTs clinic of Our Lady of Apostle Hospital, Jos. The minimum sample size of 225 was determined using Fisher's Formula Z^2pq/d^2, where global TB prevalence rate of 0.178 was used [21]. A total of 301 patients participated in the study having met the inclusion criteria and correctly and completely filled the questionnaire. Of the 301 patients, 34 of them participated in the intervention study.

Inclusion Criteria: All adult TB patients (18 years and above) as well as TB/HIV co-infected patients who registered in the DOTs clinic were recruited into the study.

Research Instrument: A structured 3-sectioned questionnaire was used. The first section consisted of Socio-demographic data, the second section were questions that measured the medication adherence level while the third part was made up of questions that measured the factors influencing adherence. Structured interview using a 2-sectioned questionnaire was done before and after the cognitive intervention.

Data Collection: Having pre-tested the questionnaire, findings from the pre-test were used to make amendments on the tool before it was finally used for the study; where TB patients were given the questionnaires to fill. Interview was conducted for illiterate and visually impaired patients. The intervention questionnaire was administered to the patients and their responses

were obtained. They were educated about TB disease and the importance of adhering to taking their anti-TB medications. They were also enlightened about the DOTs programme and its objectives, after which each patient refilled the questionnaire on the next follow up visit to compare responses before and after intervention. Data was collected from October 2014 to January 2015.

Data Analysis: Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0. (Microsoft® Inc. Chicago, Illinois, USA. 2011). The observed similarities and differences were tested while cross tabulation of necessary factors with observed variables were done using the Chi-square test. *p*-value of less than 0.05 was considered significant.

Ethical Consideration: Ethical approval and permission to collect data was obtained from the Research and ethical committee and the head of the DOTs unit respectively of the Our Lady of Apostle Hospital, Jos, before the study commenced. Informed consent was sought from the respondents after careful explanation of the purpose of the study and intended respect for confidentiality was stated.

RESULTS

Three hundred and twenty questionnaires were distributed and three hundred and one (301) were correctly filled and returned, giving a response rate of 94.1%. Thirty four of the registered TB patients were recruited for the intervention study. There were more males (59.1%) than females (40.9%) patients. Majority (55.9%) were in the reproductive age group (18-40 years). Most (56.3%) of the patients were married (56.5%) and belonged to the Hausa (39.7%) ethnic group (table 1). The adherence level was 80.5%. The most frequent reasons given for medication non-adherence were: forgetfulness, felt well and side effects of the anti-TB medications (table 2). More patients (57.1%) had inadequate knowledge of TB disease with only few (29.9%) knowing the cause of TB disease. Majority (72.8%) were however aware of the DOTs programme and its objectives (table 3). The factors significantly related to adherence were ethnicity, religion, alcohol consumption, knowledge of TB disease and its management and satisfaction with health worker's service (tables 4 and 5). There was an increase in the knowledge level of the patients after the intervention (tables 6 and 7) which was highly significant ($p<0.01$). The level of TB medication adherence increased after the cognitive intervention but was not significantly related (table 8).

DISCUSSION

Most of the demographic factors (age, gender, marital status and occupation) were not significantly associated with adherence (table 4). This was similarly observed in Zambia where Age, marital status and educational levels were not significantly associated with adherence [13]. Ehrabor also reported that no socio-demographic factors considered, significantly influenced the rate of compliance under DOT, and as such they are not reliable predictive factors [18]. The study however revealed that ethnicity and religion were significantly ($p<0.01$) associated with medication adherence among the patients (table 4). This could be due to the location of the hospital close to the Hausa ethnic group settlements who were predominantly Muslims.

The level of adherence to taking anti-TB medication in the study was 80.5%. Though this was below the optimal level of greater than 90% [5,22], it was an improvement in the treatment adherence level of 47.3% reported by Salami *et al*, 2003 in the University of Ilorin Teaching Hospital, Ilorin, North Central Nigeria where they evaluated the management outcome of TB patients about 12 years ago [15] and 73% in the year 2000 in Ile-Ife South-Western Nigeria [18]. This improvement could be due to improved access to anti-TB drugs, shift from multiple/loose pills therapy to fixed dose combinations (FDC) and awareness programs on treatment adherence by the government and development partners. The most frequent reasons given for non-adherence were forgetfulness, feeling well and side effects of the medication. These were significantly related to adherence (table 5). This was similarly observed in other studies [13,16,18,20], and it calls for more patient education on the importance of medication adherence. Majority of the respondents that remembered that they had skipped their medicines took the next day so that development of drug resistance and/or therapy failure would be minimized (tables 2 and 5). Inadequate therapy of TB is one of the main reasons for treatment failure and development of acquired drug resistance [6,15]. This can occur through non-adherence to therapy or malabsorption of the anti-TB medications [23]. The cure for TB relies on the patient receiving a full, uninterrupted course of treatment, which can only be achieved if the patient and the health service work together [2].

Patient level of knowledge on TB disease and its management was significantly related to adherence (table 3c) implying that the higher the knowledge level, the higher the level of adherence, as similarly observed in other studies [3,24]. This implies that

more patient education is needed to improve medication adherence since more of the patients (57.1%) had inadequate knowledge of TB disease and its management (table 3b).

It was also observed in the intervention studies (table 6) that an increase in the knowledge level (1.88 to 3.73 out of a scale of 4) of the patients led to an increase in the level of adherence (45.7% to 54.3%). The increase in adherence levels was not significant which could be due to the small number of patients (34) that participated in the intervention study (table 8). The increase in the knowledge level was however highly significant ($p<0.01$) implying that most patients remembered what they were taught (tables 6 and 7). Studies have similarly shown that the long treatment period not well understood by patients led to non-adherence, which was seen to improve when patients were educated on the need to complete treatment [3,12,20,24,25].

Most of the support the TB patients got was from their family though this was not significantly associated with adherence (table 5). However, support was reported as a significant contributor to adherence in some studies [25-26], as they were encouraged and reminded to take their medications. Majority of patients that changed location of residence while on treatment defaulted from taking their medication (56.9%) though there was no significant association with adherence (table 5). This could be due to the fact that changing location could create a longer distance between patient's residence and health facilities therefore making it difficult for the patients to re-fill their medication [9,12,16,18]. However, proximity to the health facility on the contrary has also been found to affect the follow up attendance and treatment adherence due to stigmatization [14]. The more TB patients were satisfied with the service received from the health workers, the more they were likely to adhere to taking their medications (table 5). This was similarly observed in other studies where it was seen that the type of language used by the health workers could influence patient reaction to taking medication [13,15,16,27].

The significant association between treatment adherence and alcohol consumption (table 5) could be attributed to the fact that alcohol alters behavior [28] and is hepatotoxic [29]. This can worsen the side effects of the anti-TB medications (especially hepatotoxicity), making the patients feel worse. This study was limited by lack of follow up on more patients for the intervention study due to inability to trace the patients.

CONCLUSION

The effort of the government and development partners is appreciated however, medication adherence among TB patients needs to be improved so as to achieve success cure rate of 90% and above. Adherence monitoring plans such as home visits and care should be sustained and home based care should be encouraged to help overcome factors such as forgetfulness and transportation. There is also the need to offer medication adherence counseling to TB patients especially on the need to complete treatment in order to prevent treatment failure and the development and spread of resistant TB strains.

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Table 1: Demographic characteristics of the respondents

Variable	Frequency	Percentage
Gender		
Male	178	59.1
Female	123	40.9
Age category (in years)		
18-30	64	21.3
31-40	104	34.6
41-50	62	20.6
51-60	48	15.9
61 and above	22	7.3
Marital status		
Married	170	56.5
Single	84	27.9
Divorced/separated	30	10.0
Widowed	16	5.3
Ethnicity		
Hausa	120	39.9

Yoruba	56	18.6
Igbo	39	13.0
Others	86	28.6
Education		
No formal education	128	42.5
Primary education	31	10.3
Secondary education	68	22.6
Tertiary education	74	24.3
Occupation		
Student	64	21.3
Civil servant	45	15.0
Self-employed	62	20.6
Private sector employee	10	3.3
Unemployed	63	20.9
Housewife	57	18.9

Table 2: Adherence practices of respondents

Variable	Frequency	Percentage
Frequency of taking anti-TB medication		
Once daily	291	96.7
Twice daily	3	1.0
Weekly	0	0
I don't know	7	2.3
Medication non-adherence during intensive phase of treatment (N=301)		
Never missed	275	91.4
≥2 days	26	8.6
Medication non-adherence during continuation phase of treatment (N=301)		
Never missed	297	98.7
≥2 consecutive weeks	4	1.3
What did do on realizing you have missed taking your medication? (N=58)		
Continued the next day	32	55.2
Consulted the doctor	8	13.8
Ignored	10	17.2
Stopped taking the drug	3	5.2
No response	5	8.6
Reasons for medication non-adherence (N=58)		
Travelled	6	10.3
Felt sick and depressed	10	17.2
Ran out of drugs at home	5	8.6
Felt well and need not to continue medication	9	15.5
Lack of money for transportation	1	1.7
Side effects of anti-TB medicines	7	12.1
Forgot	13	22.4
Does not want to be seen in the clinic	2	3.4
No response	5	8.6

Table 3: Knowledge Assessment

Table 3a: Percentage of respondents with the correct knowledge of subject area assessed

Subject area	Frequency	Percentage
Cause of TB	90	29.9
Mode of transmission of TB	113	37.5
Cure of TB	135	44.9
TB Prevention	140	46.5
Awareness of DOTs	219	72.8

N=301

Table 3b: Knowledge level of respondents

Knowledge Level	Frequency	Percentage
Adequate	129	42.9
Inadequate	172	57.1

Table 3c: Association between Knowledge level and Medication Adherence

Knowledge level	N	Not adhere N (%)	Adhere N (%)	Chi-Sq value	*p*-value
Adequate	129	14 (10.9)	115 (89.1)	10.280	0.001*
Inadequate	172	44 (25.6)	128 (74.4)		

* $p<0.01$

Table 4: Association between Adherence and TB patient's Demographic Characteristics

Variable	N	Not adhere N (%)	Adhere N (%)	Chi-Sq value	*p*-value
Sex					
Male	178	36 (20.2)	142 (72.9)	0.256	0.613
Female	123	22 (17.9)	101 (82.1)		
Age					
18-30	64	8 (12.5)	56 (87.5)	8.772	0.119
31-40	104	15 (14.4)	89 (85.6)		
41-50	62	15 (24.2)	47 (75.8)		
51-60	48	13 (27.1)	35 (72.9)		
60 and above	22	7 (31.8)	15 (68.2)		
Marital Status					
Married	170	37 (21.8)	133 (78.2)	4.906	0.297
Single	84	10 (11.9)	74 (88.1)		
Divorced/Separated	30	8 (26.7)	22 (73.3)		
Widow/widower	16	3 (18.8)	13 (81.2)		
Ethnicity					
Hausa	120	31 (31.8)	89 (74.2)	12.247	0.007**
Yoruba	56	2 (3.6)	54(96.4)		
Igbo	39	8 (20.5)	31 (79.5)		
Others	86	17 (19.8)	69 (80.2)		
Religion					
Christianity	136	20 (14.7)	116 (85.3)	9.226	0.026*
Islam	152	32 (21.1)	120 (78.9)		
Others	10	4 (40.0)	6 (60.0)		
Occupation					
Student	64	6 (9.4)	58 (90.6)	9.877	0.079
Civil Servant	45	6 (13.3)	39 (86.7)		
Self Employed	62	18 (29.0)	44 (71.0)		
Private Sector	10	2 (20.0)	8 (80.0)		
Unemployed	63	12 (19.0)	51 (81.0)		
House wife	57	14 (24.6)	43 (75.4)		
Educational Level					
No formal Education	128	34 (26.6)	94 (73.4)	8.767	0.067
Primary	31	6 (19.4)	25 (80.6)		
Secondary	68	10 (14.7)	58 (85.3)		
Tertiary	73	8 (11.0)	65 (89.0)		

Key: ** $p<0.05$; ** $p<0.01$*

Table 5: Association between Adherence and Factors Influencing TB Medication Adherence

Variable	N	Not adhere N (%)	Adhere N (%)	Chi-Sq value	*p*-value
Personal Factors:					
Knowledge level of respondents					
Adequate	129	14 (10.9)	115 (89.1)	10.280	0.001**
Inadequate	172	44 (25.6)	128 (74.4)		
Cause of TB					
Virus	18	1 (1.7)	17 (7.0)	7.852	0.097
Bacteria	90	12 (20.7)	78 (32.1)		
Fungi	4	0 (0)	4 (1.6)		
Don't Know	190	45 (77.6)	144 (59.2)		
Mode of TB transmission					
Water	20	4 (6.9)	16 (6.6)	13.510	0.004**
Air	113	10 (17.2)	103 (42.4)		
Fire	1	0 (0)	1 (0.4)		
Don't Know	167	44 (75.9)	123 (50.6)		
Is TB curable?					
Yes	135	17 (29.3)	118 (48.6)	10.310	0.006**
No	8	0 (0)	8 (3.3)		
Don't know	158	41 (70.7)	117 (48.1)		
Is TB Preventable					
Yes	140	16 (27.6)	124 (51)	13.070	0.004**
No	4	0 (0)	4 (1.6)		
Don't Know	157	42 (72.4)	115 (47.3)		
Awareness of DOTs					
Yes	219	38 (65.5)	181 (74.5)	1.900	0.168
No	82	20 (34.5)	62 (25.5)		
Reason for not taking medication					
Forgot	14	13 (22.4)	1 (0.4)	252.678	0.000**
Felt depressed	10	10 (17.2)	0 (0)		
Felt well	9	9 (15.5)	0 (0)		
Side effect of anti-TB medicines	7	7 (12.1)	0 (0)		
Travelled	7	6 (10.3)	1 (0.4)		
Ran out of medicines at home	6	5 (8.6)	1 (0.4)		
Does not want to be seen in clinic	2	2(3.4)	0 (0)		
Lack of money for transportation	1	1 (1.7)	0 (0)		
Never missed taking medication	245	5 (8.5)	240 (98.8)		
What was done when you realized you missed your medication					
Continued the next day	32	32 (55.2)	0 (0)	263.795	0.000**
Consult the doctor	9	8 (13.8)	1 (0.4)		
Ignore	10	10 (17.2)	0 (0)		
Stop taking drug	3	3 (5.2)	0 (0)		
Never missed taking medication	247	5 (8.6)	242 (99.6)		
Variable	**N**	**Not adhere N (%)**	**Adhere N (%)**	**Chi-Sq value**	***p*-value**
Social Factor					
Who knows you have TB?					
Family	242	45 (77.6)	197 (81.1)	0.385	0.825
Friend	55	12 (20.7)	43 (17.7)		
Pastor/Imam	4	1 (1.7)	3 (1.2)		
How do they treat you? (Support)					
Caring	205	40 (70.2)	165 (68.2)	1.434	0.488
Not caring	92	16 (28.1)	76 (31.4)		
Neutral	2	1 (1.8)	1 (0.4)		
Structural Factors:					
Distance between residence and health					

facility					
< 10 KM	221	41 (70.7)	180 (74.1)	0.275	0.600
> 10 KM	80	17 (29.3)	63 (25.9)		
Change of location of residence while on anti-TB medication					
Yes	194	33 (56.9)	161 (66.3)	1.790	0.181
No	107	25 (43.1)	82 (33.7)		
Health Service Factor:					
Satisfied with service of health workers					
Yes	269	57 (98.3)	212 (87.2)	5.999	0.014*
No	32	1 (1.7)	31 (12.8)		
Other Factors					
Smoking Status					
Yes	180	40 (69.0)	140 (57.6)	2.510	0.113
No	121	18 (31.0)	103 (42.4)		
Alcohol Consumption Status					
Yes	106	27 (46.6)	79 (32.5)	4.047	0.044*
No	195	31 (53.4)	164(67.5)		

* $p < 0.05$; ** $p < 0.01$

INTERVENTION

Table 6: Effect of Intervention on Mean Knowledge Score

	Mean score ± SEM	***p*-value**
Pre-intervention	1.88 ± 0.21	0.000
Post-intervention	3.73 ± 0.11	

N=34; ** $p < 0.01$

Table 7: Effect of Intervention on Knowledge Area Assessed

Knowledge area	**N (%) of correct response**		***p*-value**
	Pre-intervention	Post-intervention	
Cause of TB	6 (17.6)	29 (85.3)	0.000
Transmission of TB	11 (32.3)	30 (88.2)	0.000
Cure of TB	26 (76.5)	34 (100)	0.003
TB Prevention	21 (61.8)	34 (100)	0.000
Awareness of DOTs	29 (85.3)	34 (100)	0.020

N=34; ** $p< 0.01$, *$p < 0.05$

Table 8: Effect of Intervention on TB patient's Adherence Level

	Adherence level N (%)	***p*-value**
Pre-intervention	21 (61.8)	0.206
Post-intervention	25 (73.5)	

N=34; $p > 0.05$

REFERENCES

1. World Health Organization. Adherence to long term therapies: evidence for action 2003; 125-127.
2. Horne R et al. Concordance, adherence and compliance in medicine taking. Report for the National Coordinating Centre for NHS Service Delivery and Organization R & D (NCCSDO) 2005.
3. Gebremariam MK et al. Barriers and facilitators of adherence to TB treatment in patients on concomitant TB and HIV treatment: a qualitative study. BMC Public Health 2010; 10(651): 1471-2458.
4. Reichman LB, Lardizabal AA. Adherence to tuberculosis treatment. Wolters Kluwer Health UpToDate 2010. http://www.uptodate.com/contents/adherence-to-tuberculosis-treatment (Accessed May 23, **2012**).
5. Federal Ministry of Health. National Tuberculosis and Leprosy Control Programme. Department of Public Health Worker's Manual, 5th ed. 2008.
6. Lars O, Terrence B. Adherence to medication. New England Journal of Medicine 2005; 353: 487-97.
7. Ruslami RA. Step-wise approach to find a valid and feasible method to detect non-adherence to tuberculous drugs. Southeast Asian Journal of Tropical Medical Public Health 2008; 39: 1083-7.
8. Vermeire E et al. Patient adherence to treatment: three decades of research. A comprehensive review. Journal of Clinical Pharmacy and Therapeutics 2001; 26(5): 331-342. http://onlinelibrary.wiley.com/doi/10.1046/j.1365-2710.2001.00363.x/full (Accessed February 19, **2015**).

9. Chukuma A et al. Adherence to Tuberculosis Therapy in UNILORIN Teaching Hospital, Ilorin, North-central Nigeria. International Journal of Science, Environmental and Technology 2013; 2(6): 144-1461.
10. WHO Report. Global Tuberculosis Control Surveillance, Planning, Financing 2008.
11. Opara AC. Optimizing adherence to pharmaceutical care plans. In: Opara AC, Ed. Essentials of Pharmaceutical Care. Lagos: Acybex Publication, 2010: 115-118.
12. Munro SA et al. Patient adherence to tuberculosis treatment: A systematic review of qualitative research. PLoS Med 2007; 4(7):238. http://www.medscape.com. (Accessed May 10, **2012**)
13. Kaona FAD et al. An assessment of factors contributing to treatment adherence and knowledge of TB transmission among patients on TB treatment. BMC Public Health 2004; 4(68): 1471-2458. http://www.biomedcentral.com (Accessed May 10, **2012**).
14. Jing J et al. Factors affecting therapeutic compliance: A review from the patients perspective. Therapeutic and clinical risk management 2008; 4(1): 269-286.
15. Salami AK, Oluboyo PO. Management of pulmonary tuberculosis. A nine year review in Ilorin. West African Medicine 2003; 22: 114-9.
16. Widjanarko B et al. Factors that influence treatment adherence of tuberculosis patients living in Java, Indonesia. Patient preference and adherence: Dove Press Journal 2009; 3: 231-238.
17. Nicholas-English G, Poirer S. Optimizing adherence to pharmaceutical care plans. Journal of American Pharmacist's Association 2000; 40(4): 475-485.
18. Erhabor GE et al. Factors influencing Compliance in Patients with Tuberculosis on Directly Observed Therapy at Ile-Ife, Nigeria. East African Medical Journal 2000; 77(5): 235.
19. Bello SI, Itiola OA. Drug adherence amongst tuberculosis patients in the University of Ilorin Teaching Hospital, Ilorin, Nigeria. African Journal of Pharmacy and Pharmacology 2010; 4(3): 109-114.
20. Sariem CN et al. Factors Influencing Tuberculosis Medication Adherence in a Tertiary Health Institution in Nigeria. West African Journal of Pharmacy 2013; 24(2): 66-75.
21. World Health Organization. Tuberculosis Fact Sheet 2011. http://www/who.int/tb/publications/2011. (Accessed February 20, **2012**)
22. Awofeso N. Anti-tuberculosis medication side-effects constitute major factor for poor adherence to tuberculosis treatment. World Health Organization 2008; 86(3): 161-240. http://www.who.int. (Accessed February 20, **2012**).
23. Kays MB. Tuberculosis. In: Applied Therapeutics: The Clinical Use of Drugs, 9th ed, Koda-Kimble MA, Young LY, Alldredge BK, Corelli RL, Guglielmo BJ, Kradjan WA, Williams BR, Eds; Lippincott Williams and Wilkins: Philadelphia, **2009**; pp. 61-1-22.
24. Bam TS et al. Factors affecting patient adherence to DOTS in urban Kathmandu, Nepal. International Journal of Tuberculosis and Lung Disease 2006; 10(3): 270-6.
25. Thiam S et al. Effectiveness of a strategy to improve adherence to tuberculosis treatment in a resource-poor setting. JAMA. 2007; 297(4): 380-386.
26. Sumartojo E. When tuberculosis treatment fails. A social behavioral account of patient adherence. International Bibliographic Information on Dietary Supplements: Am-Rev-Respiratory-Disease 1993; 147(5): 1311-20.
27. Somerville MA, Orkin AJ**.** Human rights discrimination and AIDS: Concepts and Issues. AIDS 1989; 3(1)**:** S283.
28. http://www.tipshealth.info/effect-of-alcohol-on-the-blood 2011.
29. Smart RG, Mann RE. Alcohol and the epidemiology of liver cirrhosis. Alcohol Health & Research World 1992; 16(3):217–222.