

Medication Adherence among Pulmonary Tuberculosis Patients in Treatment Centers in a Southern Nigerian Local Government Area: Question Mark on Performance of DOTS Services

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Abstract

Background: Directly observed treatment short-course (DOTS) offers free, accessible and effective treatments with high treatment success rate and retention. Despite this, evidence from Rivers State suggest a downward trend in tuberculosis (TB) cure rate and a high burden of drug resistance among pulmonary tuberculosis (PTB) patients. Medication adherence appears to play a key role in TB evolution. Aim: to assess medication adherence and its determinants among pulmonary TB clients in DOTS centers.

Methodology: A total of 225 adult PTB clients from eight active DOTS centers in Obio/Akpor Local Government Area of Rivers State were selected. A validated questionnaire, Morisky Medication adherence Scale-8 was used to collect medication-taking behaviour of clients, dichotomised into adherent and non-adherent. Binary logistic regression was conducted to check crude association between medication adherence and client/treatment factors. Variables with $p < 0.2$ were selected and subjected to multivariate logistic regression with alpha set at $p < 0.05$.

Results: Non-adherence to medication was 35.1% with forgetfulness and stress with medication plan as top reasons for non-adherence. Factors associated with non-adherence included persisting sputum production (aOR: 2.951(1.027-8.482); $p=0.045$), past treatment history (aOR: 5.422(1.93-15.228); $p=0.001$) and smoking (aOR: 7.779(1.58-38.305); $p=0.012$).

Conclusion: Over one-thirds of PTB clients in DOTS centers in Obio/Akpor LGA were non-adherent to anti-TB medications. Factors associated with non-adherence included persisting sputum production, past treatment history and smoking. To attenuate these risk factors for non-adherence, training and retraining of DOTS center staff on counselling is a smart option that can be explored by the LGA, providers and managers of the DOTS programme.

Key words: Pulmonary TB; Medication adherence; DOTS and Nigeria.

Introduction

Over the years, tuberculosis has emerged as a single infectious disease with the highest mortality worldwide, infecting about 5,000 people every hour and with over 5,500 mortalities daily^[1]. However, there are very effective treatments for tuberculosis (TB) using very potent anti-TB drugs^[2], which under the directly observed treatment short-course (DOTS) approach, have

treatment success rate more than 80% in our environment and significant retention of patients in care^[3]. TB medication adherence appears to play a key role in the pandemic's evolution^[2]. According

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to the WHO, adherence to the medicine is the degree to which a person's behaviour is consistent with the health care provider's recommendation to take the medicine^[4].

The upward trend in cases of drug-resistant TB in Nigeria is a challenge that deserves attention^[1]. This trend is even more disturbing when one considers that TB treatment is widely available, free and that anti-TB drugs are very effective^[2]. Despite the adequate supply side and the equally high demand for TB treatment, resistant cases continue to rise, especially in cases of pulmonary TB where transmission is even more for those at close contact with the droplets. In determining the reason for this phenomenon, it should be borne in mind that various factors exist, such as adherence to anti-TB medications.

According to the Global Tuberculosis Report of 2019^[1], Nigeria contributed 4 per cent to the 10 million people who developed tuberculosis in 2018, ranking 6th amongst 30 countries with the highest burden of tuberculosis and 1st in sub-Saharan Africa. Globally, TB management continues to suffer a setback in detection and treatment; in 2017 about 3.6 million new cases were reported to national authorities, Nigeria ranked 3rd following India and Indonesia among the 10 countries that accounted for 80 per cent of the global gap. Nigeria's treatment success rates of 80.2% for tuberculosis^[5] and 52% for multi-drug resistant TB^[1], both of

which are below the WHO's treatment targets of 85% and 75% respectively^[1,7].

Meanwhile, several studies in Africa and Nigeria have shown low adherence to TB drugs, which presents serious challenges to curbing the transmission of the disease^[8,9,10]. Studies have documented varying degrees of poor medication adherence to anti-TB. Some studies in Nigeria have recorded non-adherence as high as 19.5% in North-Central^[11] and 25.8% in South-Eastern Nigeria^[10]. Recent studies have also pointed out disturbing trends such as those of studies in Rivers State which have indicated a declining trend in cure rate despite effective treatment^[12] and drug-resistant TB burden as high as 46.7%^[13].

Relevant clinical expertise and the availability of

anti-TB drugs (which are very effective, affordable and accessible) need to be balanced against patient-reported measures such as medication adherence. It is, therefore, imperative to conduct a study to evaluate adherence to medication among PTB patients in TB treatment centers in Obio/Akpor LGA in Rivers State, South-South Nigeria, in order to inform decisions in the TB management programs and curb drug resistance especially among people with PTB which constitutes large proportion of TB patients.

Materials and Methods

Study design

A descriptive cross-sectional study design was used to assess adherence to anti-TB medication among patients accessing TB treatment centers in Obio/Akpor LGA of Rivers State.

Study Setting

This study was carried out in selected tuberculosis treatment centers in Obio/Akpor LGA of Rivers State, South-South geopolitical zone of Nigeria. Obio/Akpor LGA has one treatment center located in a tertiary hospital (the University of Port Harcourt Teaching Hospital), 15 in model primary healthcare centers (MPHC) and 40 in private hospitals spread across the LGA. However, of all these only about 40 centers are active while the majority of inactive centers are found in private.

Sample Size

Cockran's sample size formula^[14] for descriptive study was used to derive a minimum sample size of 205 based on prevalence of pulmonary tuberculosis (smear positive) in Rivers State (15.8%) in a previous study. A sample size of 225 was obtained after adjusting by 10% for non-response.

Eligibility criteria

Adults aged 18 and up with confirmed pulmonary tuberculosis who were managed as drug-susceptible TB cases in the intensive or continuation phases of treatment were included in the study. Patients with other co-morbid conditions or severe illnesses were excluded from participating in the study.

Sampling Technique

Participants were chosen using a two-stage sampling technique from TB treatment centers in

the Obio/Akpor LGA. Eight TB treatment centers were selected in the first stage by simple random sampling, by balloting from the 40 active TB treatment centers in the LGA. Following proportional to size allocation, participants were chosen from each center by systematic random sampling as they arrived each center for medication refills.

Data collection

Data was collected using a self-administered semi-structured questionnaire comprising mainly of Morisky Medication adherence Scale 8 (MMAS 8). The MMAS 8 is a self-report tool that is structured to measure medication taking behaviour of patients.

Variables

Self-report was used to collect measures for this study. Clients' adherence to anti-TB medication was measured using MMAS 8. The MMAS 8 contains 8 item, where questions 1 through 7 requires a "yes" or "No" answer while question 8 had a 5 point Likert response scale ("always," "usually," "sometimes," "once in a while," and "never;" scale numbered from 0-4) [16]. Each "no" response is scored 0, "yes" response scored 1 while for question 8 that has a Likert scale where "never" response was scored as 1, 'once in a while' and 'sometimes' are scored 0.75 each, 'usually' is 0.25 and 'all the time' is 0 [17]. Total MMAS score ranges from 0-8 with scores < 6 indicating non-adherence, scores 6-7 for medium adherence and scores 8 representing highest adherence [17].

Data analysis

Data from the questionnaires were extracted, coded and entered into Microsoft Excel ® 1997-2003 Version and imported into International Business Machines (IBM) Statistical Package and Service Solution (SPSS), Version 25 for analysis. Categorical data were presented in tables using frequencies and proportions. Dependent variable (medication adherence) was dichotomised into adherent (MMAS scores ≥ 6) and non-adherent (MMAS scores <6) and presented in pie chart. Pattern of response to the questions on the MMAS-8 tool was compared and presented in table. Binary logistic regression was conducted to check the crude association between medication adherence and each client factors (client characteristics and treatment

factors). Variables with $p < 0.2$ were selected and further subjected to multivariate logistic regression with level of significance set at $p < 0.05$.

Results

A data completion rate of 92.4% was achieved for the 225 questionnaires self-administered to eligible pulmonary TB clients in treatment centers in Obio/Akpor LGA of Rivers State within a 2-months study period (from March to April 2020). Respondents were drawn from five model primary healthcare centers and one each from tertiary hospital, medicals and private hospitals.

Table 1: Responses to questions on anti-TB medication

S/No	Statement Regarding Medication (n=208)	Yes %	No %
1	Do you sometimes forget to take your medications?	28.8	71.2
2	Thinking over the past two weeks, were there any days when you did not take your medications?	22.1	77.4
3	Have you ever cut back or stopped taking your medications without telling your doctor, because you felt worse when you took it?	15.4	84.6
4	When you travel or leave home, do you sometimes forget to bring along your medications?	16.3	83.7
5	Did you take your medications yesterday?	85.1	14.9
6	When you feel like your health condition is under control, do you sometimes stop taking you medications?	13	87
7	Do you ever feel hassled about sticking to your treatment plan?	37	63
8	How often do you have difficulty remembering to take all your medications?		%
	Never/rarely		47.6
	Once in a while		30.3
	Sometimes		20.7
	Usually		1
	All the time		0.5

On response to questions on the 8 panel MMAS 8 scale, a large proportion of respondents felt hassled about sticking to their treatment plan (77, 37%), sometimes forgot to take their medications (60, 28.8%), missed their medications within the past 2 weeks (46, 22.1%) and failed taking their medication the day before the interview (31, 14.9%) (See Table 1 above).

On the level of adherence to anti-TB medications,

over a third (73, 35.1%) of clients with pulmonary TB in treatment centers in Obio/Akpor LGA were found to be non-adherent to anti-TB medication (see Figure 1).

With lowest and highest ages of 18 and 78 years, respectively, the respondents' mean age was 36.3 (SD 9.4). The vast majority of respondents, 65 (31.3%), are between the ages of 28 and 37 years old, with males constituting more than half (51.4%), and nearly half (47.1%) are married. Concerning the relationship between clients' characteristics and medication adherence, only residence showed significant association. Greater proportion of clients who live in the urban areas (87, 70.7%) had better adherent to medication than those who live in the rural area (48, 56.5%) and this association was found to be statistically significant ($\chi^2=4.488$; $df=1$; $p=0.034$). Also a higher proportion of clients who smoke (10, 83.3%) were non-adherent to medication than non-smokers (63, 32.1%) and this association was found to be statistically significant ($\chi^2=13.008$; $df=1$; $p=0.001$) (See Table 2).

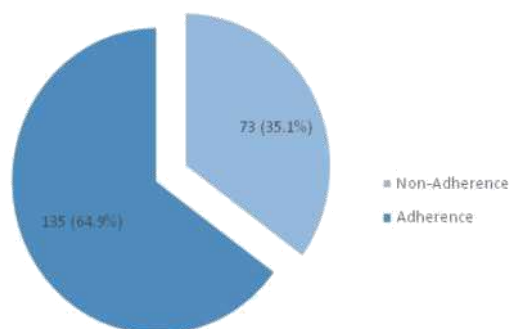


Figure 1: Medication adherence of respondents

Table 2: Relationship between medications adherence and respondents' characteristics

Variables (n=208)	MEDICATION ADHERENCE		Total n(%)	χ ²	df	P
	Adherence n(%)	Non-Adherence n(%)				
AGE GROUP				0.53	4	0.971
18-27years	35 (62.5)	21 (37.5)	56 (100)			
28-37years	44 (67.7)	21 (32.3)	65 (100)			
38-47years	36 (65.5)	19 (34.5)	55 (100)			
48-57years	9 (60)	6 (40)	15 (100)			
>57years	11 (64.7)	6 (35.3)	17 (100)			
SEX				0.204	1	0.652
Male	71 (66.4)	36 (33.6)	107 (100)			
Female	64 (63.1)	37 (36.6)	101 (100)			
MARITAL STATUS				1.874*	3	0.619
Single	65 (69.1)	29 (30.9)	94 (100)			
Married	61 (62.2)	37 (37.8)	98 (100)			
Divorced/Separated	3 (60)	2 (40)	5 (100)			
Widow/Widower	6 (54.5)	5 (45.5)	11 (100)			
EDUCATIONAL LEVEL				1.332*	3	0.728
None	9 (69.2)	4 (30.8)	13 (100)			
Primary	14 (56)	11 (44)	25 (100)			

Secondary	65 (64.4)	36 (35.6)	101 (100)			
Tertiary	47 (68.1)	22 (31.9)	69 (100)			
OCCUPATION				2.052	2	0.358
CLASS 1	90 (65.7)	47 (34.3)	137 (100)			
CLASS 2	36 (60)	24 (40)	60 (100)			
CLASS 3	9 (81.8)	2 (18.2)	11 (100)			
EMPLOYMENT STATUS				0.629	1	0.428
Employed	78 (67.2)	38 (32.8)	116 (100)			
Unemployed	57 (62)	35 (38)	92 (100)			
RESIDENCE				4.488	1	0.034**
Rural	48 (56.5)	37 (43.5)	85 (100)			
Urban	87 (70.7)	36 (29.3)	123 (100)			
SMOKING				13.008	1	0.001**
Yes	2 (16.7)	10 (83.3)	12 (100)			
No	133 (67.9)	63 (32.1)	196 (100)			

Key: ** P =significant

Meanwhile, medication adherence was associated with clients' treatment factors such as sputum production status ($\chi^2=11.101$; $df=1$; $p=0.001$), cough status ($\chi^2=5.495$; $df=1$; $p=0.019$), and past treatment ($\chi^2=17.105$; $df=1$; $p=0.001$) (See Table 3).

Variables	MEDICATION ADHERENCE Adherence n(%)	Non-Adherence n(%)	Total n(%)	χ ²	df	P
DURATION OF TREATMENT (n=208)				0.925	1	0.336
Intensive Phase	72 (62.1)	44 (37.9)	116 (100)			
Continuation Phase	63 (68.5)	29 (31.5)	92 (100)			
SPUTUM PRODUCTION STATUS (n=208)				11.101	1	0.001**
Productive	100 (59.5)	68 (40.5)	168 (100)			
Unproductive	35 (87.5)	5 (12.5)	40 (100)			
RESULT OF SPUTUM TEST AT COMMENCEMENT (n=168)				0.117	1	0.808
Positive	88 (59.1)	61 (40.9)	149 (100)			
Negative	12 (63.2)	7 (36.8)	19 (100)			
COUGH STATUS (n=168)				5.495	1	0.019**
Still Coughing	28 (47.5)	31 (52.5)	59 (100)			
Stopped Coughing	72 (66.1)	37 (33.9)	109 (100)			
PAST TREATMENT FOR TB (n=208)				17.105	1	0.001**
Yes	6 (26.1)	17 (73.9)	23 (100)			
No	129 (69.7)	56 (30.3)	185 (100)			
HAVE TREATMENT SUPPORTER (n=208)				0.02	1	0.887
Yes	80 (64.5)	44 (35.5)	124 (100)			
No	55 (65.5)	29 (34.5)	84 (100)			
NATURE OF TREATMENT SUPPORTER (n=124)				1.453	1	0.228
Family Member	73 (66.4)	37 (33.6)	110 (100)			
Others	7 (50)	7 (50)	14 (100)			

Table 4: Factors associated with medication

adherence among respondents

	Adherent n(%)	Non-Adherent n(%)	OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Residence (n=208)						
Rural	48 (56.5)	37 (43.5)	Ref		Ref	
Urban	87 (70.7)	36 (29.3)	2.863 (1.045-2.322)	0.035**	2.278 (0.657-2.488)	0.47
Smoking (n=208)						
Yes	2 (16.7)	10 (83.3)	Ref		Ref	
No	133 (67.9)	63 (32.1)	10.556 (2.246-49.605)	0.003	7.779 (1.58-38.305)	0.012**
Sputum production status (n=208)						
Productive	100 (59.5)	68 (40.5)	Ref		Ref	
Unproductive	35 (87.5)	5 (12.5)	4.76 (1.775-12.764)	0.002**	2.951 (1.027-8.482)	0.045**
Cough status (n=168)						
Still Coughing	28 (47.5)	31 (52.5)	Ref		Ref	
Stopped Coughing	72 (66.1)	37 (33.9)	2.821 (1.512-5.26)	0.001**	2.009 (0.98-4.118)	0.037
Past treatment for TB (n=208)						
Yes	6 (26.1)	17 (73.9)	Ref		Ref	
No	129 (69.7)	56 (30.3)	6.527 (2.444-17.427)	0.001**	5.422 (1.93-15.228)	0.001**

Key: ** p=significant

Of both client characteristics and treatment factors, only residence, smoking, sputum production status, cough status and past treatment history were found to be significant associate with medication adherence. Non-smokers and clients with unproductive cough had significantly higher odds of being adherent to anti-TB medication than smokers (aOR: 7.779 (1.58-38.305); p=0.012) and clients with productive cough (aOR: 2.951 (1.027-8.482); p=0.045). Also clients without past history of TB treatment had significantly higher odds of being adherent to anti-TB medication than clients who had previous history TB treatment (aOR: 5.422 (1.93-15.228); p=0.001) (see Table 4 above).

Discussion

In this study, over a third of pulmonary TB patients in treatment centers in Obio/Akpor LGA were found to be non-adherent to anti-TB medication. A similar high level of non-adherence to medication among drug-susceptible pulmonary tuberculosis patients was documented in a South-Eastern Nigerian study^[10] and in another study in North-Central Nigeria^[18]. One of the main causes of failure of clients in the former to adhere to anti-TB drugs was forgetfulness and is in agreement with the findings of this study. The findings of our study were also similar to the observations of other African studies, which also described high levels of non-adherence among TB patients^[8,9]. This also agrees with the findings of in their study in China among TB

patients in the rural area using the Chinese version of MMAS in which they advanced two main reasons for high non-adherence to anti-TB medication in their country^[19]. Firstly, the lack of health infrastructure in rural areas where 80% of the registered TB patients live. Secondly, though Directly Observed Treatment Short-course (DOTS) enjoys wide penetration, its full implementation has remained inefficient. This agrees with the findings of in their comparison of quality of TB care in rural and urban parts of Rivers State in which they found constraints in infrastructure (though more in urban than rural areas unlike the Chinese study) and completely abandoned DOTS in the light of anti-TB drugs that are widely available^[20]. However, our finding of high levels of non-adherence was not consistent with the finding of who documented a much lower level in India. The difference with their result may be have been due to the study design which was prospective and included non-TB and extra-pulmonary TB patients in their analysis^[21].

Review of the pattern of response to the questions on the MMAS-8 tool is very revealing and mirrors the high non-adherence recorded in this study. Almost a third of patients sometimes forget to take their medication, actually missed at least a dose of their medication over the immediate past two weeks period and 15% failed to take their medications the previous day. The very large proportion of patients who feel hassled about sticking to the medication plan makes it imperative to strengthen the national TB Control Programme by use of trained counsellors who can profile patients into risk categories and deliver targeted adherence and other counselling and support as well as adequately operationalizing DOTS according to programme design^[19,20].

The high level of non-adherence to anti-TB drugs could also be explained by its positive association with such selected determinants as current smoking status, previous TB treatment, cough status while on treatment, sputum production status at diagnosis and residence (p < 0.05). The finding of this study of a positive association between smoking and anti-TB medication adherence highlights the need for a certain degree of smoking cessation programme in caring for PTB since from this study, patients who smoke during treatment have more than seven times

more risk of experiencing non-adherence than TB patients that are non-smoker. The timing of an anti-TB drug and smoking can explain this finding as well as misconception of mixing anti-TB drugs with cigarette smoking and this agrees with other chronic disease adherence studies^[22,23] and study among TB patients^[21]. This study also highlighted the need for screening for history of previous TB treatment as clients who had been treatment for TB in the past had over five times higher risk of being non-adherent to anti-TB drugs and agrees with the findings of significant association with history of previous treatment documented in other studies in Africa^[8,24]. Meanwhile, the association of non-adherence with productive cough in TB patients (though this association was not significant) may be due to the patient's previous unsuccessful efforts with treating productive cough which may now diminish their zeal in taking further medications including anti-TB drugs and may also relate to failing treatment due to illness severity^[21].

Income and other socioeconomic factors not being associated with anti-TB drug non-adherence agrees with the design of the TB control programme in which drugs and tests are provided at no cost to patients which may have lessened the burden on them and improved access to drugs^[21].

Efforts at educating clients and the community about the effectiveness of anti-TB medication and adherence should be intensified by the head of the LGA department of health, the Medical Officer of Health, working with players at the LGA level particularly the TB coordinator, the PHC coordinator and the social mobilization officer, and at the facility level particularly the medical officers, TB focal persons and community health extension workers in addressing forgetfulness, pressure on sticking to the medication plan and other reasons for clients default in anti-TB medication adherence. Training and retraining of providers at the DOTS centers in the LGA can help strengthen profiling of clients in other to attenuate the identified risk factors for non-adherence in the LGA through counselling.

Conclusion

Over one thirds of clients with pulmonary tuberculosis receiving treatment at DOTS centers in Obio/Akpor LGA of Rivers State were non-adherent to their anti-

TB medications. Anti-TB medication adherence is a treatment behaviour that contribute to TB treatment success rate especially cure for those bacteriologically diagnosed and TB medication adherence appears to play a key role in the pandemic's evolution^[2]. Forgetfulness and pressure on sticking to the medication plan were the top reasons for the high non-adherence recorded in this study. Factors associated with TB drug non-adherence included having persisting sputum production while on treatment (aOR: 2.951 (1.027-8.482); p=0.045), past treatment history (aOR: 5.422 (1.93-15.228); p=0.001) and smoking (aOR: 7.779 (1.58-38.305); p=0.012). To improve client profiling and attenuate these risk factors for non-adherence in the LGA, counselling, training and retraining of DOTS center staff members are smart options that should be explored by the LGA, providers and managers of the DOTS programme.

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