ORIGINAL ARTICLE

ISSN: 0331 - 670X

https://doi.org/10.51412/psnnjp.2025.03

The Nigerian Journal of PHARMACY
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THE OFFICIAL ORGAN OF THE PHARMACEUTICAL SOCIETY OF NIGERIA FOUNDED 1927

Evaluation of Pharmacist Interventions on Treatment Outcomes of Pulmonary Tuberculosis Patients in Secondary Health Facilities Abuja

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ARTICLE INFO

Article history:

Received 9th July 2024
Revised 25th April 2025
Accepted 26th April 2025
Online Published

Keywords:

Pharmacist,
Tuberculosis,
Adherence,
Intervention

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ABSTRACT

Introduction: Tuberculosis is a chronic infection that remains one of the major health problems in most developing countries. Poor treatment outcomes have serious consequences which include spread of the disease, morbidity and mortality. The world health organization (WHO) recommended minimum successful outcomes of 85%; this has not been achieved in most facilities rendering the services. The aim of the study was to evaluate the impact of Pharmacist interventions on the treatment outcomes of pulmonary tuberculosis patients in secondary health facilities in Abuja.

Method: A total of 110 patients undergoing Directly Observed Therapy Short course (DOTS) were recruited and split into control and intervention groups. Both groups received health education on; healthy living, cough etiquette, disease pathophysiology, infection control, prevention, and medication adherence. But the intervention group received phone calls and text messages throughout their six-month treatment. A questionnaire was administered to both groups before the health education as in the case with the intervention group, this was to assess their baseline knowledge of the disease and to measure the medication adherence level, while the post-intervention survey evaluated the impact of pharmacist-led interventions on improving knowledge, adherence, and treatment outcomes on both groups. The questionnaire included a combination of multiple-choice questions, Likert-scale items, and open-ended questions to obtain comprehensive insights into the respondents' perspectives. In addition to the questionnaire, a specially designed form (proforma), was employed to systematically collect data on treatment outcomes from the respondents' hospital records post-intervention.

Results: The study showed a statistically significant difference ($p<0.05$) in medication adherence after interventions with more than 70% of participants having good adherence(100%), disease knowledge and social history in intervention group accompanied with phone calls and text messages as compared to control group with 75.9% non-adherance. The study established successful treatment outcomes of tuberculosis of 87.5% in the intervention group as against 74.1% in the control group from the secondary healthcare facilities used for the research.

Conclusion: The study showed that pharmacist intervention improves knowledge of tuberculosis disease, medication adherence with 87.5% successful treatment outcomes for patients with tuberculosis attending the secondary healthcare facilities in Abuja.

INTRODUCTION

Tuberculosis (TB) infection is caused by the bacillus *Mycobacterium tuberculosis*. It typically affects the lungs (pulmonary) but can affect other sites as well (extra pulmonary) [1]. Tuberculosis is a chronic infection that is present in all parts of the world. In most developing countries, it remains one of the major health problems [2]. There were an estimated 10 million new TB cases, 5.8 million among men, 3.2 million among women and 1.0 million among children in 2017 [3]. There were also an estimated 1.3 million TB deaths among HIV negative and three hundred thousand (300,000) and HIV positive tuberculosis patients in 2017 [3].

National Tuberculosis and Leprosy Control Program

(NTBLCP) is responsible for the coordination and control of tuberculosis in Nigeria and is supported by STOP TB partnership initiatives whose aim is to eliminate tuberculosis in Nigeria [4]. Monitoring the outcome of treatment using standardized approaches is essential in order to evaluate the effectiveness of the interventions used in the management of tuberculosis because patients on antituberculosis drugs need to take about four drugs daily for an intensive phase of two months and inappropriate treatment could lead to infectivity of people around and development of resistance [5].

Enhancing the quality of health care requires not only well-trained, available and motivated personnel but also the active participation of the Pharmacist in the healthcare team [6]. Pharmacists are currently involved in the pharmacotherapeutic aspect of care, due to extensive knowledge and training in Pharmaceutical care to identify and resolve drug therapy problems. This pharmaceutical activity has given rise to patient-centered pharmaceutical practices, of which a vital element is the pharmaceutical interventions [6]. Pharmaceutical interventions have been reported to impact positively on morbidity, adverse drug effect [7,8] and the reduction of cost of treatment [9].

More than 90% of tuberculosis cases occur in developing countries due to poor resource setting environment [1]. With the modes of transmission of TB, there was need for effective evaluations of treatment outcomes. Unsuccessful treatment outcome is a problem due to poor adherence and this can lead to infectivity and resistance. With the re-emergence of tuberculosis as a major public health concern in Nigeria and with the advent of some unsuccessful treatment and multi-drug resistant TB, it is important to evaluate the treatment outcome of tuberculosis [10, 11]. This study was carried out to evaluate Pharmacist interventions on treatment outcomes of tuberculosis patients attending secondary health facilities in Abuja.

METHOD

Study Design

The study design was a hospital-based prospective randomized study, whereby a total of one hundred and ten (110) respondents were enrolled from January to June 2018. (A total number of 50 TB outpatients of Asokoro District Hospital and 60 TB outpatients from Nyanya General Hospital). The respondents were randomized into control and intervention groups using online random number picker. The study consisted of two phases: an initial baseline survey through a questionnaire, followed by the evaluation of treatment outcomes using data from the respondents' hospital files. A structured, self-administered questionnaire was developed to assess the respondents' baseline knowledge, attitudes, and practices related to their treatment regimen. The questionnaire was distributed twice: first, prior to any pharmacist intervention, and then again after the interventions were carried out. The pre-intervention questionnaire aimed to capture the initial understanding and treatment adherence of the respondents, while the post-intervention version was designed to evaluate the effectiveness of the pharmacist-led interventions in enhancing knowledge, promoting adherence, and improving health outcomes. The questionnaire included a combination of multiple-choice questions, Likert-scale items, and open-ended questions to obtain comprehensive insights into the respondents' perspectives. In addition to the questionnaire, a treatment outcome proforma, was employed to systematically collect data on treatment outcomes from the respondents' hospital records. This form was specifically tailored to categorize outcomes into two major classifications: successful and unsuccessful. Successful outcomes included patients who were either cured or had completed their treatment regimen, while unsuccessful outcomes were categorized as patients who died, experienced treatment failure, or defaulted on their treatment. The proforma was designed to ensure consistency in data collection, facilitating the accurate tracking of each patient's progress and enabling meaningful comparisons between pre- and post-intervention outcomes. The form allowed the research team to gather critical information without disrupting the clinical workflow, providing a reliable measure of the intervention's impact.

Study Site

The study was carried out in two secondary health facilities in Abuja Municipal Area Council of Federal Capital Territory. The two facilities were Asokoro District Hospital (ADH) and Nyanya General Hospital (NGH).

Asokoro District Hospital is a secondary facility that also offers some degree of tertiary services. It is a 120 bed-space hospital. The hospital has various units that provide wide range of services which include; Pharmaceutical services (In-patient, Out-patient, NHIS, ARV pharmacy, DRF store), Accident and Emergency services, general out-patient services, Obstetrics and Gynecology (O and G) services, Paediatric and Neonatal services, General Neurology surgery, Internal medicines (cardiology clinic, urology, Endocrine unit, etc.), Intensive Care Unit (ICU), Renal dialysis unit, Optometry and Ophthalmology

services, Laboratory services (including DOTS Lab) Radiology services, Physiotherapy, Immunization and family planning services as well as housing Institute of Human Virology (IHVN) and CDC specialized laboratory. The hospital engages in Residency training of Physicians and Pharmacists.

Nyanya General Hospital (NGH) is a secondary health facility serving a large population of both FCT residents as well as neighbouring and nearby states of Nasarawa, Kaduna and Plateau. NGH offers free antenatal care to women, care and free treatments to children below five years of age. It is a 61 bedded facility with various units that provide a wide range of services which include Pharmaceutical Services (in-patient, out-patient, ARV Pharmacy, DRF store), accident and emergency services, general out-patient obstetrics and gynecology, dental service, physiotherapy, DOTS unit, immunization and family planning unit.

Study Population

New sputum smear positive pulmonary tuberculosis patients that were registered in the two health facilities were the study population.

Sample Size Determination

The sample size was calculated using Yamane Method of sample size calculation [12], at 95% confidence interval.

$n=N/(1+N(e)^2$

n= the sample size

N= the population under study (ADH=63; NGH=76) for the period under study

e=the margin error (it could be 0.10; 0.05; 0.01)

For Asokoro District Hospital; N=63

$n=63/1+63(0.05)^2=63/1+0.157=63/1.15=54.7$; n~~55

For Nyanya General Hospital; N=76

$n=76/1+76(0.05)^2 =76/1+76(0.0025) =76/1+0.19 = 76/1.19 =63.86$; n~~64

Eligibility Criteria

The Eligibility criteria include; Pulmonary tuberculosis patients with sputum smear positive, patients that were willing to participate, Patients and care givers that could read and write and Patients and caregivers that had a phone.

Study Instruments

The questionnaire was designed to evaluate participants' knowledge of tuberculosis, while the adherence measurement was based on validated tools from previous studies [13] on treatment compliance. For this study, a treatment outcome proforma was used to systematically gather data from the respondents' hospital records. This proforma was specifically designed to track and classify the outcomes of tuberculosis treatment into two broad categories:

1. Successful outcomes: This included patients who were either cured or had completed their treatment regimen according to the treatment protocol.
2. Unsuccessful outcomes: This covered patients who either died, experienced treatment failure, or defaulted on their treatment (i.e., those who did not complete the prescribed regimen).

Validation of Instrument

Pretesting of the questionnaire used was done at Wuse General Hospital and Maitama District Hospital to evaluate patients understanding of the questions. About 10% of the study population was used for pretesting (n=11). Some questions were reworded to eliminate ambiguous phrasing.

Data Collection

Nurses and community health workers, were responsible for bringing and organizing patients' hospital files,. Pharmacists, in addition to their role in health education, medication adherence counseling, and final outcome assessment, administered the questionnaire in order to ensure proper documentation and a seamless data collection process.

Education of participants

The 110 participants, who were sputum smear-positive TB patients were educated on healthy living, cough etiquette, disease pathophysiology, infection control, prevention, and medication adherence. The intervention group was also informed to expect phone calls and text messages as a follow-up to their treatment.

Outcomes Measured

The study measured several outcomes, including participants' knowledge of the disease, medication adherence, and tuberculosis treatment outcomes. The treatment outcomes were categorized as either successful or unsuccessful. Successful outcomes included patients who were cured or had completed treatment, while unsuccessful outcomes comprised treatment failure, defaulters, and deaths. Additionally, patients who were transferred out could not be evaluated. The data on treatment outcomes were collected from patients' folders and the treatment register by the pharmacists.

Data Analysis and Presentation

The data collected were imputed into SPSS version 22.0 and presented as percentages in tables and charts. Chi square was used to compare the categorical variables in the intervention and control group as well as the treatment outcomes. For all the statistical analysis, a p-value of ≤ 0.05 was considered to be statistically significant in this study.

Ethical consideration

Ethical approval was obtained from Health Research Ethics committee of health and Human Services Secretariat, Federal Capital territory Administration (FCTA). Also, a written and signed consent form was obtained from the participants after the study and the objectives were explained to them.

RESULTS

Table 1.
Socio-Demographic Distribution of Sputum Smear Positive Tuberculosis Patients.

	CONTROL GROUP		INTERVENTION GROUP	
Patients Characteristics	n	%	n	%
Age				
<15	0	0.0	0	0.0
15-24	6	11.1	12	21.4
25-34	13	24.1	18	32.1
35-44	21	38.9	13	23.2
45-54	7	13.0	7	12.5
55-64	5	9.3	5	8.9
>64	2	3.7	1	1.8
Gender				
Male	28	51.9	30	53.6
Female	26	48.1	26	46.4
Education				
No formal education	6	11.1	2	3.6
Primary school	6	11.1	3	5.4
Secondary school	30	55.6	28	50.0
Tertiary school	12	22.2	23	41.1
Employment status				
Civil servant	11	20.4	15	26.8
Private	7	13.0	1	1.8
Self-employed	18	33.3	23	41.1
House wife	8	14.8	3	5.4
Unemployed	3	5.6	4	7.1
Student	7	13.0	10	17.9

Assessment of the Respondents' Disease Knowledge Which Was Conducted both Before and After the Pharmacist's Intervention

A total of 54 and 56 respondents were in the control and intervention groups respectively. Before intervention, 15(27.8%) and 27(48.2%) the respondents knew what tuberculosis was in both control and intervention group respectively. While 39(72.2%) and 29(51.8%) did not know what tuberculosis was in both group. As per the causes of tuberculosis, majority of the respondents did not know what causes tuberculosis in both control and intervention group. For how the disease can be transmitted, 25(46.3%) and 26(46.4%) knew how it is transmitted while 29(53.7%) and 30(53.6%) did not know the disease was transmitted (Table 2). After the Pharmacist intervention, the control group had 26(48.11%) that knew what pulmonary tuberculosis was while 28(51.85) did not know what TB was. The intervention group had 54(96.4%) that knew what TB is and only 2(3.6%) did not know 16(29.6%) and 60(89.3%) knew what causes TB in the control and intervention group respectively after Pharmacist intervention, majority of the respondents knew the signs and symptoms of TB 42(77.8%) and 51(91.1%) respectively in both control and intervention group. 38(70.4%) respondents in the control group and 52(92.9%) in the intervention group knew how TB can be transmitted while 16(29.6%) and 4(7.1%) in control and intervention group respectively did not know how TB can be transmitted after Pharmacist intervention.(Table 3)

Table 2.

Assessment of the Respondents' Disease Knowledge before Intervention

Questions asked	Response	Control	Intervention	Chi-square	p-value
Have you heard about Tuberculosis	1	29 (53.7%)	25 (44.6%)	0.903	0.342
	0	25 (46.3%)	31 (55.4%)		
What is pulmonary Tuberculosis	1	15 (27.8%)	27 (48.2%)	4.864	0.027
	0	39 (72.2%)	29 (51.8%)		
What cause Tuberculosis?	1	9 (16.7%)	18 (32.1%)	3.555	0.059
	0	45 (83.3%)	38 (67.9%)		
What are the signs and symptoms of tuberculosis	1	6 (11.1%)	18 (32.1%)	7.129	0.008
	0	48 (88.9%)	38 (67.9%)		
How can tuberculosis be transmitted	1	25 (46.3%)	26 (46.4%)	0.000	0.989
	0	29 (53.7%)	30 (53.6%)		

Table 3.

Assessment of the Respondents' Disease Knowledge after Intervention

Characteristics Response	Response	Control	Intervention	Chi-square	p-value
Have you heard about tuberculosis	1	54 100.0%)	56 (100.0%)		
	0				
	1	26 (46.4%)	54 (96.4%)	34.300	0.000
What is pulmonary Tuberculosis	0	30 (46.4%)	2 (3.6%)		

What cause Tuberculosis?	1	16 (29.6%)	50 (89.3%)	40.765	0.000
	0	38 (70.4%)	6 (10.7%)		
What are the signs and symptoms of tuberculosis	1	42 (77.8%)	51 (91.1%)	3.718	0.054
	0	12 (22.2%)	5 (8.9%)		
How can tuberculosis be transmitted	1	38 (70.4%)	52 (92.9%)	9.345	0.002
	0	16 (29.6%)	4 (7.1%)		

Key:
1 = yes/ correct 0= no/ wrong

Assessment of patient medication Adherence before and after Pharmacist Intervention in the Health Facilities using Patient Medication Refill Card and Oral interview

A total number of 110 sputum smear positive pulmonary tuberculosis patients participated. These were divided into 54 and 56 participated in the control and intervention group respectively. 50 (92.6%) and 51 (91.10%) had poor medication adherence (<100%) before the intervention in both control and intervention groups respectively. While only 4 (7.4%) and 5 (8.9%) had good medication adherence (100%) respectively. After the Pharmacist intervention, 40 (71.4%) of the participants in the Pharmacist intervention group had good medication adherence (100%) while only 13 (24.1%) had poor medication adherence.

Table 4. Patient medication Adherence before and after Pharmacist Intervention

Characteristics	Medication adherence	Control	Intervention	Chi-square	p-value
Pre	Poor	50 (92.6%)	51 (91.1%)	0.085	0.771
	Good	4 (7.4%)	5 (8.9%)		
Post	Poor	41 (75.9%)	16 (28.6%)	24.691	0.000
	Good	13 (24.1%)	40 (71.4%)		

Social History of Respondents before and after a Pharmacist Intervention.

There was a significant association between ($p < 0.05$) respondents that smokes at baseline and after Pharmacist follow-up. After Pharmacist intervention, the number of respondents that smokes significantly ($p < 0.05$) reduced (Table 5).

There was a significant association between ($p < 0.05$) frequency of intake of alcohol of respondents at baseline and Pharmacist follow-up. After intervention the frequency of alcohol intake by respondents significantly ($p < 0.05$) reduced (Table 6).

Table 5.

Assessment of Social History of Respondents in Nyanya General Hospital

	Characteristics	Before N (%)	After N (%)	Chi-Square	P-value
Did you smoke cigarette?	No response	0 (0.0)	0 (0.0)	29.400	0.000*
	Yes	5(16.7)	4 (13.3)		
	No	25 (83.3)	26 (86.7)		
	Total	30 (100.0)	30 (100)		
When last did you smoke?	No response	24(80.0)	27(90.0)	115.600	0.000*
	Yesterday	0(0.0)	0(0.0)		
	Last week	0(3.3)	0(0.0)		
	Last Month	3(10.0)	1(3.3)		
	More than six month	2(6.7)	2(6.7)		
	Total	30(100)	30(100)		
How often do you drink alcohol or alcoholic beverages?	No response	0 (0.0)	0(0.0)	58.667	0.000*
	Daily	3 (10.0)	1(3.3)		
	2-3 times in a week	3 (10.0)	0 (0.0)		
	Weekly	1 (3.3)	0 (0.0)		
	Once in a while Don't	13 (43.3)	13(43.3)		
	drink at all	10 (33.3)	17(36.7)		
	Total	30(100)	30(100)		

Table 6**.**

Assessment of Social History of Respondents in Asokoro District Hospital

	Characteristics	Before N (%)	After N (%)	Chi-Square	P-value
Did you smoke cigarette?	No response	1 (3.8)	1(3.8)	57.731	0.000*
	Yes	5(19.2)	2(7.7)		
	No	20 (76.9)	23 (88.5)		
	Total	26 (100.0)	26 (100.0)		
When last did you smoke?	No response	19 (73.1)	21 (80.8)	106.077	0.000*
	Yesterday	1(3.8)	0 (0.0)		
	Last week	2(7.7)	0 (0.0)		
	Last Month	1 (3.8)	2 (7.7)		
	More than six month	3 (11.5)	2 (7.7)		
	Total	26 (100)	26 (100)		
How often do you drink alcohol or alcoholic beverages?	No response	0(0.0)	1 (3.8)	65.231	0.000*
	Daily	1(3.8)	0 (0.0)		
	2-3 times in a week	3 (11.5)	2 (7.7)		
	Weekly	1 (3.8)	1 (3.8)		
	Once in a while Don't	14 (53.8)	13 (50.0)		
	drink at all	7 (26.9)	9 (34.6)		
	Total	26 (100)	26 (100)		

Assessment of Literacy Status and Treatment Outcomes of Pulmonary Tuberculosis Patients after Pharmacist Intervention in the Health Facilities.

The 110 participants were divided into control and intervention groups. The outcomes measured were categorized as successful (sum total of cured and treatment completed patients) and unsuccessful (sum total of defaulter died, treatment failed, transferred out patients) with their literacy status

The study showed a total sum of successful outcomes of 40 (74.1%) and 49 (87.5%) in the control and intervention groups respectively. Among these, those with secondary school education had the highest successful outcomes of 33.3% in the control group followed by 16.7% for those with higher education while those with primary and no formal education had 9.2% and 14.8 successful outcomes respectively. The intervention group with 87.5% successful outcome had it based on literacy status with those secondary educational level having a successful outcome of 24 (42.9%) followed by secondary education of 33.9%. all the participant with primary and no formal education formed 7.1% and 3.6% respectively and they all had successful outcomes in the intervention group.

Table 7.

Assessment of Literacy Status and Treatment Outcomes of Pulmonary Tuberculosis Patients after Pharmacist Intervention in the Health Facilities.

Literacy Status	Control		Intervention	
	Successful N (%)	Unsuccessful N (%)	Successful N (%)	Unsuccessful N (%)
No formal education	8 (14.8)	1 (1.9)	2 (3.6)	0 (0)
Primary education	5 (9.2)	1 (1.9)	4 (7.1)	0 (0)
Secondary education	18 (33.3)	9 (16.7)	24 (42.9)	2 (3.6)
Higher or tertiary education	9 (16.7)	3 (5.5)	19 (33.9)	5 (8.9)
TOTAL	40 (74.1)	14 (25.9)	49 (87.5)	7 (12.5)

Assessment of Employment Status and Treatment Outcomes of Pulmonary Tuberculosis Patients after Pharmacist Intervention

The total 110 participants from the two health facilities were divided into control and intervention groups. They were categorized according to their areas of employment. The study showed the sum total of successful outcome across all employment categories as 40 (74.1%) and 49 (87.5%) in control and intervention groups respectively. Among these; the study showed that those that were self-employed had a successful outcome of 12 (22.2%) and 19 (33.9%) in both control and intervention group respectively. The study showed civil servant category had successful outcome of 10 (18.5%) and 14 (25%) participation in both control and intervention group respectively. The students category had 7 (12.9%) and 9 (16.0) participants having successful treatment outcomes in both control and intervention group respectively. Housewives and those that were unemployed had 3 (5.6%) and 3 (5.4%) successful outcomes in both categories for control and intervention

groups respectively. While those that worked in private establishment had 5 (9.3%) and 1 (1.8%) successful outcomes in both control and intervention groups respectively.

Unsuccessful outcomes was 7 (12.9%) in self-employed category for control and 4 (7.1%) for intervention groups. Civil servant had unsuccessful outcome of 2 (3.7%) and 1 (1.8%) for control and intervention group respectively. The private employment category had 1 (1.8%) and 1 (1.8%) unsuccessful outcome in both control and intervention group while unemployed and student category had no unsuccessful outcome 0 (0%) in control group. They all had successful outcome. Private and housewife category in the intervention group had zero (0%) unsuccessful outcomes respectively. (Table 8). The total sum of unsuccessful outcomes in both control and intervention group were 25.9% and 12.5% respectively. (Table 8)

The study showed a statistically significant different ($p < 0.005$) in the treatment outcomes between control and intervention group after pharmacist intervention

Table 8.

Assessment of Employment Status and Treatment Outcomes of Pulmonary Tuberculosis Patients after Pharmacist Intervention

Employment status	Control		Intervention	
	Successful N (%)	Unsuccessful N (%)	Successful N (%)	Unsuccessful N (%)
Civil servant	10 (18.5)	2 (3.7)	14 (25)	1 (1.8)
Private	5 (9.3)	1 (1.85)	1 (1.8)	0 (0)
Self employed	12 (22.2)	7 (12.9)	19 (33.9)	4 (7.1)
House wife	3 (5.6)	4 (7.4)	3 (5.4)	0 (0)
Unemployed	3 (5.6)	0 (0)	3 (5.4)	1 (1.8)
Student	7 (12.9)	0 (0)	9 (16.0)	1 (1.8)
TOTAL	40 (74.1)	14 (24.9)	49 (87.5)	7 (12.5)

DISCUSSION

This study was conducted at two secondary health facilities in Abuja, Asokoro District hospital and Nyanya General Hospital both situated in Abuja Municipal Area Council of Abuja. The study evaluated Pharmacist intervention on the treatment outcomes of pulmonary tuberculosis patients. The study also assessed the disease knowledge of the signs and symptoms as well as modes of transmission. Other components of the study were assessment of medication adherence through medication refill and as well as comparing the treatment outcomes from the two health facilities.

The socio-demographic findings in this study showed the majority of the participants age distribution was in range of 25 – 44 years. The finding of this study was in agreement with similar study in India that tuberculosis occurs in adults in their productive age of 25 – 54 years [11]. The study showed that the male participants were slightly higher than females from the two facilities. This finding was in agreement with global TB report that had more male population having tuberculosis than female [1]. This might be due to, men having more susceptibility to TB due to biological differences,

such as higher rates of conditions like smoking and alcohol use, which weaken the immune system and increase the risk of developing TB, also males are often involved in jobs that may increase their exposure to TB.

The findings of this study on their educational status showed majority of the respondents having secondary school education and was closely followed by those with tertiary or higher educational status. Previous research showed that educational level of patients was an integral part of disease management [14]. Education improves patients' ability to adopt preventive behaviors, such as covering their mouths when coughing, practicing good hygiene, and following infection control guidelines to prevent spreading TB to others. The findings of this study also showed that comparing the ratio of those with secondary or higher education with those without formal education or primary, those with higher education had better understanding of the disease as it was observed in the disease knowledge assessment section of the study.

From the study, majority of the respondents were self-employed in both control and intervention groups. This might lead to low socio-economic state which was one of the barriers to treatment outcomes [15]. Although, Individuals with high educational qualifications or specialized skills who are self-employed may enjoy a higher socio-economic status. For example, consultants, software developers, or business owners with expertise in a particular area often have more financial security. This study also confirmed this as majority of the defaulter (part of unsuccessful) were the self-employed category in both groups.

Before intervention, the knowledge of the disease was poor in both the control and intervention groups. Though majority of the participants have heard about the disease, majority of them did not know what causes it and most importantly modes of transmission. After the Pharmacist intervention, the study showed majority of the participants in the intervention group had gained the knowledge and knew the causes, modes of transmission. The findings of the research also showed that there was statistically significant difference in knowledge of disease before and after Pharmacist intervention between control and intervention group. Majority of the participants that knew about the disease before got the information from health care professionals.

The statistically significant difference observed in this study in the Pharmacist intervention group is in line with WHO recommendation that says one of the strategies for improving adherence is health education which entails provision of information about tuberculosis [15]. This study also assessed the medication adherence through medication refill card and the findings showed that majority of the Pharmacist intervention group had good medication adherence as compared to the control group that only very few had good adherence. The findings of the study also showed statistically significant difference between the control group and Pharmacist intervention group. The outcomes measured were successful (which was the sum total of cured and treatment completed) and unsuccessful (died, default, treatment failure and transferred out) outcomes. The study was able to achieve a successful outcome of eighty-seven percent and above in the intervention group as against the control group with seventy-four percent successful outcomes. The study was in agreement with findings of the study conducted in a tertiary health facility in Nigeria [16], where the pharmacist intervention group had a successful outcome of over eighty-seven percent as compared to control group without pharmacist intervention. A significant number of respondents quit smoking and reduced their intake of alcoholic beverages following the pharmacist's intervention, marking a notable improvement from baseline. This finding highlights the potential impact of pharmacist-led interventions on lifestyle modifications, opening up new avenues for research into the broader role of pharmacists in promoting long-term behavioral change and disease prevention. Smoking is one of the major risk factor in the development and management of tuberculosis. Alcohol intake is also one of the barriers to successful outcomes [15]. This study was in agreement with another study [17] which indicates that intensive counseling, follow-up phone calls, and text messages improve treatment outcomes. A similar study [18] had 83.3% successful outcome within follow up patients group. Another study [19] had 80.71% successful treatment outcome with Pharmacist intervention.

The study was able to achieve the recommended percentage of treatment outcome in the Pharmacist intervention group while the control group could not. This could be as a result of the intensive counseling, phone calls and reminder text messages offered to the intervention group. Although both facilities had successful treatment outcomes, those patients in the Pharmacist intervention group attending Nyanya General Hospital had higher percentage of successful treatment outcomes than those attending Asokoro District Hospital. This study also found out that the disease knowledge of the patients greatly improved after the Pharmacist intervention in the intervention group more than the control group without Pharmacist intervention.

Also, there was improvement in the characteristics of social life of the participant as most of them gave up smoking and alcohol beverage intake in the intervention group as compared to the control group.

CONCLUSION

In conclusion, the Pharmacist interventions significantly improved disease knowledge, medication adherence, and social life and treatment outcomes of pulmonary tuberculosis patients.

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