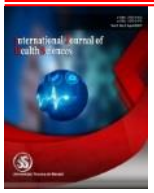

International Journal of Health Sciences

Available online at www.sciencescholar.us
Vol. 10 No. 1, April 2026, pages: 23-36
E-ISSN: 2550-696X
https://doi.org/10.53730/ijhs.v10n1.15891

Effect of Health Education on Treatment Adherence among Drug-sensitive Pulmonary Tuberculosis Patients in selected DOTS Facilities in Ebonyi State, Nigeria

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Manuscript submitted: 09 December 2025, Manuscript revised: 27 January 2026, Accepted for publication: 18 February 2026

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Keywords

adherence;
directly observed therapy short course;
health education;
pulmonary tuberculosis patients;
Tuberculosis;

Abstract

Background: Adherence to Tuberculosis (TB) therapy is critical to achieving a cure. Effective patient education could influence treatment-related attitudes and behaviors, thereby enhancing therapeutic compliance and optimal health outcomes. **Aim:** To assess the effect of health education on treatment adherence among drug-sensitive pulmonary TB patients in ten DOTS facilities in Ebonyi State. **Method:** A quasi-experimental design was employed to recruit 248 respondents drawn from a population of 487 patients using a multi-stage sampling approach. The intervention and control groups consisted of 129 and 119 respondents, respectively, with the intervention group receiving a two-month health education package and the WHO standard routine care, while the control group received only the WHO standard routine care. A validated questionnaire was administered to the respondents before and after the intervention. **Result:** The intervention group achieved 99.2% TB knowledge, 97.7% attitude, and 88.3% treatment adherence after the intervention. However, the control group showed 83.2%, 73.9%, and 68.1% for knowledge, attitude, and treatment adherence, respectively. There was a statistically significant difference between sex and level of treatment adherence in the intervention group, with females showing higher adherence ($p<0.049$). **Conclusion:** The study showed that regular health education improves patients' knowledge, attitude, and adherence to TB treatment.

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Contents

1 Introduction

Worldwide, over 10 million people get tuberculosis each year, and 1.5 million people die from the disease, making tuberculosis (TB) the world's greatest infectious disease-related cause of death for adults (WHO, 2021). An estimated 15 Nigerians die from TB every hour, with the highest burden in children under the age of five (KNCV-Nigeria, 2024). To control the spread of the disease, anti-TB therapy was introduced. Parts of the TB control policies recommended by the World Health Organization (WHO) are the directly observed treatment short-course (DOTS), with directly observed therapy (DOT) as the key component (WHO, 2024). DOT has essentially remained a tool for monitoring tuberculosis treatment. In TB treatment, strict adherence is vital to best clinical outcomes. However, monitoring adherence, particularly in low and middle-income countries like Nigeria with a high burden of cases, requires considerable time and resource investments from healthcare personnel and patients (Netto et al., 2024). Video-observed therapy (VOT) is a good substitute for DOT, more affordable and patient-friendly (Chen et al., 2024). However, VOT is not practicable in settings with poor internet services, coupled with the fact that many of the TB patients are not literate (Chen et al., 2024).

The ability to adhere to TB therapy is critical to obtaining a cure. TB medication non-adherence can worsen symptoms, increase infectivity and drug resistance, with consequent rise in mortality (Yadav et al., 2020). Global treatment success rate (TSR) for TB patients treated with first-line regimens was 88% in 2022 (WHO, 2024). This result is lower than the standard of the WHO of at least 90% (WHO, 2024). Different studies conducted in Nigeria reported up to 24% non-adherence rates (Ajayi et al., 2025; Edeh et al., 2023; Iweama et al., 2021). In Ebonyi State, there is a paucity of current studies on the TB treatment adherence rate. However, Umeokonkwo et al. (2020), reported 17.4% and 14.1% default and death rates, respectively. Another study conducted on drug-resistant TB patients in Ebonyi state revealed 8.1% and 29% default and death rates, respectively (Nwali et al., 2024). Poor drug adherence has been documented to be a contributory factor to higher rates of morbidity, death, and financial burden (Alinaitwe et al., 2025).

Patients who are not well-informed on TB illness, care, and treatment are more likely not to adhere to the regimen. Appropriate information influences personal attitudes and actions toward treatment compliance, thereby supporting the patient's healing process (Yeti & Usman, 2021). In some cases, TB patients may feel no need to continue therapy once they get better (Zhang et al., 2020). Various strategies and interventions are designed to improve knowledge and medication compliance. One of such interventions is health education to improve the TB patients' knowledge.

Health education plays a crucial role in improving adherence by empowering individuals to understand their condition, treatment plan, and the importance of following prescribed medications and therapies, ultimately leading to better health outcomes (Bhattad & Pacifico, 2022). Giving patients precise instructions and addressing their concerns gives them greater confidence to take charge of their health and manage their condition. When patients are educated about their treatment options, they can actively participate in decision-making, leading to greater adherence. Patients who get informed can learn coping mechanisms to control their symptoms, take their medications as prescribed, and handle treatment-related difficulties (Hickmann et al., 2022). However, such a conventional view may be influenced by various factors, including beliefs, culture, and socio-economic background. Therefore, this study assessed the effects of health education intervention on the adherence of TB patients to the treatment course in Ebonyi state.

2 Materials and Methods

Study Design
A quasi-experimental research design with intervention and control groups was employed in the study.

Area of Study
The study was conducted in ten selected DOT facilities in Ebonyi State: viz Alex Ekwueme Federal University Teaching Hospitals, Abakaliki, Nkagbogo MDG, Afikpo, St Patrick's Hospital, Ebonyi, General Hospital, Onueke, Ochege MDG, Onicha, General Hospital, Iboko, Maria Inis Mission Hospital, Ishieluu, Enyibuchiri Health Center, Ikwo, Bethel Mission Hospital, Onicha, and Onyx Clinic, Izzi.

Study Population
The population for the study included all 487 pulmonary TB patients who were started on drug-sensitive tuberculosis (DS-TB) treatment in the selected DOTS facilities in quarter two 2025

Inclusion Criteria
- The participant must be a pulmonary TB patient receiving first-line TB medication for at least two weeks and be willing to participate.
- The patient must have three months to complete therapy.
- Must be within the age of 18 years or above

Exclusion Criteria
- Drug-resistant TB patients and those transferred outside the study area
- Severely ill participants, or those with underlying medical conditions that may affect compliance.
- Participants who are pregnant or breastfeeding.

Sample Size Determination
The Yamen's formula below was used to calculate the sample size.
$n = N/1+N(e)^2$ where
n = minimum sample size:
N = total population of patients registered in quarter 2, 2025 (487)
e= acceptable sampling error usually set at 5% (0.05)
Hence,
n= 487/1+487(0.05)2 = 219.61 ≈ 220
Anticipating a 10% attrition rate, the sample size was:
n = 242
Nonetheless, 248 respondents were recruited.
.
Sampling Technique
A multi-stage sampling technique was adopted with a purposive selection of all 10 DOTS facilities that reported at least 15 cases in the 2nd quarter of 2025. Furthermore, a total of 248 respondents were recruited (129 in the intervention arm and 119 in the control arm).

Study Instrument
A validated self-administered questionnaire involving the WHO Knowledge Attitude Practice (KAP) template for assessing demographic data and TB-related KAP, and the Morisky 8-Item Adherence Questionnaire was used to elicit the required information from the respondents from both arms of the study before the intervention package [WHO (2008); Onyango et al., (2020); Worgu et al., (2022)]. An Overall score of ≥50% was regarded as good knowledge/attitude. An adherence score of ≥6 represents good adherence, while scores <6 denote poor adherence.

Procedure for Data Collection

Five trained research assistants (Local Government TB supervisors) conducted the health education package in the intervention arm once a week for one month, then once biweekly for another month. Standardized materials (National Tuberculosis, Leprosy and Buruli Ulcer Manual, Center for Disease Control and Prevention TB guide, posters, and leaflets) were used. The content of the training included knowledge of TB disease, treatment, and possible side effects, risks, and consequences associated with non-adherence behaviours, stigma prevention, and the benefits of TB medication adherence. The package was delivered on different days within the five working days of the week to enable the researchers to visit each site twice for supervision during the period of the exercise. An interactive lecture pattern was adopted, and time was allotted for questions and answers. The control arm received only the WHO standard routine care.

The questionnaire administered during the baseline data collection was re-administered to the same participants in both intervention and control arms at the end of the two-month intervention package.

Statistical Analysis

The analysis of data was conducted using SPSS version 25.0. Proportions and percentages were used to report categorical data. To evaluate the relationship between categorical variables, the chi-square test and Fisher's exact test were employed. An independent samples t-test was used to compare the pre- and post-intervention measurements. Variables were considered significant if their p-value was less than 0.05.

Ethical Consideration

Ethical approval was obtained from the Ethical Committee of Ebonyi State Ministry of Health, with the number EBSHREC/036/2025/0036. The ethical clearance, together with a letter of introduction from the Department of Nursing Science, Ebonyi State University, was presented to the DOTS facility heads to get their consent. The study's goals were clearly explained to the participants, and their verbal consent was obtained before the questionnaire was given out, emphasizing their right to decline participation at any time if they did not want to continue.

3 Results and Discussions

3.1 Results

The socio-demographic characteristics of the respondents in the Intervention and Control groups are shown in Table 1. There were slight majority of males in both the Intervention (53.5%) and Control (54.6%) groups. The largest age group in both the Intervention and Control groups was the 36-45-year-olds. The occupation shows a more noticeable difference as farmers carry the highest population (38.8% and 53.8% for intervention and control groups, respectively). Both groups have a similar proportion of individuals living far from DOTS facilities (61.2% in the Int. and 56.3% in the Control).

Table 1
Socio-demographic characteristics of the respondents

Demographic Variables	Intervention (n=129)	Control (n=119)
Sex		
Male	69(53.5)	65(54.6)
Female	60(46.5)	54(45.4)
Age (years)		
16-25	12 (9.3)	16(13.4)
26-35	23(17.8)	24(20.2)
36-45	52(40.3)	29(24.4)
46-55	11 (8.5)	15(12.6)
56-65	18(14.0)	20(16.8)

Demographic Variables	Intervention (n=129)	Control (n=119)
66 & above	13(10.1)	15(12.6)
Marital status		
Married	80(62.0)	81(68.1)
Single	40(31.0)	27(22.7)
Divorced	4 (3.1)	1 (0.8)
Widow	5 (3.9)	10 (8.4)
Occupation		
Apprentice	8 (6.2)	10 (8.4)
Artisan	22(17.1)	13 (10.9)
Civil Servant	13(10.1)	6 (5.0)
Farming	50(38.8)	64(53.8)
Trading	24(18.6)	15 (12.6)
Student	6 (3.1)	7 (5.9)
None	6 (6.2)	4 (3.7)
Educational Status		
None	22(17.1)	23(19.3)
Primary	41(31.8)	38(31.9)
Secondary	48(37.2)	45(37.8)
Tertiary	18(14.0)	13 (10.9)
Location		
Far from DOTS facility (>10Km)	79(61.2)	67(56.3)
Close to DOTS facility (≤10Km)	50(38.8)	52(43.7)
HIV Status		
Positive	9 (7.0)	5 (4.2)
Negative	120(93.0)	114(95.8)

Also, Table 2 shows the effect of health education on the knowledge of TB among the patients in the intervention and control arms of the study. The intervention group revealed a very great improvement in all the variables following the health education package (99.2% against 74.4%), unlike the control group that demonstrated no improvement (83.2% against 82.4%).

Table 2
Assessment of the respondents' knowledge of tuberculosis

	Pre-test scores	Pre-test scores		Post-test scores	Post-test scores	
Variables	Intervention (n=129)	Control (n=119)	χ2 (p-value)	Intervention (n=129)	Control (n=119)	χ2 (p-value)
Cause of TB						
Mycobacterium	54(41.9)	67(56.3)	9.604	127(98.4)	76(63.9)	50.162
Cold air	13(10.1)	13(10.9)	(0.048)	1 (0.8)	12(10.1)	(<0.001)
Poison	6 (4.7)	8 (6.7)		0 (0.0)	7 (5.9)	
Smoking/ Alcohol	19(14.7)	7 (5.9)		1 (0.8)	10 (8.4)	
I don't know	37(28.7)	24(20.2)		0 (0.0)	14(11.8)	
Common symptoms of TB						
Cough of 2 weeks or more	96(74.4)	102(85.7)	4.907(0.027)	127(98.4)	97(81.5)	20.314(<0.001)
Fever	30(23.3)	29 (24.4)	0.042(0.837)	110(85.3)	28(23.5)	95.604(<0.001)
Weight Loss	34(26.4)	57 (47.9)	12.366(0.000)	113(87.4)	52(43.7)	53.373(<0.001)
Night Sweat	28(21.7)	20 (16.8)	0.952(0.329)	105(81.4)	18(15.1)	108.742(<0.001)

	Pre-test scores	Pre-test scores		Post-test scores	Post-test scores	
Variables	Intervention (n=129)	Control (n=119)	χ2 (p-value)	Intervention (n=129)	Control (n=119)	χ2 (p-value)
I don't know	18(14.0)	0 (0.0)	17.904(0.000)	0 (0.0)	6 (5.0)	6.665(0.010)
TB is transmissible from one person to another						
Yes	93(72.1)	84(70.6)	7.401	127(98.4)	85(71.4)	36.570
No	11 (8.5)	2 (1.7)	(0.025)	1 (0.8)	8 (6.7)	(<0.001)
I don't know	25(19.4)	33(27.7)		1 (0.8)	26(21.8)	
Mode of TB transmission						
Through infectious cough & sneezing droplets	84(65.1)	68(57.1)	8.366	128(99.2)	74(62.2)	56.267
Sharing of food & drinks	6 (4.7)	18(15.1)	(0.039)	0 (0.0)	15(12.6)	(<0.001)
Through body contact	10 (7.8)	6 (5.0)		0 (0.0)	3 (2.5)	
I don't know	29(22.5)	27(22.7)		1 (0.8)	27(22.7)	
Is TB curable						
Yes	105(81.4)	104(87.4)	0.039	128(99.2)	99(83.2)	20.585
No	4 (3.1)	5 (4.2)	(0.218)	0 (0.0)	5 (4.2)	(<0.001)
I don't know	20(15.5)	10(8.4)		1 (0.8)	15(12.6)	
Is TB treatment free in Nigeria						
Yes	93(72.1)	109(91.6)	19.913	127(98.4)	103(86.6)	13.354
No	7 (5.4)	6 (5.0)	(0.000)	0 (0.0)	5 (4.2)	(0.001)
I don't know	29(22.5)	4 (3.4)		2 (1.6)	11 (9.2)	
How do you think TB is treated?						
Anti-TB medicine	109(84.5)	117(98.3)	17.108	128(99.2))	117(98.3)	1.092
Traditional medicine	3 (2.3)	2 (1.7)	(0.000)	1 (0.8)	1 (0.8)	(0.579)
I don't know	17(13.2)	0(0.0)		0 (0.0)	1 (0.8)	
How long does anti-PTB therapy usually last?						
3 months	18 (14.0)	14(11.8)	1.328	1 (0.8)	2(1.7)	20.918
6 months	87(67.4)	76(51.3)	(0.722)	123(95.3)	90(75.6)	(0.000)
≥9 months	12(9.3)	14(11.8)		4 (3.1)	14(11.8)	
I don't know	12(9.3)	15(25.2)		1 (0.8)	13(10.9)	
Not taking TB treatment can lead to death						
Yes	100(89.1)	93(78.2)	0.493	108(83.7)	89(74.8)	4.661
No	1 (0.8)	2 (1.7)	(0.782)	1 (0.8)	5 (4.2)	(0.097)
I don't know	28(10.1)	24(20.2)		20(15.5)	25(21.0)	
Level of Knowledge						
Poor knowledge	33(25.6)	21(17.6)	2.288	1 (0.8)	20(16.8)	20.525
Good Knowledge	96(74.4)	98(82.4)	(0.130)	128(99.2)	99(83.2)	<0.001

Furthermore, Table 3 assessed the respondents' attitude to TB treatment before and after the intervention. The number of respondents who reported receiving assistance from a treatment supporter/family dropped by 5% at the end of the intervention. Additionally, up to 34% of respondents in the intervention group and 47.1% in the control group reported that people in the community stigmatized those with TB. A significant difference

in overall attitude was observed. The intervention group had 97.7% of patients displaying a good attitude towards treatment, while only 73.9% in the control group had a positive attitude ($\chi^2 = 29.451$, $p < 0.001$).

Table 3
Assessment of the respondents' attitude to tuberculosis treatment

Attitude to TB/treatment	Pre-test scores Intervention (n=129)	Pre-test scores Control (n=119)	χ2 (p-value)	Post-test scores Intervention (n=129)	Post-test scores Control (n=119)	χ2 (p-value)
Do you think TB treatment will completely cure you?						
Yes	115(89.1)	109(91.6)	4.352	127(98.4)	112(94.1)	3.344
No	4(3.1)	7(5.9)	(0.113)	1 (0.8)	4 (3.4)	(0.188)
Not sure	10(7.8)	3 (2.5)		1 (0.8)	3 (2.5)	
Have you experienced any improvement in your symptoms since treatment?						
Yes	111(86.0)	99(83.2)	5.753	126(97.1)	102(85.7)	14.396
No	9(7.0)	17(14.3)	(0.563)	1 (0.8)	15 (12.6)	(0.001)
Not sure	9(7.0)	3(2.5)		2 (1.6)	2 (1.7)	
Anti-TB treatment can be combined with herbs/over the counter drugs						
Yes	47(36.4)	34(28.6)	3.287	8 (6.2)	32(26.9)	47.969
No	63(48.8)	58(48.7)	(0.193)	115(89.1)	58(48.7)	(<0.001)
Not sure	19(14.7)	27(22.7)		6 (4.7)	29(24.4)	
It is embarrassing to have to take TB treatment						
Yes	24 (18.6)	35 (29.4)	4.449	5 (3.9)	38(31.9)	34.192
No	96(74.4)	79 (66.4)	(0.108)	116(89.9)	77(64.7)	(<0.001)
Not sure	9(7.0)	5 (4.2)		8 (6.2)	4 (3.4)	
Complying with a clinic appointment is more troublesome than worth it						
Yes	54(41.9)	60(50.4)	2.026	8 (6.2)	56(47.1)	57.152
No	60(46.5)	49(41.2)	(0.363)	115(89.1)	55(46.2)	(<0.001)
Not sure	15(11.7)	10(8.4)		6 (4.7)	8 (6.7)	
Regular opening of windows is important to prevent TB transmission						
Yes	80(62.0)	85(71.4)	16.328	112(86.8)	84(70.6)	12.355
No	41(31.8)	15(12.6)	(<0.001)	12(9.3)	16(13.4)	(0.002)
Not sure	8(6.2)	19(16.0)		5 (3.9)	19(16.0)	
Do you feel supported by your treatment supporter/family and friends during your treatment?						
Yes	117 (90.7)	117(90.7)	1.715	110(85.3)	101(84.9)	7.574
No	8(6.2)	10(7.8)	(0.424)	19 (14.7)	12 (10.1)	(0.023)
Not sure	4(3.1)	2(1.6)		0 (0.0)	6 (5.0)	
TB disease and treatment should be hidden from people						

Attitude to TB/treatment	Pre-test scores Intervention (n=129)	Pre-test scores Control (n=119)	χ2 (p-value)	Post-test scores Intervention (n=129)	Post-test scores Control (n=119)	χ2 (p-value)
Yes	50(38.7)	49(41.2)	0.476	13(13.2)	45(37 8)	8.874
No	70(54.3)	64(53.8)	(0.789)	106(82.2)	68(57.1)	(0.012)
Not sure	9(7.0)	6(5.0)		6 (4.7)	6(5.0)	
People in the community stigmatize those with TB						
Yes	72(55.8)	64(53.8)	1.197	44(34.1)	56(47.1)	8.874
No	48(37.2)	42(35.3)	(0.549)	76(58.9)	48(40.3)	(0.012)
Not sure	9(7.0)	13(10.9)		9 (7.0)	15(12.6)	
Level of Attitude						
Poor Attitude	29(22.5)	30(25.2)	0.257	3 (2.3)	31(26.1)	29.451
Good Attitude	100(77.5)	89(74.8)	(0.614)	126(97.7)	88(73.9)	(<0.001)

Furthermore, findings revealed a change in medication adherence prior to and after the health education package (fig. 1). Adherence was 66.7% before health education, and 88.3% post-intervention compared to the control group.

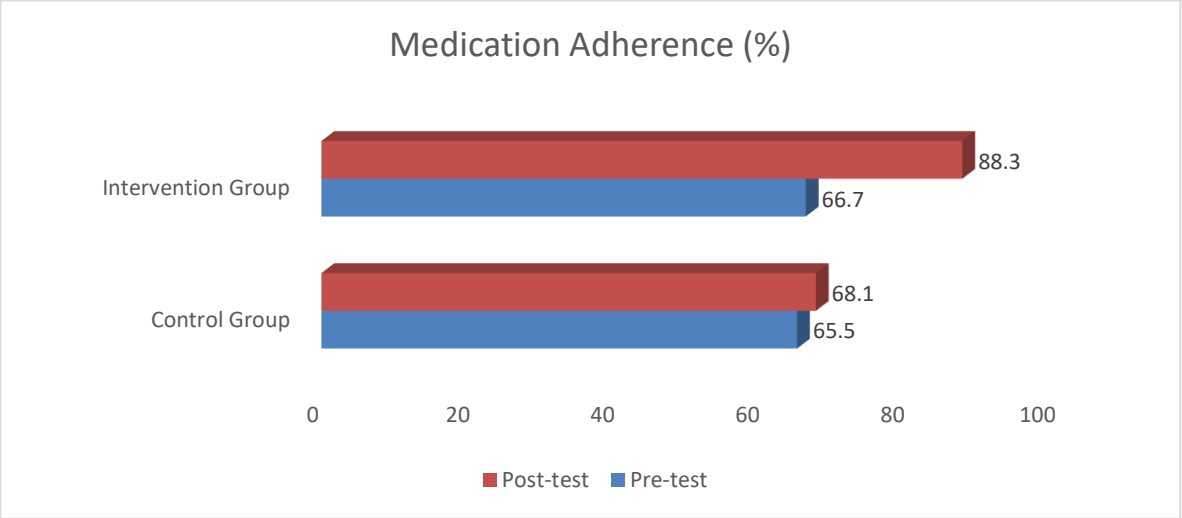

Figure 1: Patient medication adherence prior to and after the health education package

The t-test value of 6.882 in the intervention arm was significant with a P-value < 0.001 (Table 4).

Table 4
Effect of health education on medication adherence among TB patients in selected DOTS facilities in Ebonyi State

Groups	N	Mean Pre-test Scores	Mean Post-test Scores	Mean Difference	t-test	P-value
Intervention	129	5.84±2.24	7.34±1.06	1.50	6.882	<0.001
Control	119	5.71±1.78	6.14±1.92	0.44	1.825	0.069

In addition, the researchers further examined the socio-demographic moderators of the effect of health education on medication adherence among TB patients in both the Intervention and Control groups. The

findings revealed that females showed better adherence (p = 0.049) compared to males. There were also some variations in Age across both groups, but without a significant moderation effect on adherence. However, patients 16-25 and 46-55years had better adherence compared to other groups, while older age groups in the Control group (66 and above) had lower adherence. Similarly, widows demonstrated more favourable adherence in both groups. Among various occupations, civil servants and students seem to show more adherence in the intervention arm. Patients with tertiary education exhibited better adherence in both groups (Table 5)

Table 5
Socio-demographic moderators of the effect of health education and medication adherence among TB patients in selected DOTS facilities in Ebonyi State

Demographic Variables	Intervention (n-129)			Control (n=119)		
	Good	Poor	χ2 (P-value)	Good	Poor	χ2 (P-value)
Sex						
Male	60(87.0)	9(13.0)	3.881	44(67.7)	21(32.3)	2.139
Female	58(96.7)	2(3.3)	(0.049)	43(79.6)	11(20.4)	(0.144)
Age (years)						
16-25	12(100.0)	0 (0.0)	4.57*	12(75.0)	4 (25.0)	4.421*
26-35	20(87.0)	3(13.0)	(0.485)	16(66.7)	8 (33.3)	(0.491)
36-45	49(94.2)	3 (5.8)		22(75.9)	7 (24.1)	
46-55	11(100.0)	0 (0.0)		9(60.0)	6 (40.0)	
56-65	16(88.9)	2(11.1)		16(80.0)	4 (20.0)	
66 & above	11(84.6)	2(15.4)		8 (53.3)	7 (46.7)	
Marital status						
Married	73(91.2)	7 (8.8)	1.918*	59(72.8)	22(27.2)	4.283*
Single	37(92.5)	3 (7.5)	(0.590)	19(70.3)	8 (29.6)	(0.233)
Divorced	3 (75.0)	1(25.0)		0 (0.0)	1 (100)	
Widow	5(100.0)	0 (0.0)		9 (90.0)	1 (10.0)	
Occupation						
Apprentice	7(87.5)	1(12.5)	1.943*	6 (0.0)	4 (100)	2.344*
Artisan	20(91.7)	2(8.3)	(0.857)	9 (63.6)	4 (36,4)	(0.885)
Civil Servant	13(100.0)	0 (0.0)		4(100.0)	2 (0.0)	
Farming	45(90.0)	5(10.0)		42(73.8)	22(26.2)	
Trading	22(91.7)	2 (8.3)		10(70.0)	5 (30.0)	
Student	6(100.0)	0 (0.0)		5 (71.4)	2 (28.6)	
None	5 (83.3)	1(16.7)		4 (100)	0 (0.0)	
Educational Status						
None	20(90.9)	2 (9.1)	0.763*	13(56.5)	10(43.5)	7.168*
Primary	36(87.8)	5(12.2)	(0.859)	26(68.4)	12(31.6)	(0.067)
Secondary	44(91.7)	4 (8.3)		36(80.0)	9(20.0)	
Tertiary	17(94.0)	1 (6.0)		12(92.3)	1 (1.1)	
Location						
Far from DOTS facility	73(92.4)	6 (7.6)	0.233	51(76.1)	16(23.9)	1.652
Close to DOTS facility	45(90.0)	5(10.0)	(0.634)	34(65.4)	18(34.6)	(0.199)
HIV Status						
Positive	8(88.9)	1(11.1)	0.071*	4 (80.0)	1 (20.0)	0.164*
Negative	119(91.5)	11(8.5)	(0.784)	82(71.9)	32(28.1)	(0.693)

*Fisher's exact test used

3.2 Discussions

Before the health education package, barely half of the respondents in both groups (41.9% & 56% for intervention and control groups, respectively) identified Mycobacterium as the causative organism for TB. The results indicate that there is a largely homogenous perception of the disease among participants in both groups. The number of respondents who gained knowledge of the cause of tuberculosis rose to almost 100% at the end of the health education exercise in the intervention group, which was not in the control group, which revealed a marginal increase. This result highlights the importance of health education in improving patients' knowledge of their disease condition and invariably indicates the pathway for a favourable treatment outcome. A similar result was reported by a previous study conducted in Abuja, Nigeria, where participants' knowledge of the aetiology of TB rose to 89.3% after health education intervention (Ajayi et al., 2025). The majority of the respondents from both groups had good knowledge of the mode of TB transmission, its curability, zero cost of treatment, and six months therapy duration. However, the Intervention group demonstrated a significantly higher understanding of this fact. This is in tandem with previous studies in Nigeria (Ajayi et al., 2025; Edeh et al., 2023). A study conducted in southwest Nigeria showed that increased treatment adherence and cure rates among TB patients are substantially correlated with increased knowledge about the disease (Sile et al., 2023).

The baseline attitude of the respondents in both groups showed similar beliefs on the practice of combining TB therapy with herbs or over-the-counter drugs (Table 3). This narrative changed among the participants in the Intervention group after the health education exercise, as the result showed a significant difference. Health education seems to have reduced the tendency to combine TB treatment with unverified remedies in the Intervention group. A previous study conducted in Latvia supported this finding by emphasizing that many herbal remedies have the potential to interact with various medications, which can lead to adverse effects or hinder the effectiveness of those medications (Anochie et al., 2013). Although the findings of this study revealed a reduction in the number of respondents who reported that people in the community stigmatize TB patients post-intervention, the numbers were very high. This aligned with a prior study done in Imo state, Nigeria, where, despite high awareness and knowledge levels, participants expressed a lack of desire to relate with TB patients (Daniel et al., 2025). The stigma surrounding tuberculosis (TB) serves as a significant and often concealed obstacle, greatly impeding effective treatment and posing a serious challenge to global TB control (John et al., 2024). The overall attitude of respondents from the intervention group improved significantly after receiving the health education package. This notable change indicates that participants' attitudes toward tuberculosis were successfully improved by the intervention. This finding is in line with previous studies (Fasoranti, 2016; WHO, 2025). The result also supports Hickmann et al. (2022) that patients who get informed can learn coping mechanisms to control their symptoms, take their medications as prescribed, and handle treatment-related difficulties.

Before the intervention, both groups demonstrated considerable adherence to the TB therapy, although this was not statistically significant (fig. 1). However, at the end of the intervention, the mean score for the intervention group rose from 5.84 to 7.34 (Table 4). This suggests that the improvement in medication adherence in the intervention group is statistically significant, meaning that health education has had a measurable impact on adherence. This finding is supported by Faroranti (2016) with a similar result, where the mean score rose from 2.39 to 3.09 in the intervention group. Conversely, the t-test value of 1.825 is relatively low, suggesting a minor effect in the control arm. The findings of the study also agree with another study conducted by Bhattad & Pacifico (2022), which emphasized that health education plays a crucial role in improving adherence by empowering individuals to understand their condition, treatment plan, and the importance of following prescribed medications and therapies.

The findings from this study reveal that sex was significantly associated with TB therapy adherence. Thus, females were found to be more adherent to TB treatment after receiving the intervention package than their male counterparts. This is in agreement with a previous study done in Anambra (Edeh et al., 2023). The reason may be linked to the findings made by WHO (2025), which revealed that women frequently express a deep commitment to following their treatment plans to take care of their children and dependents, which drives them to focus on their health and see their treatment through to completion. The result is, however, contrary to another study conducted in South Africa, where males showed higher adherence to TB therapy (Katende-Kyenda, 2025). This finding may be attributed to the setting in which the study was conducted.

4 Conclusion

This study reveals the importance of health education intervention programmes in improving patients' knowledge, attitude, and adherence to tuberculosis treatment. The 88.3% adherence rate attained after the intervention programme was highly commendable. The Ebonyi state TB programme should design similar packages and ensure it is enforced in all the DOTS facilities to improve treatment adherence. There is a dire need to embark on massive community awareness campaigns and engagement of community leaders to combat stigma and discrimination attached to TB disease.

Conflict of Interest
The authors declare that there is no conflict of interest.

Funding
None received

Acknowledgments
Our profound gratitude goes to the Ebonyi State Ministry of Health Ethical Committee and State TBL programme for giving us approval to conduct this study. A special appreciation to the management of Ebonyi State University Nursing Science Department for their unwavering support and advice throughout this academic endeavour. Our heartfelt gratitude goes to our research assistants and respondents.

References

Ajayi, R. F., Zezi, A. U., Ya'u, J., & Wanche, E. M. (2025). Evaluation of Pharmacist Interventions on Treatment Outcomes of Pulmonary Tuberculosis Patients in Secondary Health Facilities Abuja. *The Nigerian Journal of Pharmacy*, *59*(1), 19-30.

Alinaitwe, B., Shariff, N. J., & Madhavi Boddupalli, B. (2025). Treatment adherence and its association with family support among pulmonary tuberculosis patients in Jinja, Eastern Uganda. *Scientific Reports*, *15*(1), 11150.

Anochie, P. I., Onyeneke, E. C., Onyeozirila, A. C., Igbolekwu, L. C., Onyeneke, B. C., & Ogu, A. C. (2013). Evaluation of public awareness and attitude to pulmonary tuberculosis in a Nigerian rural community. *Germs*, *3*(2), 52.

Yeti, E., & Usman, A. N. (2021). Risk factors analysis of non-compliance of Tuberculosis (TB) patients taking medicine in Puskesmas Polonia, Medan, 2021. *Gaceta Sanitaria*, *35*, S227-S230. https://doi.org/10.1016/j.gaceta.2021.10.027

Bhattad, P. B., & Pacifico, L. (2022). Empowering patients: promoting patient education and health literacy. Cureus, 14(7).

Chen, E. C., Owaisi, R., Goldschmidt, L., Maimets, I. K., & Daftary, A. (2024). Patient perceptions of video directly observed therapy for tuberculosis: a systematic review. *Journal of Clinical Tuberculosis and Other Mycobacterial Diseases*, *35*, 100406. https://doi.org/10.1016/j.jctube.2023.100406

Daniel, A. A., Adogo, B., Gamde, M.S & Agwom, K. (2025). Impact of Stigma on Diagnosis, Treatment, and Quality of Care for Patients with Tuberculosis: A Review. *International Journal of Biological & Medical Research*. 16(4): 8292-8296.

Edeh, G. C., Ezenyeaku, C. A., Ifeadike, C. O., Awugosi, M. C., Ekwebene, O. C., & Chiekezie, C. F. (2023). Tuberculosis medication adherence in a secondary care center in South-Eastern Nigeria. *J Clin Med Images*, *3*, 1522.

Fasoranti, A. J. (2016). Effect of Health Education Intervention on Treatment Adherence in Patients with Pulmonary Tuberculosis Lagos State, Nigeria. *International Journal of Human Kinetics, Health and Education*, *2*(2).

Hickmann, E., Richter, P., & Schlieter, H. (2022). All together now–patient engagement, patient empowerment, and associated terms in personal healthcare. *BMC health services research*, *22*(1), 1116.

Iweama, C. N., Agbaje, O. S., Umoke, P. C. I., Igbokwe, C. C., Ozoemena, E. L., Omaka-Amari, N. L., & Idache, B. M. (2021). Nonadherence to tuberculosis treatment and associated factors among patients using directly observed treatment short-course in north-west Nigeria: A cross-sectional study. *SAGE open medicine*, *9*, 2050312121989497.

John, S., Lawan, B., Ahmad, A. A, & Abdulkarim, S. (2024). Effect of Health Education Program on Knowledge, Attitude, and Practice Towards Tuberculosis among Nomads in Adamawa State, Nigeria. *Texila International Journal of Public Health*.

Katende-Kyenda, L. N. (2025). Determinants of non-adherence to anti-tuberculosis treatment in a public primary healthcare clinic in South Africa: Improving the quality of long-term care. *International journal of environmental research and public health*, *22*(8), 1209.

KNCV Tuberculosis Foundation in Nigeria (2024). TB in Nigeria

Netto, T.A.L., Diniz, B. D., Odutola, P., Dantas, C. R., de Freitas, M. C. F. L. C., Hefford, P. M., & Bes, T. M. (2024). Video-observed therapy (VOT) vs directly observed therapy (DOT) for tuberculosis treatment: A systematic review on adherence, cost of treatment observation, time spent observing treatment and patient satisfaction. *PLoS neglected tropical diseases*, *18*(10), e0012565.

Nwali, N.I**.,** Umoke, P.C.I., Nwali, M.I., Umoke, M., Mbaocha, B.O., Egede, J.O., *et al.* (2024). Treatment outscomes of multi-drug resistant tuberculosis patients managed in Ebonyi State from October 2017 - September 2020. *Kasmera, 52*(2).

Onyango, P. A., Ter Goon, D., & Rala, N. M. D. (2020). Knowledge, attitudes and health-seeking behaviour among patients with tuberculosis: a cross-sectional study. *The Open Public Health Journal*, *13*(1).

Sile, I., Teterovska, R., Onzevs, O., & Ardava, E. (2023). Safety concerns related to the simultaneous use of prescription or over-the-counter medications and herbal medicinal products: survey results among Latvian citizens. *International journal of environmental research and public health*, *20*(16), 6551.

Umeokonkwo, C. D., Okedo-Alex, I. N., Azuogu, B. N., Utulu, R., Adeke, A. S., & Disu, Y. O. (2020). Trend and determinants of tuberculosis treatment outcome in a tertiary hospital in Southeast Nigeria. *Journal of infection and public health*, *13*(7), 1029-1033. https://doi.org/10.1016/j.jiph.2019.10.012

Worgu, G. O., Onotai, L. O., & Asuquo, E. O. (2022). Medication Adherence among Pulmanory Tuberculosis Patients in Treatment Centers in a Southern Nigerian Local Government Area: Question Mark on Performance of DOTS Services. *Nigerian Medical Journal*, *63*(5), 418-424.

World Health Organization (2008). Advocacy, communication and social mobilization for TB control: a guide to developing knowledge, attitude and practice surveys. WHO/HTM/STB/2008.46

World Health Organization (2008). Advocacy, communication and social mobilization for TB control: a guide to developing knowledge, attitude and practice surveys. WHO/HTM/STB/2008.46

World Health Organization (2024). Treatment supporter. WHO TB Knowledge Sharing Platform.

World Health Organization (2025). Tuberculosis and gender. Global Tuberculosis Report. Geneva, Switzerland.

World Health Organization. Global tuberculosis report 2021. World Health Organization

Yadav, R. K., Kaphle, H. P., Yadav, D. K., Gurung, S. C., Khatri, E., & Baral, S. (2020). Factors associated with treatment adherence among tuberculosis patients in gandaki province of Nepal. *SAARC Journal of Tuberculosis, Lung Diseases and HIV/AIDS*, *18*(1), 8-21.

Zhang, J., Yang, Y., Qiao, X., Wang, L., Bai, J., Yangchen, T., & Chodron, P. (2020). Factors influencing medication nonadherence to pulmonary tuberculosis treatment in Tibet, China: a qualitative study from the patient perspective. *Patient preference and adherence*, 1149-1158.

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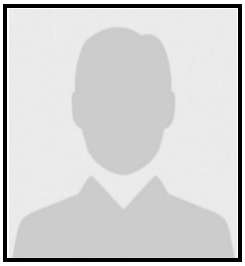

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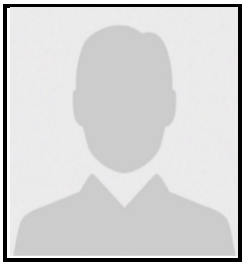

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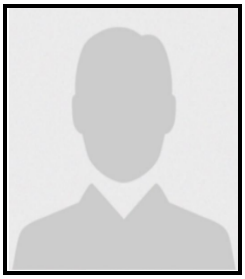

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