***Original Research Article***

**A 5 YEAR RETROSPECTIVE STUDY ON TUBERCULOSIS (TB) TREATMENT OUTCOME IN ENUGU STATE TEACHING HOSPITAL CHEST CLINIC, PARKLANE.**

**Abstract**

**Background**: Tuberculosis (TB) remains a serious global health challenge. Every year, it affects millions of people and is currently the leading cause of death from a single infectious agent surpassing even HIV. Several factors can influence the outcome of TB treatment, including a person's age, marital status, educational background, HIV status, how soon they seek medical care, and the type of treatment they receive. Individuals at the extremes of age both the very young and the elderly often have weaker immune systems, which can affect how well they respond to treatment. Hence, it became important to articulate the reported burden and treatment outcomes of TB in Enugu State in relation to the national burden so as to equip health workers in the states and beyond with the information that will help them to inform their clients and the general public.

**Objectives:** This study aims to ascertain TB treatment outcomes in Enugu State Teaching Hospital Chest Clinic, Parklane from a retrospective point of view.

**Methodology**: The study employed a retrospective design using register from the ministry of health Enugu in nature. It involved a designed proforma which was used in data collection from documented treated cases. Data was presented using Tables, Graphs, Bar charts, Chi square and analyzed using the statistical package for social sciences (SPSS) 22 statistical package, at a significance level of P< 0.05.

**Results**: The result revealed that 2013 has the greatest proportion of registered individuals managed for TB (23.3%), followed by those registered in 2014 (22.4%), with 2017 having the least record (16.8%). There were more males 271 (63.2%) than females were 158 (36.8%). nearly half of the study population had their treatment completed (47.1%), 20.7% were cured, 16.6% were transferred out, 13.1% of them died, 12.6 of them were lost to follow up, 1.4% of them had treatment failure and 0.9% of them were not evaluated. There was no statistically significant difference in the distributions of male and female patients who had good or poor treatment outcomes (χ2 = 1.558, *p*=0.212). The younger patients (1 – 30 years) had higher proportions of good treatment outcome while the older ones

**Conclusion:** Findings in this study points to the positive impact of the different strategic programs which combat TB. The Global strategy and targets for TB prevention care and control appears to yield positive results, this is reflected by the decreasing trend in the prevalence of TB cases.

**KEYWORDS: Tuberculosis, Trend, Prevalence, Treatment, Infections**

**1.1 BACKGROUND OF STUDY**

TB is a major global health problem. It causes illness among millions of people each year and ranks as the leading cause of death from a single infectious disease worldwide (above HIV infection) [1]. Geographically, the burden of TB is highest in Asia and Africa and almost 80% of TB cases among people living with HIV reside in Africa [2]. Despite the existence of effective medications, tuberculosis (TB) remains a global health crisis and continues to be one of the most significant public health challenges of the 21st century [3]. It exerts a profound impact on society, contributing to a range of socio-economic issues including job loss, poverty, social discrimination, diminished self-worth, and poor school attendance, among others [3].

The primary goals of TB treatment are multifaceted which involves: to achieve a complete cure for the individual, to avert death resulting from active disease or its long-term consequences, to minimize the risk of recurrence, to prevent the emergence of drug-resistant strains, and to reduce the spread of the infection within the community [4]. In the early 1990s, the WHO introduced the Directly Observed Treatment Short Course (DOTs) strategy as a cost-effective way to control TB and improve health. A key component of DOTs strategy is to improve patient adherence to treatment and thus prevents the development of drug resistance [5]

The control of the disease in Nigeria is coordinated by the National tuberculosis and leprosy control program (NTBLCP) in line with the ‘Stop TB Partnership’ initiatives whose ultimate target is to eliminate TB as a public health problem (less than 1 case per million population) by the year 2050 [6]. The DOTS strategy, where patients took their daily tuberculosis medications under the supervision of healthcare workers, is no longer widely used. This is mainly because of a lack of trained TB professionals, limited funding, and difficulty accessing TB services [7]. Today, treatment has shifted to a more patient-centered approach. This newer strategy prioritizes the needs of both patients and their communities, and it helps overcome many of the challenges that came with the DOTS method [8].

TB treatment outcomes are affected by several factors which include Age, marital status, level of education, HIV status, time of presentation for treatment and treatment category. Those at the extreme of age have weak immune response [9]. It has been observed that married patients are more likely to be compliant to treatment due to encouragement from their spouses [10]. In addition, educational level is perceived to reduce ignorance and increase knowledge on drugs management and consequences [11].

TB is a global health problem considered an epidemic by the WHO. It is one of the top 10 causes of death and the leading cause of death from a single infectious agent ranking above HIV/AIDS [12]. Nigeria holds the position of the 7th most affected country globally and the 2nd in Africa among the top 30 nations with the highest tuberculosis (TB) burden. As a developing nation, Nigeria reflects a broader pattern seen across many low and middle-income countries, where TB rates tend to be significantly higher. This trend highlights a strong connection between tuberculosis and poverty [13].

Poverty often brings with it a range of conditions that create an environment ripe for TB transmission such as malnutrition, overcrowded living spaces, poor ventilation, and inadequate sanitation. These factors collectively increase an individual's vulnerability to contracting the disease [14]. Furthermore, TB itself can deepen poverty: it reduces a person’s ability to work, limits their productivity, and imposes substantial costs for diagnosis and treatment. This creates a vicious cycle in which poverty fuels the spread of TB, and TB, in turn, entrenches poverty, making it even harder for affected individuals and communities to break free [15].

The recent retrospective study on tuberculosis (TB) treatment outcomes in Enugu State covered the period from 2000 to 2009. During that time, the total number of TB cases increased each year, rising from 914 in 2000 to 1,684 in 2009 [16]. This study aims to provide more information on the prevalence of TB and treatment outcomes at the Chest Clinic of Enugu State University Teaching Hospital, Parklane. The focused objectives of this study were to determine the prevalence of Tuberculosis, the pattern of treatment outcome and to study the factors associated with Tb treatment outcome in Enugu State Teaching Hospital Chest Clinic, Park lane from Jan. 2013 to Dec 2017

**2.0 METHODOLOGY**

**2.1 STUDY AREA**

This study was carried out in Enugu metropolis Enugu state in south east region of Nigeria. Enugu is an urban settlement. Economically, the state is predominantly rural and agrarian with trading and civil service, most people are Christians.

Enugu State Teaching Hospital Chest Clinic, Parklane is one out of the Eleven DOTS centres of the Enugu state ministry of health. Enugu state ministry of health is in Enugu north LGA of Enugu state. It offers specialized health services to indigenes and non-indigenes of the state. It is the main organ of government charged with the function to ensure access to quality health care services for the citizens of Enugu State is the State ministry of Health. The State Ministry of Health has two major arms: Policy Development and Planning Directorate (PDPD) and the State Health Board. Each arm is made up of eight departments, each headed by a Director [17].

 The TB control unit is under the Public health services department. This unit offers the following services:

* To identify and investigate all suspected cases of TB and their contacts as soon as possible after notification.
* To provide information to the Medical Officer of Health as investigations are completed.
* To identify all persons with suspected or confirmed TB disease, and ensure that they receive appropriate treatment.
* To ensure that persons, who are at high risk for progression from infection to active disease, receive preventive therapy and do not develop the disease.
* To ensure that contacts of TB cases are identified and receive appropriate medical care and remain under medical supervision until completion of course of treatment.
* To monitor and document the treatment status of all patients with TB, and correct deficiencies.
* To conduct clinics which provide clients with effective care in a comfortable environment.
* To educate clients, contacts, families and the public; and provide counseling regarding TB prevention and control and the importance of medication compliance.
* To compile statistical data on the number of TB cases and contacts investigated.
* To provide each Community Health Clinic with updated lists of TB cases so that they can reinforce health education and provide additional supervision.
* To improve those social conditions which increase the risk of infection.

**2.2 STUDY DESIGN**

A retrospective study of TB treatment outcome in Enugu State Teaching Hospital Chest Clinic, Parklane, Enugu state from January 2013 – December 2017, making use of the register for TB treatment from Enugu state Ministry of Health.

**2.3 STUDY POPULATION**

The study population included all individuals managed for TB in Enugu State Teaching Hospital Chest Clinic, Parklane, Enugu State from January 2013 to December 2017 using secondary data on TB cases registered annually by the TB control unit of the Ministry of Health, Enugu State Nigeria

**2.3.1 INCLUSION CRITERIA**

Individuals managed for TB

**2.3.2 EXCLUSION CRITERIA**

TB patients with incomplete data

**2.4 SAMPLE SIZE**

This included all individuals managed for TB and registered annually by the Enugu State Teaching Hospital Chest Clinic, Parklane, Enugu State Nigeria for the period Jan, 2013- Dec, 2017

**2.5 STUDY INSTRUMENTS**

Data for this research was collected using a proforma designed by the researchers with questions adapted from a Nigerian study [18]. It contained socio-demographic information and other questions peculiar to the study such as, type of patient, type of TB, Diagnosis made with, HIV status, treatment outcome (treatment success, Relapse, treatment failed, Died, Defaulted, Transferred Out).

**2.6 DATA COLLECTION METHOD**

Data was collected, by researchers from Enugu state Ministry of Health which contained the required information on individuals managed for TB in Enugu State Teaching Hospital Chest Clinic, Parklane, Enugu State. Before the collection of Data, the researchers were trained by a research supervisor, for a period of one day, on the methods, objectives, content of the tool and other logistics of the study before data collection commenced. Data collection spanned through a period of one month.

**2.7 DATA MANAGEMENT.**

**2.7.1 Measurement of Variables**

The key outcome variables that were assessed included;

**Objective 1: To determine the prevalence of TB**. For this study, period prevalence was calculated as the number of all cases of TB in Enugu State Teaching Hospital Chest Clinic, Parklane, Enugu state within 2013 to 2017, this included both old and new cases of TB.

Period Prevalence = T1 X 100% 26

 T2

Where

Period prevalence= the proportion of the population that is affected by TB at some time during a given period.

T1 = Total number of people affected by TB

T2 = Total population

**Objective 2: To determine the TB treatment outcome:** was derived by calculating the percentage of each treatment outcomes;

 (1) Cured

 (2) Died (a patient who died during treatment irrespective of cause);

 (3) Failed (A TB patient whose sputum smear or culture is positive at the 5th month or later during treatment);

(4) Defaulted (a patient who did not come back to complete chemotherapy and there was no evidence of cure through the sputum result during the fifth month of therapy),

(5) Treatment interruption (A TB Patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more), and

(6) Transferred out (a patient who was transferred to another treatment center and for whom treatment results are not known).

**Objective 3: To study the factors associated with Tb treatment outcome**. The treatment outcomes thus determined was cross tabulated with their socio demographic variables and other variables associated with the treatment.

**2.7.2 Statistical analysis**

After the collection of data, data was analyzed and presented using Tables, Graphs, Bar charts, Chi square where necessary. Data was analyzed using the statistical package for social sciences (SPSS) 22 statistical package, at a significance level of P< 0.05.

**2.8 ETHICAL CONSIDERATIONS**

Ethical clearance and approval from the ministry of health was gotten before survey was done.

**2.9 LIMITATIONS**

Limitations anticipated which were not farfetched and they included shortcomings in record keeping as important demographic data like occupation, height, weight, religion among others were probably not recorded by the personnel involved. Secondly, the recorded TB cases in the DOTS centers may not be a true representation of affected population in the state due self-medication and death.

**3.0 RESULTS**

|  |
| --- |
| **TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF PATIENTS (N = 429)** |
| **Variable** | **Frequency** (%) |
| **Year** |
| 2013 | 100 (23.3) |
| 2014 | 96 (22.4) |
| 2015 | 83 (19.3) |
| 2016 | 78 (18.2) |
| 2017 | 72 (16.8) |
| **Gender** |
| Male | 271 (63.2) |
| Female | 158 (36.8) |
| **Age Group in years (Mean = 42 years, SD=18 years)** |
| 1 – 15 years | 21 (4.9) |
| 16 – 30 years | 96 (22.4) |
| 31 – 45 years | 136 (31.7) |
| 46 – 60 years | 105 (24.5) |
| >60 years | 71 (16.6) |
| **HIV Status** |
| Positive | 134 (31.2) |
| Negative | 295 (68.8) |

SD – Standard Deviation

**TREATMENT FINDINGS**

**TABLE 2: PATTERN OF TB TREATMENT OUTCOME IN ENUGU STATE TEACHING HOSPITAL CHEST CLINIC, PARKLANE, ENUGU STATE** **FROM JANUARY 2013 TO DECEMBER 2017**

|  |  |
| --- | --- |
| **Variable** | **Frequency** (%) |
| **Type of patient** |
| New TB patient | 404 (94.2) |
| Relapsed | 12 (2.8) |
| Treatment after failure | 2 (0.5) |
| Treatment after loss to follow up | 1 (0.2) |
| Other previously treated | 6 (1.4) |
| Transfer | 4 (0.9) |
| **Site of infection** |
| Pulmonary | 420 (97.9) |
| Extrapulmonary | 9 (2.1) |
| **Treatment outcome** |
| Cured | 89 (20.7) |
| Treatment completed | 202 (47.1) |
| Treatment failure | 6 (1.4) |
| Died | 56 (13.1) |
| Lost to follow up | 54 (12.6) |
| Not evaluated | 4 (0.9) |
| Transferred out | 71 (16.6) |
| **Treatment outcome category** |
| Good | 291 (67.8) |
| Poor | 138 (32.2) |

**Factors associated with treatment outcome**

The results presented in Table 3 – Table 8 show the relationship between treatment outcome and different factors which include year, gender, age group, HIV status, type of patient and site of infection.

|  |
| --- |
| **TABLE 3****RELATIONSHIP BETWEEN TREATMENT OUTCOME AND YEAR**  |
|  | **Treatment outcome** |  |
| **Factor / Variable** | Good (n=291) | Poor (n=138) | **Test statistic** |
| **Year** |
| 2013 (n=100) | 81 (81.0%) | 19 (19.0%) | χ2 = 13.735 df=4 *p*=0.008\* |
| 2014 (n=96) | 67 (69.8%) | 29 (30.2%) |
| 2015 (n=83) | 54 (65.1%) | 29 (34.9%) |
| 2016 (n=78) | 48 (61.5%) | 30 (38.5%) |
| 2017 (n=72) | 41 (56.9%) | 31 (43.1%) |

As shown in Table 3, a statistically significant relationship was found between treatment outcome and year of registration and management (χ2 = 13.735 *p*=0.008). It was observed that there was significant progressive decrease in the percentages of the patients that had good treatment outcome as well as progressive increase in the percentages of the patients that had poor treatment outcome across the years from 2013 – 2017 (see Table 3).

|  |
| --- |
| **TABLE 4****RELATIONSHIP BETWEEN TREATMENT OUTCOME AND GENDER**  |
|  | **Treatment outcome** |  |
| **Factor / Variable** | Good (n=291) | Poor (n=138) | **Test statistic** |
| **Gender** |
| Male (n=271) | 178 (65.7%) | 93 (34.3%) | χ2 = 1.558df=1 *p*=0.212 |
| Female (n=158) | 113 (71.5%) | 45 (28.5%) |

|  |
| --- |
| **TABLE 5****RELATIONSHIP BETWEEN TREATMENT OUTCOME AND AGE GROUP**  |
|  | **Treatment outcome** |  |
| **Factor / Variable** | Good (n=291) | Poor (n=138) | **Test statistic** |
| **Age group** |
| 1 – 15 years (n=21) | 17 (81.0%) | 4 (19.0%) | χ2 = 13.296df=4*p*=0.010 |
| 16 – 30 years (n=96) | 78 (81.3%) | 18 (18.8%) |
| 31 – 45 years (n=136) | 84 (61.8%) | 52 (38.2%) |
| 46 – 60 years (n=105) | 67 (63.8%) | 38 (36.2%) |
| >60 years (n=71) | 45 (63.4%) | 26 (36.6%) |

|  |
| --- |
| **TABLE 6****RELATIONSHIP BETWEEN TREATMENT OUTCOME AND HIV STATUS**  |
|  | **Treatment outcome** |  |
| **Factor / Variable** | Good (n=291) | Poor (n=138) | **Test statistic** |
| **HIV status** |
| Positive (n=134) | 73 (54.5%) | 61 (45.5%) | χ2 = 15.927 df=1 *p*<0.001\* |
| Negative (n=295) | 218 (73.9%) | 77 (26.1%) |

|  |
| --- |
| **TABLE 7****RELATIONSHIP BETWEEN TREATMENT OUTCOME AND TYPE OF PATIENT**  |
|  | **Treatment outcome** |  |
| **Factor / Variable** | Good (n=291) | Poor (n=138) | **Test statistic** |
| **Type of patient** |
| New TB patient (n=404) | 272 (67.3%) | 132 (32.7%) | χ2 = 5.670 df=5 *p*=0.340 |
| Relapsed (n=12) | 10 (83.3%) | 2 (16.7%) |
| Treatment after failure (n=2) | 1 (50%) | 1 (50%) |
| Treatment after loss to follow up (n=1) | 0 (0.0%) | 1 (100%) |
| Other previously treated (n=6) | 4 (66.7%) | 2 (33.3%) |
| Transfer (n=4) | 4 (10028%) | 0 (0.0%) |

|  |
| --- |
| **TABLE 8****RELATIONSHIP BETWEEN TREATMENT OUTCOME AND SITE OF INFECTION**  |
|  | **Treatment outcome** |  |
| **Factor / Variable** | Good (n=291) | Poor (n=138) | **Test statistic** |
| **Site of infection** |
| Pulmonary (n=420) | 286 (68.1%) | 134 (31.9%) | χ2 = 0.635 df=1 *p*=0.426 |
| Extrapulmonary (n=9) | 5 (55.6%) | 4 (44.4%) |

**4.0 DISCUSSION**

The result in chapter 4 shows that the annual number of TB cases reduced from 100 (23.3%) cases in 2013 to 72(16.8%) in 2017 although this result represent only a DOTS Centre in Enugu state. Compared to a study by Dim et al. in Enugu state, Nigeria, the annual number of all TB cases showed a rising trend from 914 cases in the year 2000 to 1,684 in 2009 [18]. This reduction in the number of cases may partly be explained by the impact of increased awareness programs like the WHO End TB strategy and Global strategy and targets for TB prevention care and control (endorsed in 2014).

The prevalence of pulmonary TB in our study was found to be 97.9%. This is quite higher than the prevalence of 59.6%, in Enugu state as noted by Danlami et al [18], <60% (Eze et al, in Delta state) [19] and 66% (Ukwuaja, Ebonyi state) [20]. However, the prevalence of Extrapulmonary TB was 2.1% which is almost same with 2% reported by Eze et al and 3% by ukwaja. These difference may be attributed to the fact that our study involved only one DOTS Centre in Enugu state.

In our study, total number of males TB cases (271) was higher than females TB cases(158). This corresponds to the earlier results of Ukwuaja in Ebonyi state [20] but differs from the study by Dim et al in Enugu state where the number of female TB cases was higher than males [18].The reasons for these differences may be attributed to various factors such as access to care, ethnicity, HIV co-infection, as well as other biological, social and cultural variables, as earlier suggested by Ukwuaja [20]. Also it has been found that immune responses, after immunization, have been found to be more vigorous in women, resulting in greater antibody production and increase cell mediated immunity [20].

With respect to treatment outcome, nearly half of the study population had their treatment completed (47.1%), 20.7% of them were cured, 16.6% were transferred out, 13.1% of them died, 12.6% of them were lost to follow up, 1.4% of them had treatment failure and 0.9% of them were not evaluated. A Treatment Success rate of 67.8% was recorded. This success rate is a bit higher than 65% recorded by Dim et al, Enugu state [18]. However, Dim et al recorded a higher cure rate of 63.8% as opposed to 20.7% recorded in our study. Treatment success rates in other regions include 76.6% (Akinola et al, Ibadan) [21], 69% (Muhammed et al, parkinstan) [22], 81.8% (Tizazu and Ermias, Ethiopia) [23], 79.5% (Manissero et al, Europe) [24]. This suggests that there is averagely an improved success rate of tuberculosis treatment across borders.

In our study, the gender comparison showed that there was no statistically significant difference in the distributions of male and female patients who had good or poor treatment outcomes. This is as opposed to the findings by Akinola *et al* in Ibadan that Male gender was found to predict poor treatment outcome [21].Tizazu and Ermias in Ethiopia found that female gender was attributed to good treatment outcome [23] which can be attributed to the reasons stated above.

Age was found to have a significant association with treatment outcome. Those who were between the ages of 1 – 15 years and 16 – 30 years had significantly higher proportion of good treatment outcome (81.0%, 81.3% respectively) than those between the ages of 31 – 45 years, 46 – 60 years and above 60 years (61.8%, 63.8%, 63.4%). This is supported by Muhammed *et al,* Bahawalpur, Pakistan, who found that older patients (45 years and above) were at greater risk of having unsuccessful treatment outcomes [22].Tizazu and Ermias in Ethiopia also reported that patients aged 15-40 years had a successful treatment outcome(95.7%) [23].Summarily, the younger patients (1 – 30 years) had higher proportions of good treatment outcome while the older ones (35 & above) had higher proportions of bad treatment outcome. This can partly be explained by the reduced immune response acquired at older age.

The association between treatment outcome and HIV status gave a statistically significant result [25]. The patients who were HIV negative had greater proportion (73.9%) of those who had good treatment outcome than those who were HIV positive (54.5%). This is supported by the findings of Yenework et al, in Gondar University Hospital, Ethiopia, who stated that TB patients co-infected with HIV have poorer treatment outcome as compared to non-co-infected patients [25]. This finding is due to the immunosuppression seen in HIV Patients.

There was no significant association found between treatment outcome and other factors like site of infection and type of patient.

**5.0 CONCLUSION**

It is very possible to eradicate TB completely from the world. Our findings in this study is an attestation of the positive impact of the different strategic programs which combat TB. The Global strategy and targets for TB prevention, care and control appears to yield positive results, this is reflected by the decreasing trend in the prevalence of TB cases from 2013 to 2017.

Treatment outcome of TB is widely dependent on numerous factors.

Younger aged patients had better treatment outcome compared to the older counterparts. Hence this calls for an emphasis on more strict prophylactic measures in the management of geriatrics.

More males were found to manifest symptoms of TB than females. Preventive measures remain the best choice to reduce incidence among gender.

 HIV infection has been widely associated with TB. This means that the control of TB infection and that of HIV infection should be concurrent. Most deaths from TB recorded in this study is mostly contributed by a co-infection with HIV. This means that a high index of suspicion should be expressed in the management of HIV patients.

There was no significant association found between treatment outcome and other factors like site of infection and type of patient.

**6.0 RECOMMENDATIONS**

Even though there is a constantly decreasing trend in the incidence of TB cases from 2013 to 2017, as observed by this study, more inputs have to be done to achieve a TB free nation.

More retrospective studies should be carried out to investigate the extent of association between other factors like poverty, overcrowding and residence to treatment outcome and infectivity.

More work should be carried out on the association between HIV and TB.

The treatment outcome of drug resistant TB and the factors affecting it should be accessed.

We recommend that a concise retrospective study of treatment outcome in the remaining ten DOTS Centers in Enugu state should be carried out in order to determine the treatment outcome in Enugu state.

**REFERENCE**

1. World Health Organization. Global Tuberculosis Report 2018, WHO, Geneva, Switzerland, 2018; Pgs 1, 245-248 (www.who.int. last cited 28/02/2019).
2. Tobin EH, Tristram D. Tuberculosis Overview. [Updated 2024 Dec 22]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK441916/>
3. Manstead A. S. R. (2018). The psychology of social class: How socioeconomic status impacts thought, feelings, and behaviour. *The British journal of social psychology*, *57*(2), 267–291. <https://doi.org/10.1111/bjso.12251>
4. Bloom BR, Atun R, Cohen T, et al. Tuberculosis. In: Holmes KK, Bertozzi S, Bloom BR, et al., editors. Major Infectious Diseases. 3rd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2017 Nov 3. Chapter 11. Available from: https://www.ncbi.nlm.nih.gov/books/NBK525174/ doi: 10.1596/978-1-4648-0524-0\_ch11
5. World Health Organization. Tuberculosis report. The Stop TB Strategy. 2012. Pg 1-2. (www.who.int. last cited 28/02/2019).
6. Kwaghe, A. V., Umeokonkwo, C. D., & Aworh, M. K. (2020). Evaluation of the national tuberculosis surveillance and response systems, 2018 to 2019: National Tuberculosis, Leprosy and Buruli Ulcer Control Programme, Abuja, Nigeria. *The Pan African medical journal*, *35*, 54. <https://doi.org/10.11604/pamj.2020.35.54.21493>
7. Chaiya, C., Panezai, S., Saqib, S. E., & Ashraf, M. (2022). Satisfaction of Tuberculosis Patients with Directly Observed Treatment Strategy under Pakistan Health Care Policy: A Mixed-Method Study. *Healthcare (Basel, Switzerland)*, *10*(12), 2529. <https://doi.org/10.3390/healthcare10122529>
8. Tadesse S, Tadesse T. Treatment success rate of tuberculosis patients in Dabat, northwest Ethiopia. Health. 2014; 6(5): 306–310
9. Ngala, S. M., Tantoh, D. M., Nfor, O. N., Francis, G. D., Fitame, A., & Chu, Y. W. (2025). Age-specific relationship between HIV and TB treatment outcomes in the West Region of Cameroon: a cross-sectional study. *BMC infectious diseases*, *25*(1), 475. <https://doi.org/10.1186/s12879-025-10860-3>
10. Malih Radhi, M., Niazy, S. M., & Naser Abed, S. (2023). Individual-related factors associated with treatment adherence among hypertensive patients. *Journal of public health in Africa*, *14*(6), 2466. <https://doi.org/10.4081/jphia.2023.2466>
11. Akamike, I.C., Okedo-Alex, I.N., Eze, I.I. *et al.* Why does uptake of family planning services remain sub-optimal among Nigerian women? A systematic review of challenges and implications for policy. *Contracept Reprod Med* **5**, 30 (2020). <https://doi.org/10.1186/s40834-020-00133-6>
12. Zhang, SX., Miao, FY., Yang, J. *et al.* Global, regional, and national burden of HIV-negative tuberculosis, 1990–2021: findings from the Global Burden of Disease Study 2021. *Infect Dis Poverty* **13**, 60 (2024). <https://doi.org/10.1186/s40249-024-01227-y>
13. Olaleye SA, Balogun OS, Adusei-Mensah F. Bibliometric structured review of tuberculosis in Nigeria. *Afr Health Sci*. 2023;23(2):139-160. doi:10.4314/ahs.v23i2.16
14. Ferreira, M.R.L., Bonfim, R.O., Bossonario, P.A. *et al.* Social protection as a right of people affected by tuberculosis: a scoping review and conceptual framework. *Infect Dis Poverty* **12**, 103 (2023). <https://doi.org/10.1186/s40249-023-01157-1>
15. Kirubi, B., Ong’ang’o, J., Nguhiu, P. *et al.* Determinants of household catastrophic costs for drug sensitive tuberculosis patients in Kenya. *Infect Dis Poverty* **10**, 95 (2021). <https://doi.org/10.1186/s40249-021-00879-4>
16. Orji, C. J., Chime, O. H. and Ossai, E. N. (2019) “Determinants of Successful Tuberculosis Treatment Outcome in a State University Teaching Hospital in South East, Nigeria: A 5 Year Retrospective Study”, *International Journal of TROPICAL DISEASE & Health*, 39(1), pp. 1–8. doi: 10.9734/ijtdh/2019/v39i130195.
17. Enugu State Ministry of Health Enugu. Nigeria: Planning, Research and Statistics Department. Enugu State Annual Health Statistical Report, June 2016.
18. Danlami, M. B., Aliyu, B., & Samuel, G. (2020). INCIDENCE OF RIFAMPICIN-RESISTANCE PRESUMPTIVE *M. TUBERCULOSIS* CASES AMONG OUTPATIENTS IN KEBBI STATE, NIGERIA. *African journal of infectious diseases*, *15*(1), 47–52. <https://doi.org/10.21010/ajid.v15i1.6>
19. Eze GU, Aduh U, Obiebi IP, Obodo KT. Profile and Treatment Outcomes of Patients with Tuberculosis: A Five Year Review of Patients on DOTS in Delta State, Nigeria. Journal of Community Medicine and Primary Health Care. 2016;30 (1): 34-46.
20. Ukwaja K1, Alobu I, Ifebunandu N, Osakwe C, Igwenyi C. From DOTS to the Stop TB Strategy: DOTS coverage and trend of tuberculosis notification in Ebonyi, southeastern Nigeria, 1998-2009. Pan African Medical Journal. 2011; 9:12.
21. Akinola AF, Abimbola SO, Afolabi EB. Treatment outcomes among pulmonary tuberculosis patients at treatment centers in Ibadan, Nigeria. Journal of African Medicine. 2009; 8 (2):100-104.
22. Muhammad A, Zainab A, Razia KF,Iram M,Saima A, Shane S. Analysis of tuberculosis treatment outcomes among pulmonary tuberculosis patients in Bahawalpur, Pakistan. Journal of British Medical council 2018; 11:370
23. Tizazu ZA, Ermias T. Tuberculosis treatment outcome and associated factors among smear-positive pulmonary tuberculosis patients in Afar, Eastern Ethiopia: a retrospective study. The Brazilian Journal of infectious diseases. 2016; 20(6): 635-636.
24. Manissero D, Hollo V, Huitric E, Ködmön C, Amato-Gauci A. Analysis of tuberculosis treatment outcomes in the European Union and European Economic Area: efforts needed towards optimal case management and control. Journal of European Surveillance. 2010;15(11): 1-2.
25. Yenework S, Shitaye A, Abel F. D, Mucheye G. Successful TB treatment outcome and its associated factors among TB/HIV co-infected patients attending Gondar University Referral Hospital, Northwest Ethiopia: An institution based cross-sectional study. Journal of British Medical Council on Infectious Diseases. 2017; 17(1): 132