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Treatment outcomes of Tuberculosis single infection and Tuberculosis/HIV co-infection in Rivers State University Teaching Hospital, Nigeria.

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Abstract

Introduction: Tuberculosis (TB) and TB/HIV co-infection are significant contributors to morbidity and mortality globally. The interaction between these two infections is multifaceted, with each disease influencing the epidemiology and progression of the other, which poses diagnostic and therapeutic challenges, particularly in developing countries. This study evaluated and compared the treatment outcomes of TB single infection and TB/HIV co-infection among patients at Rivers State University Teaching Hospital.

Methods: This was a two-year retrospective review of the clinical records of all adult patients with tuberculosis and TB/HIV coinfection at the tuberculosis clinic of RSUTH between January 2023 and December 2024. Patients' clinical records were assessed to extract demographic data, retroviral status, treatment outcomes and analysed using SPSS version 27.

Results: A total of 685 adult patients were involved in the study; over half (52.0%) were aged between 21 and 40 years old. Mean (SD) = 34 (4.5), and 383 (55.9%) were male. Up to 33.6% were TB/HIV co-infected, with 216 persons on antiretroviral therapy. Patients with TB-only infections had significantly higher cure rates (37.8% vs. 24.8%, p value = 0.001), while those with TB/HIV co-infection experienced higher mortality (9.6% vs. 1.5%, p value = 0.001) and were more lost to follow-up (49.5% vs. 38.6%, p value = 0.005).

Keywords: Tuberculosis, Tuberculosis/HIV coinfection, Treatment outcomes, Nigeria

Background

Tuberculosis (TB) is a highly contagious and infectious disease mainly caused by the bacilli *Mycobacterium tuberculosis,* leading to the formation of tubercles in different parts of the body. [1] Tuberculosis and human immunodeficiency virus (HIV) disease are two of the most significant global health challenges, each contributing to substantial morbidity and mortality worldwide, as it has been estimated that more than one-third of people living with HIV (PLHIV) are infected with TB. [2] The twin epidemics of tuberculosis and HIV have a bidirectional relationship that poses a dual public health burden to low- and middle-income countries like Nigeria with limited resources. [3,4]

The interaction between these two infections is multifaceted, with each disease influencing the epidemiology and progression of the other.[5] The clinical scenario is complex, as HIV significantly increases the risk of developing active TB, while TB is the leading cause of death among people living with HIV (PLHIV). People living with HIV (PLHIV) have 20 times the risk of developing tuberculosis compared to those without HIV and HIV infection is one of the most potent risk factors for developing active TB.[6,7,8]

The World Health Organisation (WHO) estimates that approximately one-third of the world's population is infected with Mycobacterium tuberculosis; however, only a small fraction of these individuals develop active TB disease, typically those with weakened immune systems, such as people living with HIV.[2,9] In 2021, there were an estimated 10.6 million new TB cases worldwide, of which about 8% (approximately 810,000) were among people living with HIV, with TB accounting for about one-third of AIDS-related deaths globally.[2,7]

The African region, particularly sub-Saharan Africa, bears the highest burden of TB/HIV co-infection, accounting for over 80% of all cases. This is largely due to the high prevalence of HIV in this region, coupled with TB's endemicity. Southern Africa, including countries like South Africa, Eswatini, and Lesotho, reports the highest rates of TB/HIV co-infection, with co-infection rates in some regions exceeding 50%. Other regions with significant TB/HIV co-infection burdens include Southeast Asia and Eastern Europe.[7,10]

Nigeria is ranked sixth among the thirty highest TB-burdened and high multi-drug-resistant TB (MDR-TB) countries. In 2020, it was estimated that 452,000 people were infected with tuberculosis, of which only 135,784 (30%) were diagnosed and reported to the National TB Program (NTP), and 34,000 had co-infection with HIV.[11]

TB and HIV co-infection also pose several shield diagnostic. Collaborative TB/HIV activities and management of comorbidities are the key components of the 'end TB strategy'.[4,12,13] Understanding the treatment outcomes in individuals co-infected with TB and HIV versus those with TB alone is critical for optimising clinical management and public health strategies, as the outcomes for individuals with TB/HIV co-infection are often more complex and less favourable compared to those with TB alone. The interaction between TB medications and antiretroviral therapy (ART), along with issues like drug resistance and treatment adherence, complicates the management of co-infected patients. In contrast, TB single infection typically shows more straightforward treatment outcomes when managed according to standard TB treatment protocols. Comparing these outcomes highlights the additional challenges posed by co-infection and underscores the need for integrated treatment approaches to improve patient care and reduce mortality rates. [11,14,15,16]

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Nigeria ranks among countries with the highest burden of tuberculosis, yet evidence continues to indicate poor treatment outcomes, which have been attributed to poor quality of care. Thus, managing TB-HIV co-infection presents enormous challenges to physicians. [3,16] This study aimed to assess the different treatment outcomes in Tuberculosis singular and TB/HIV co-infection in patients receiving care in Rivers State University Teaching Hospital.

Method

The study area was the Rivers State University Teaching Hospital (RSUTH), a state government-owned tertiary health facility located in Port Harcourt, Rivers State, in the South-South geopolitical zone of Nigeria. This was a 2-year retrospective review of the clinical records of all adult patients with tuberculosis and TB/HIV coinfection in the RSUTH TB Clinic.

The study population consisted of all adult patients above 18 years of age with tuberculosis who presented to the RSUTH tuberculosis clinic between January 2023 and December 2024. Patients' clinical records were utilised to extract information, including age, sex, retroviral status, antiretroviral therapy (ART) status, other disease-related variables, and treatment outcome. The inclusion criteria include all adult patients who were treated for TB only in the last 2 years and all adult patients who were treated for TB/HIV co-infection in the last 2 years. Exclusion criteria include all patients with multidrug-resistant TB and all patients with incomplete data.

Ethical approval for the study was obtained from the Rivers State University Teaching Hospital Ethics Committee (RSUTH/REC/2024/630). Permission was also secured from the head of the Department of Community Medicine to access patients' records. Results of the study will be presented to the department at one of her seminar days.

Data was collected into Microsoft Excel, and exported to and analysed using the Statistical Package for Social Sciences (SPSS) version 27. The Chi-square test was used to test for significant relationships between treatment outcome and single-infected patients versus TB/HIV co-infected patients. A p value of <0.05 was considered statistically significant.

Results

A total of six hundred and eighty-five (685) patients were enrolled into the TB clinic of the Rivers State University Teaching Hospital over the two-year period and 383(55.9%) were male, with a male-to-female ratio of 1.3:1. While only 4 (0.6%) patients were above 80 years of age, over half of the patients (52.0%) were aged between 21 and 40 years old. (Table 1).

Table 1: Demographics of the study population

Variable	Frequency	Percentage
Sex		
Male	383	55.9
Female	302	44.1
Age group		
≤20 years	34	5.0
21-40 years	356	52.0
41-60 years	226	33.0
	65	9.5
	4	0.6

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61-80 years		
≥81 years		
Total	685	100.0

Mean = 34 SD=4.5

Almost all patients were new cases of tuberculosis with pulmonary involvement, and the most common method of diagnosis was with the GeneXpert test, which was able to make a diagnosis in 440 (64.2%) patients. Multiple diagnostic methods were used concurrently on each patient as indicated. Most patients weighed between 61 and 90 kg; however, 9 (1.3%) adults weighed ≤ 30 kg. The clinical characteristics of the patients are demonstrated in Table 2.

Table 2: Clinical characteristics of the study population

Clinical characteristics	**Frequency n=685**	**Percent**
Site of Tuberculosis		
Pulmonary	671	98.0
Extrapulmonary	14	2.0
Method of diagnosis of Tuberculosis		
Clinical	79	11.5
Gene Xpert	440	64.2
TB LAM	46	6.7
AFB	4	0.6
Radiology (X rays)	114	16.6
Biopsy	2	0.3
Status of the patient		
New case of TB	586	98.0
Relapse	99	2.0
Weight of patient at recruitment (kg)		
≤30kg	9	1.3
31-60kg	487	71.1
61-90kg	176	25.7
≥91kg	13	1.9

Key: TB LAM= Tuberculosis lipoarabinomannan, AFB= Acid fast bacilli

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Two hundred and thirty persons (33.6%) had HIV coinfection, and the majority of them (216 persons) were on antiretroviral therapy. (Figure 1)

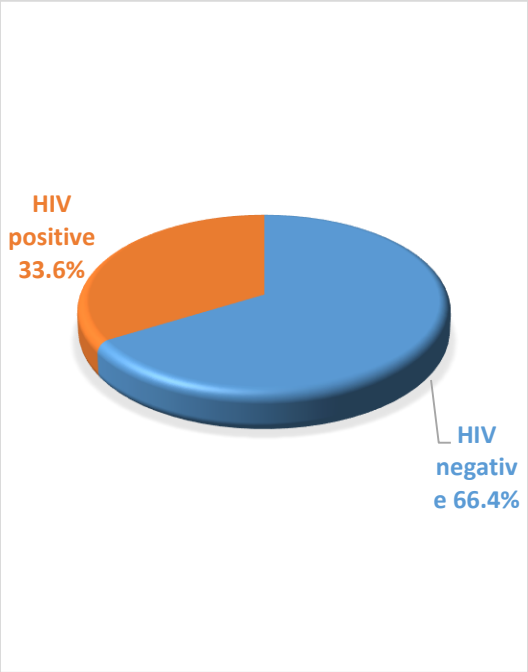

Figure 1: Retroviral status of the study population

Mortality during the study period was 4.2%, as 29 persons died; however, 229 (33.4%) were cured, and 290 (42.3%) were lost to follow-up, as shown in Figure 2.

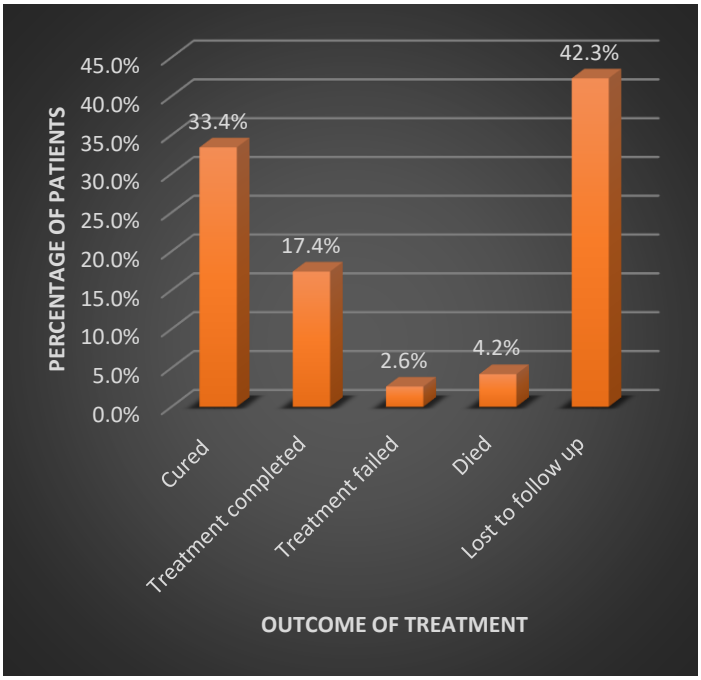

Figure 2: Outcome of treatment for tuberculosis

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Among the patients with TB single infection, 172 (37.8%) were cured, 85 (18.8%) completed treatment, 7 (1.5%) died, and 176 (38.6%) were lost to follow-up. Conversely, among the patients with TB/HIV coinfection, almost half, 114 (49.5%), were lost to follow-up; only 57 (24.8%) were cured; 34 (14.8%) were treatment-completed, and 22 (9.6%) died. Patients with TB-only infections had significantly higher cure rates than patients with TB/HIV coinfection (37.8% vs. 24.8%, p-value = 0.001), while patients with TB/HIV coinfection had significantly higher mortality than those with TB single infection (9.6% vs. 1.5%, p-value = 0.001) as well as a significantly high dropout rate as they were lost to follow-up (49.5% vs. 38.6%, p-value = 0.005). Treatment success (cured + treatment completed) in TB-singly infected patients is 257 (56.6%), and in TB/HIV coinfection it is 91 (39.6%). These findings are summarised in Table 3.

Table 3: Treatment outcomes of Tuberculosis single infection and Tuberculosis/HIV co-infection

Outcome of treatment	TB infection Frequency (%)	TB/HIV coinfection Frequency (%)	Chi square (p value)
Cured	172(37.8)	57(24.8)	11.7 (0.001)
Treatment completed	85(18.8)	34(14.8)	1.6 (0.203)
Treatment failed	15(3.3)	3(1.3)	2.4(0.124)
Died	7(1.5)	22(9.6)	24.3 (0.001)
Lost to follow up	176(38.6)	114(49.5)	7.8 (0.005)
Total	455 (100.0)	233 (100.0)	

Discussion

Tuberculosis (TB) is highly infectious, and people who have TB can infect up to 10-15 other people through close contact over the course of a year. Without proper treatment, up to two-thirds of HIV-negative people with TB and nearly all HIV-positive people with TB will die. [2,7] This study analysed the TB treatment registry of a major tertiary health facility in Port Harcourt, Nigeria.

Most patients were young and middle-aged, with over half of the recruited patients aged between 21 and 40 years and fewer cases in older age groups. This finding aligns with a similar study in sub-Saharan Africa, both of which underscore the vulnerability of this economically viable workforce of the society, which may be aggravated by high exposure rates and socioeconomic factors such as poor housing and occupational risks. However, the higher proportion of elderly patients in this study could be attributed to regional differences, as Rivers State caters to a more diverse patient population, including older individuals from rural settings, where delayed diagnosis is more common. [19] The male predominance noted in this study has also been reported by other authors and is often attributed to higher smoking rates, occupational exposure, and biological differences that increase males' susceptibility to TB. [20] Efforts to mitigate TB prevalence should consider targeted interventions for the most affected age groups and address gender-specific barriers to care.

The dominance of new cases of TB in this study suggests ongoing transmission within the community, emphasising the need for intensified TB control measures, including public awareness and early case detection. [21] Although

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extrapulmonary TB (EPTB) was only documented in a minority of the cases, with better investigative capacity, advanced molecular diagnostic methods may better identify these cases, allowing for the detection of a small percentage of EPTB cases that might otherwise go undiagnosed. [22,23]

HIV co-infection is one of the most important risk factors for active TB in developing countries, as it increases the susceptibility to primary infection as well as reactivation for patients with latent TB infection. Approximately a third of patients in this study were HIV positive, although not all were on antiretroviral therapy (ART). These results align with reports by the World Health Organisation (WHO), which estimates that one-third of TB patients in high-burden regions are HIV-positive, reflecting the close association between the two diseases. [6,7] However, the fact that not all HIV-positive patients were on ART suggests a significant treatment gap which could contribute to poorer outcomes in co-infected individuals and thus raises concerns about the effectiveness of integrated care delivery. Addressing these gaps is critical for reducing mortality and improving outcomes for TB/HIV co-infected patients. [16] Strengthened diagnostic capacity, early treatment initiation, and enhanced ART coverage are critical to addressing these challenges.

The WHO recommends a treatment success rate of at least 85-90% for all diagnosed TB cases defined as 'cure' or 'treatment completed' (patient completed treatment but last smear unavailable or extrapulmonary TB). [24] The treatment outcomes for patients with TB infections revealed a cure rate of 33.4% and a treatment completion rate of 17.4% with a total treatment success rate of 50.8%, which is well below the recommendations. A higher rate of successful treatment outcomes reduces the TB burden and mortality rate in the population, while an unsuccessful treatment outcome has an immediate effect on the socioeconomic well-being of the population, as clinically, it will fast-track the spread of multi-drug-resistant pulmonary tuberculosis in the community. [25,26] Thus, monitoring and evaluating the treatment outcomes of pulmonary tuberculosis should be an integral part of an effective TB control program in the state.

Almost half of the patients on treatment for TB were lost to follow-up, which may be linked to socio-economic challenges seen in developing climes, including poor access to healthcare and patient tracking mechanisms. Additionally, the low treatment failure rate and mortality rate suggest that the treatment regimen is generally effective when adhered to. These outcomes highlight the need for robust follow-up systems and patient-centred care models to address adherence challenges. Addressing socio-economic barriers, improving patient education, and utilising digital tools for tracking could help reduce loss to follow-up rates and enhance treatment success.

The comparison of treatment outcomes revealed notable disparities between TB singly infected patients and those co-infected with TB and HIV. TB cure rates were significantly higher in the TB-only group (37.8%) compared to the co-infected group (24.8%), which aligns with the literature that HIV co-infection reduces the likelihood of achieving bacteriological cure due to immunosuppression, which complicates TB recovery even with effective treatment regimens. [27,28] Treatment completion rates were also higher in TB-only patients, which may demonstrate the challenges co-infected patients face in completing treatment, attributable to the dual burden of managing ART alongside anti-TB medications, which increases the risk of treatment fatigue and poor adherence. [29]

Patients lost to follow-up was another noteworthy issue in both groups, with rates of

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49.5% in the co-infected group compared to 38.6% in TB-only patients. The increased loss to follow-up in the TB/HIV coinfection group could be attributed to the additional challenges of managing dual therapies as well as the stigma associated with HIV. Other authors also reported higher loss to follow-up rates among co-infected patients, which they attributed to socioeconomic challenges and logistical barriers in accessing integrated TB/HIV care. [28,30]

The mortality rate of 9.6% in the TB/HIV coinfection cohort was significantly higher compared to TB-only patients, reflecting the synergistic negative effects of HIV on TB prognosis due to the compounded effects of immunosuppression, increased susceptibility to opportunistic infections and the higher risk of treatment-related complications in these patients.[7,28] The outcomes emphasise the urgent need for integrated TB and HIV care, as enhanced patient support, community outreach, and adherence counselling are critical to improving outcomes in this vulnerable group. Interestingly, treatment failure rates were relatively low in both groups (3.3% for TB-only and 1.3% for co-infected). These findings support the observations by Nagu et al., who found that while treatment adherence improves outcomes in both groups, the additional complications of co-infection tend to offset the benefits of effective anti-TB regimens in co-infected individuals. [31]

Conclusion

Treatment success rates of tuberculosis are well below the recommendations, mainly driven by the alarmingly high rate of loss to follow-up, which suggests that patients lack adequate information about their diagnosis and the consequences of non-adherence to therapy. The Tuberculosis-HIV coinfection rate in this study was high, with significantly worse outcomes than TB single infection. There is a need for better integration of state TB and HIV programmes to further identify and overcome barriers for the effective implementation of existing strategies and tools to reduce the burden of TB.

Therefore, it is recommended that enhanced patient education and counselling be provided across all DOTS centres in Rivers State to improve treatment outcomes and reduce lost to follow-up to alleviate the spread of tuberculosis and HIV. The government and its partner NGOs are encouraged to improve accessibility to TB care by establishing more tuberculosis clinics closer to the communities. This would help reduce patient loss due to logistical challenges. Public awareness campaigns should be intensified to educate citizens about TB and HIV, with a strong emphasis on the importance of adherence to anti-TB therapy. These efforts should be supported by modern and efficient methods of information dissemination to ensure broader and faster outreach. Additionally, NGOs are urged to collaborate with the government in training more health workers to strengthen the human resource capacity of DOT clinics. Regular audits and assessments of treatment outcomes in these clinics should be conducted annually by partnering NGOs to ensure accountability and quality improvement. Furthermore, setting up robust surveillance systems to track trends in TB and HIV infections is vital for informed decision-making and policy development.

Health workers have a critical role to play and are advised to use all available means to ensure the correct and consistent dissemination of information on TB and HIV. They should closely monitor patients for adherence to treatment regimens and any potential side effects. Enhancing the tuberculosis programme with counselling sessions and appointment reminders—such as SMS alerts—can greatly improve treatment outcomes. To effectively carry out these responsibilities, health workers need to equip themselves with up-to-date training on

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communication strategies, patient education, and current treatment protocols. Staying informed about the latest research and treatment guidelines is essential for delivering evidence-based care.

Patients and their relatives also have key responsibilities. Patients must adhere strictly to their prescribed treatment regimens, attend all scheduled appointments, and complete the full course of treatment—even when symptoms improve. Setting personal reminders, such as calendar alerts, can support adherence to both medication and follow-up visits. Relatives are encouraged to accompany patients to their appointments and offer emotional support, which can help reduce stigma and encourage treatment completion.

Further research on the topic to include multiple centres, prospective studies and qualitative components is recommended to give depth to the findings of this study.

Limitation of the Study

A key limitation of this study was the reliance on secondary data from the DOTS register, which may have inherent biases, such as incomplete records or errors in documentation. Additionally, the study was conducted in a single institution, which limits the generalisability of the findings to other regions or facilities. Future studies should include multicentre data and incorporate primary data collection for a more robust analysis.

References

1. Barberis I, Bragazzi NL, Galluzzo L, Martini M. The history of tuberculosis: from the first historical records to the isolation of Koch's bacillus. J Prev Med Hyg. 2017 Mar;58(1):E9-E12. PMID: 28515626; PMCID: PMC5432783
2. Global Tuberculosis Report 2024 [Internet]. [cited 2025 Mar 26]. Available from: https://www.who.int/teams/global-programme-on-tuberculosis-and-lung-health/tb-reports/global-tuberculosis-report-2024
3. Selimin DS, Ismail A, Ahmad N, Ismail R, Mohd Azman NF, Azman A. Tuberculosis Treatment Outcome in Patients with TB-HIV Coinfection in Kuala Lumpur, Malaysia. J Trop Med. 2021 May 29;2021:9923378. doi: 10.1155/2021/9923378. PMID: 34194511; PMCID: PMC8181108.
4. Tola A, Mishore KM, Ayele Y, Mekuria AN, Legese N. Treatment Outcome of Tuberculosis and Associated Factors among TB-HIV Co-Infected Patients at Public Hospitals of Harar Town, Eastern Ethiopia. A five-year retrospective study. BMC Public Health. 2019 Dec 10;19(1):1658. doi: 10.1186/s12889-019-7980-x. PMID: 31822286; PMCID: PMC6902430.
5. Torpey K, Agyei-Nkansah A, Ogyiri L, Forson A, Lartey M, Ampofo W, Akamah J, Puplampu P. Management of TB/HIV co-infection: the state of the evidence. Ghana Med J. 2020 Sep;54(3):186-196. doi: 10.4314/gmj.v54i3.10. PMID: 33883764; PMCID: PMC8042796.
6. Global HIV Programme [Internet]. [cited 2025 Mar 26]. Available from: https://www.who.int/teams/global-hiv-hepatitis-and-stis-programmes/hiv/treatment/tuberculosis-hiv
7. HIV and Tuberculosis. World Health Organisation [Internet]. [cited 2025 Mar 26]. Available from:

Print ISSN: 3043-4742 Online ISSN: 3043-4750

https://www.who.int/westernpacific/health-topics/hiv-aids/hiv-and-tuberculosis

8. Sullivan A, Nathavitharana RR. Addressing TB-related mortality in adults living with HIV: a review of the challenges and potential solutions. Ther Adv Infect Dis. 2022 Mar 18;9:20499361221084163. doi: 10.1177/20499361221084163. PMID: 35321342; PMCID: PMC8935406.

9. Cohen A, Mathiasen VD, Schön T, Wejse C. The global prevalence of latent tuberculosis: a systematic review and meta-analysis. Eur Respir J. 2019 Sep 12;54(3):1900655. doi: 10.1183/13993003.00655-2019. PMID: 31221810.

10. Parker E, Judge MA, Macete E, Nhampossa T, Dorward J, Langa DC, Schacht C, Couto A, Vaz P, Vitoria M, Molfino L, Idowu RT, Bhatt N, Naniche D, Le Souëf PN. HIV infection in Eastern and Southern Africa: Highest burden, largest challenges, greatest potential. South Afr J HIV Med. 2021 May 28;22(1):1237. doi: 10.4102/sajhivmed.v22i1.1237. PMID: 34192070; PMCID: PMC8182467.

11. TUBERCULOSIS PREVENTIVE THERAPY SURGE PLAN AND ROADMAP, 2022 | NTBLCP | National Tuberculosis & Leprosy Control Programme [Internet]. [cited 2025 Mar 26]. Available from: https://ntblcp.org.ng/resources/tuberculosis-preventive-therapy-surge-plan-and-roadmap-2022/

12. Sinshaw Y, Alemu S, Fekadu A, Gizachew M. 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. BMC Infect Dis. 2017 Feb 8;17(1):132. doi: 10.1186/s12879-017-2238-7. PMID: 28178936; PMCID: PMC5299781.

13. Abere Sarah, Dan-Jumbo Alali, Oyan Boma, Eno Gomba, Bawo Michael, Asonye Samuel and Alabi Ajibola. Same Day Antiretroviral Therapy Initiation, Prevalence and Co-factors of Advanced HIV Disease in an African Population- A 1 Year Report. International STD Research and Reviews, 2022; 11(2): 47-56

14. Bruchfeld J, Correia-Neves M, Källenius G. Tuberculosis and HIV Coinfection. Cold Spring Harb Perspect Med. 2015 Feb 26;5(7):a017871. doi: 10.1101/cshperspect.a017871. PMID: 25722472; PMCID: PMC4484961.

15. Pawlowski A, Jansson M, Sköld M, Rottenberg ME, Källenius G. Tuberculosis and HIV co-infection. PLoS Pathog. 2012 Feb;8(2):e1002464. doi: 10.1371/journal.ppat.1002464. Epub 2012 Feb 16. PMID: 22363214; PMCID: PMC3280977.

16. Nnenna Nnadi, Alali Dan-Jumbo, Boma Oyan and Sarah Abere. Level and elements of satisfaction among patients on Anti-retroviral therapy enrolled in differentiated care in south- south Nigeria. Greener Journal of Medical Sciences, 2023; 13(1): 61-68

17. World Health Organization. (2013). Definitions and reporting framework for tuberculosis – 2013 revision: updated December 2014 and January 2020. World Health Organization. https://iris.who.int/handle/10665/79199

Print ISSN: 3043-4742 Online ISSN: 3043-4750

18. Tuberculosis Key Facts. World Health Organisation. [Internet]. [cited 2025 Mar 26]. Available from: https://www.who.int/news-room/fact-sheets/detail/tuberculosis

19. Adepoju VA, Adelekan A, Etuk V, Onoh M, Olofinbiyi B. How Do Private Providers Unaffiliated With the Nigeria National TB Program Diagnose and Treat Drug-Susceptible TB Patients? A Cross-Sectional Study. Glob Health Sci Pract. 2022 Dec 21;10(6):e2200210. doi: 10.9745/GHSP-D-22-00210. PMID: 36951286; PMCID: PMC9771464.

20. Horton KC. Understanding sex disparities in tuberculosis and assessing the potential impact of strategies to improve men's access to care (Doctoral dissertation, London School of Hygiene & Tropical Medicine).

21. Adamu AL, Gadanya MA, Abubakar IS, Jibo AM, Bello MM, Gajida AU, Babashani MM, Abubakar I. High mortality among tuberculosis patients on treatment in Nigeria: a retrospective cohort study. BMC Infect Dis. 2017 Feb 23;17(1):170. doi: 10.1186/s12879-017-2249-4. PMID: 28231851; PMCID: PMC5324260.

22. Horne DJ, Kohli M, Zifodya JS, Schiller I, Dendukuri N, Tollefson D, Schumacher SG, Ochodo EA, Pai M, Steingart KR. Xpert MTB/RIF and Xpert MTB/RIF Ultra for pulmonary tuberculosis and rifampicin resistance in adults. Cochrane Database Syst Rev. 2019 Jun 7;6(6):CD009593. doi: 10.1002/14651858.CD009593.pub4. Update in: Cochrane Database Syst Rev. 2021 Feb 22;2:CD009593. doi: 10.1002/14651858.CD009593.pub5. PMID: 31173647; PMCID: PMC6555588.

23. Boehme CC, Nicol MP, Nabeta P, Michael JS, Gotuzzo E, Tahirli R, Gler MT, Blakemore R, Worodria W, Gray C, Huang L, Caceres T, Mehdiyev R, Raymond L, Whitelaw A, Sagadevan K, Alexander H, Albert H, Cobelens F, Cox H, Alland D, Perkins MD. Feasibility, diagnostic accuracy, and effectiveness of decentralised use of the Xpert MTB/RIF test for diagnosis of tuberculosis and multidrug resistance: a multicentre implementation study. Lancet. 2011 Apr 30;377(9776):1495-505. doi: 10.1016/S0140-6736(11)60438-8. Epub 2011 Apr 18. PMID: 21507477; PMCID: PMC3085933.

24. Chakaya J, Petersen E, Nantanda R, Mungai BN, Migliori GB, Amanullah F, Lungu P, Ntoumi F, Kumarasamy N, Maeurer M, Zumla A. The WHO Global Tuberculosis 2021 Report–not-so-good news and turning the tide back to End TB. Int J Infect Dis. 2022 doi: 10.1016/j.ijid.2022.03.011.

25. Danlami MB, Aliyu B, Samuel G. Incidence of rifampicin-resistance presumptive M. Tuberculosis cases among outpatients in Kebbi State, Nigeria. Afr J Infect Dis. 2021;15(1):47–52. doi: 10.21010/ajid.v15i1.6

26. Oladimeji O, Adepoju V, Anyiam FE, San JE, Odugbemi BA, Hyera FL, Sibiya MN, Yaya S, Zoakah AI, Lawson L. Treatment outcomes of drug-susceptible Tuberculosis in private health facilities in Lagos, South-West Nigeria. PLoS ONE. 2021;16(1):e0244581. doi: 10.1371/journal.pone.0244581

27. Pasipanodya, J.G., McNabb, S.J., Hilsenrath, P. et al. Pulmonary impairment after tuberculosis and its contribution to TB burden. BMC Public

Print ISSN: 3043-4742 Online ISSN: 3043-4750

Health 10, 259 (2010). https://doi.org/10.1186/1471-2458-10-259

28. Suthar AB, Lawn SD, del Amo J, Getahun H, Dye C, Sculier D, Sterling TR, Chaisson RE, Williams BG, Harries AD, Granich RM. Antiretroviral therapy for prevention of tuberculosis in adults with HIV: a systematic review and meta-analysis. PLoS Med. 2012;9(7):e1001270. doi: 10.1371/journal.pmed.1001270. Epub 2012 Jul 24. PMID: 22911011; PMCID: PMC3404110.

29. Osei E, Oppong S, Adanfo D, Doepe BA, Owusu A, Kupour AG, Der J. Reflecting on tuberculosis case notification and treatment outcomes in the Volta region of Ghana: a retrospective pool analysis of a multicentre cohort from 2013 to 2017. Glob Health Res Policy. 2019 Dec 17;4:37. doi: 10.1186/s41256-019-0128-9. PMID: 31890895; PMCID: PMC6916450.

30. Kigozi G, Heunis C, Chikobvu P, Botha S, van Rensburg D. Factors influencing treatment default among tuberculosis patients in a high burden province of South Africa. Int J Infect Dis. 2017 Jan;54:95-102. doi: 10.1016/j.ijid.2016.11.407. Epub 2016 Nov 25. PMID: 27894985.

31. Nagu TJ, Aboud S, Mwiru R, Matee MI, Rao M, Fawzi WW, Zumla A, Maeurer MJ, Mugusi F. Tuberculosis associated mortality in a prospective cohort in Sub Saharan Africa: Association with HIV and antiretroviral therapy. Int J Infect Dis. 2017 Mar;56:39-44. doi: 10.1016/j.ijid.2017.01.023. Epub 2017 Feb 1. PMID: 28161460.

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