

Analysis of Incidence and associated factors of Tuberculosis (TB) Among People Living with HIV (PLHIV) Under Anti-retroviral Treatment at Bheri Hospital ART, Nepal

Authors:

Dr. Sanket Kumar Risal (*MD gastroenterologist and MD General medicine*),

Co-Author:

Dr. Urmila Parajuli (*MD Gynae-Obs*),

Dr. Parash Shrestha (*MD Physician*),

Dr. Dinesh Kumar Choudhary (*Master of Surgery in otorhinolaryngologist and Head and Neck surgeon*).

Corresponding Author;

Dr. Sanket Kumar Risal

Article Received: 23-October -2024, Revised: 13-November-2024, Accepted: 03-December-2024

ABSTRACT:

Objective: To analyze the incidence of tuberculosis (TB) and identify the associated factors among people living with HIV (PLHIV) in order to provide evidence-based insights for improving prevention, diagnosis, and management strategies, ultimately reducing the dual burden of TB and HIV. **Background:** Tuberculosis (TB) remains a major public health concern among people living with HIV (PLHIV), as the synergistic relationship between the two diseases exacerbates morbidity and mortality. This study examines the incidence and associated factors of TB among PLHIV under antiretroviral therapy (ART) at Bheri Hospital, Nepal, from October 2023 to October 2024. **Methods:** A retrospective cross-sectional study was conducted, reviewing medical records of 592 ART clients, including 312 males, 276 females, and 4 third-gender individuals. From this population, 21 newly diagnosed TB cases were identified and analyzed for demographic, clinical, and behavioral factors using statistical methods. **Results:** Among the 21 TB cases, 62% were male, 72% belonged to the working-age group (14–49 years), and 29% were from the Muslim community. Pulmonary TB accounted for 57% of cases, while extra-pulmonary TB comprised 43%. A critical finding was that only 5% of individuals had completed isoniazid preventive therapy (IPT), and the majority developed TB within the first year of ART initiation. **Conclusion:** The study underscores the disproportionate burden of TB among men, working-age adults, and specific communities, alongside gaps in preventive care. Strengthening early TB screening, IPT implementation, and integrated TB-HIV services is essential to reduce TB incidence and improve outcomes among PLHIV.

Keywords: *tuberculosis, HIV (PLHIV), World Health Organization*

INTRODUCTION:

According to WHO Tuberculosis (TB) remains a leading cause of morbidity and mortality among people living with HIV (PLHIV). The relationship between HIV and TB is synergistic, with each infection accelerating the progression of the other. Globally, PLHIV have up to 20 times higher risk of developing active TB compared to those without HIV infection (1). In areas with high TB and HIV burden like Nepal the overlap is especially concerning (3). Bheri hospital ART located on the border with India, is a key area for public health surveillance due to the high mobility of populations, which exacerbates TB and HIV transmission risks. This has led to increased efforts to strengthen HIV and TB care services

HIV infection significantly weakens the immune system, increasing vulnerability to opportunistic infections like TB. According to the World Health Organization (WHO), in 2021, an estimated 10 million people worldwide contracted TB, of which around 7.5% were PLHIV. In Nepal, TB remains endemic, with approximately 69,000 cases reported annually. A significant portion of these cases occur among PLHIV, as HIV facilitates the progression of latent TB to active disease.

Active pulmonary TB is a problem among patients who receive ART. Male patients, those with advanced HIV disease, and those who do not receive IPT are at an increased risk of developing active TB while on ART. A timely HIV diagnosis and treatment could potentially

reduce the incidence of tuberculosis while on ART (2) Even globally test and treat strategies was implemented with the aim to initiate ART in all HIV- infected individuals regardless of CD4 count, the incidence of TB remains a concern. A study conducted in Addis Ababa, Ethiopia, found that the incidence of TB among patients enrolled in ART after test and treat program was 4.84 per 100 person per years, major causes including low CD4 count, poor adherence, and not taking isoniazid prophylaxis therapy (4).

Continuous burden of TB among ART clients is a sensitive issue. It is crucial to strengthen our existing strategies to reduce TB incidence. This includes improving early HIV screening, ensuring timely initiation of ART, enhancing adherence to ART, and expanding the coverage of TB preventive therapies (5) (6)(7). Understanding the incidence and predictors of TB among ART clients is essential for planning program and interventions to mitigate this coinfection.

This article aims to analyze the prevalence and associated factors of TB among ART clients, collecting the data from patient files of Bheri hospital ART. This article seeks to provide a comprehensive overview of the factors associated with TB burden in this vulnerable population and to inform strategies for effective TB control among ART clients.

Justification

The justification for conducting a study on the **incidence and associated factors of Tuberculosis (TB) among People Living with HIV (PLHIV)** is based on the following keypoints:

1. **High Co-Infection Rates:** People living with HIV are at a significantly higher risk of developing TB due to the immunocompromised state caused by HIV. TB is a leading cause of morbidity and mortality among PLHIV, making it a critical area of public health concern, particularly in regions with high HIV prevalence.
2. **Impact on Public Health:** TB remains one of the most common opportunistic infections among PLHIV, and co-infection exacerbates both diseases, leading to poor health outcomes, including higher mortality rates. Understanding the incidence and associated risk factors is crucial for developing targeted interventions and improving treatment outcomes.
3. **Early Diagnosis and Prevention:** Identifying the factors that increase the risk of TB in PLHIV—such as lower CD4 counts, poor adherence to ART, co-existing conditions (e.g., malnutrition, smoking, alcohol use), and socio-economic factors—can lead to improved screening, early diagnosis, and preventive

strategies. Early detection of TB in PLHIV can prevent severe complications and reduce transmission.

4. **Evidence for Policy and Program Development:** The study will provide data that can inform national and local health policies and programs, particularly in areas with high HIV/TB co-infection rates. It will help tailor health interventions, including improved TB screening, diagnosis, and treatment protocols specifically for PLHIV.
5. **Contribution to Global TB Control Efforts:** TB among PLHIV is a critical component of global health initiatives such as the WHO's End TB Strategy. This study will contribute valuable data to the global effort to reduce the burden of TB in HIV-positive individuals, supporting broader health goals and the integration of HIV and TB services.
6. **Guidance for Healthcare Providers:** By identifying specific risk factors, the study will offer actionable insights to healthcare providers, enabling them to offer better-targeted care and prevention strategies to PLHIV at increased risk of TB.

In summary, the justification for this study lies in the urgent need to better understand the relationship between HIV and TB, with the goal of improving prevention, treatment, and health outcomes for PLHIV, as well as advancing public health efforts to combat both diseases simultaneously.

AIMS AND OBJECTIVE:

Aims:

1. **To determine the incidence of tuberculosis** among people living with HIV (PLHIV) in a specified population or region.
2. **To identify and analyse the factors** that contribute to the increased risk of TB in PLHIV, including demographic, socio-economic, clinical, and behavioural factors.

Objectives:

1. **To assess the prevalence of TB** among PLHIV in the study population and determine the incidence rate over a defined period.
2. **To identify socio-demographic factors** (such as age, gender, and socioeconomic status) associated with higher TB incidence in PLHIV.
3. **To evaluate clinical factors**, such as CD4 count, HIV viral load, and ART (antiretroviral therapy) adherence, that may contribute to the increased susceptibility to TB in PLHIV.
4. **To investigate behavioural factors** such as

smoking, alcohol use, and malnutrition that may increase the risk of TB among PLHIV.

5. **To assess the impact of TB/HIV co-infection** on the overall health outcomes of PLHIV, including mortality and quality of life.
6. **To recommend strategies** for improving TB prevention, diagnosis, and treatment among PLHIV based on the study findings.

Data was collected from the patient file recorded at the center. Total of 592 clients were included in the study, reviewed the record with new TB positive cases and associated factors among them. Ethical clearance for the study was taken from Nepal Health research council. Data was analyzed by using Statistical package for social science (SPSS) 2016.

RESULT (Findings):

This study reviewed 592 ART clients under treatment at Bheri hospital ART in which 312 were male, 276 were female and 4 were third gender. Among them 21 new cases who were diagnosed with tuberculosis during Oct 2023 to Oct 2024 were further analyze for associated factors.

MATERIALS AND METHODS:

This is a retrospective cross-sectional observational study to assess the prevalence of TB and associated factors among PLHIV under ART at Bheri hospital in one year during Oct 2023 to Oct 2024. The study includes the all patient under treatment at Bheri ART.

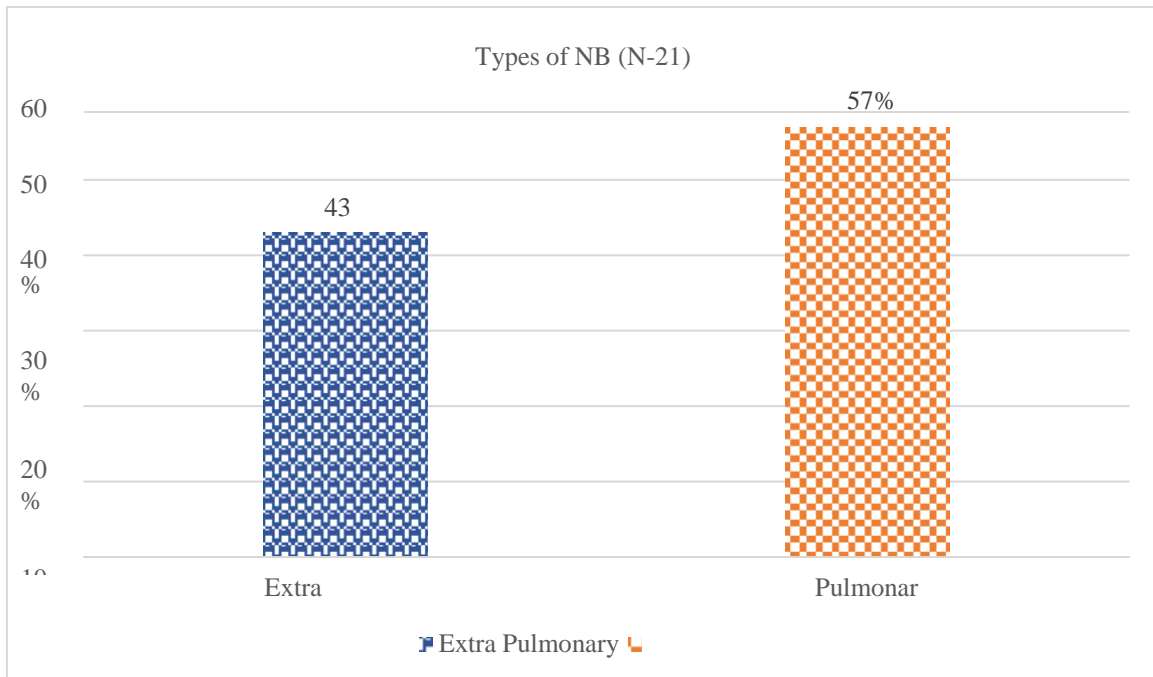
Table 1 Demographic distribution of new TB cases

S.N	Group	Frequency	Percentage
	Sex (N-21)		
1	Male	13	62%
2	Female	8	38%
	Age category (N-21)		
1	0-14	3	14%
2	14-49	15	72%
3	>50	3	14%
	Ethnicity (N-21)		
1	Brahaman/chhetri	3	14%
2	Dalit	3	14%
3	Janjati	5	24%
4	Madheshi	4	19%
5	Muslim	6	29%

The data indicates that men bear the heaviest burden of new TB cases, accounting for a staggering 62% of the total. This highlights the need for enhanced outreach and awareness programs specifically tailored for men, addressing barriers to early diagnosis and treatment. Among new TB cases reported in PLHIV, 72% were adults aged 14–49 years. This working-age group is particularly at risk, potentially due to higher exposure and the dual impact of TB and HIV on their health and livelihoods. The findings underline the importance of integrated healthcare services focusing on TB-HIV co-

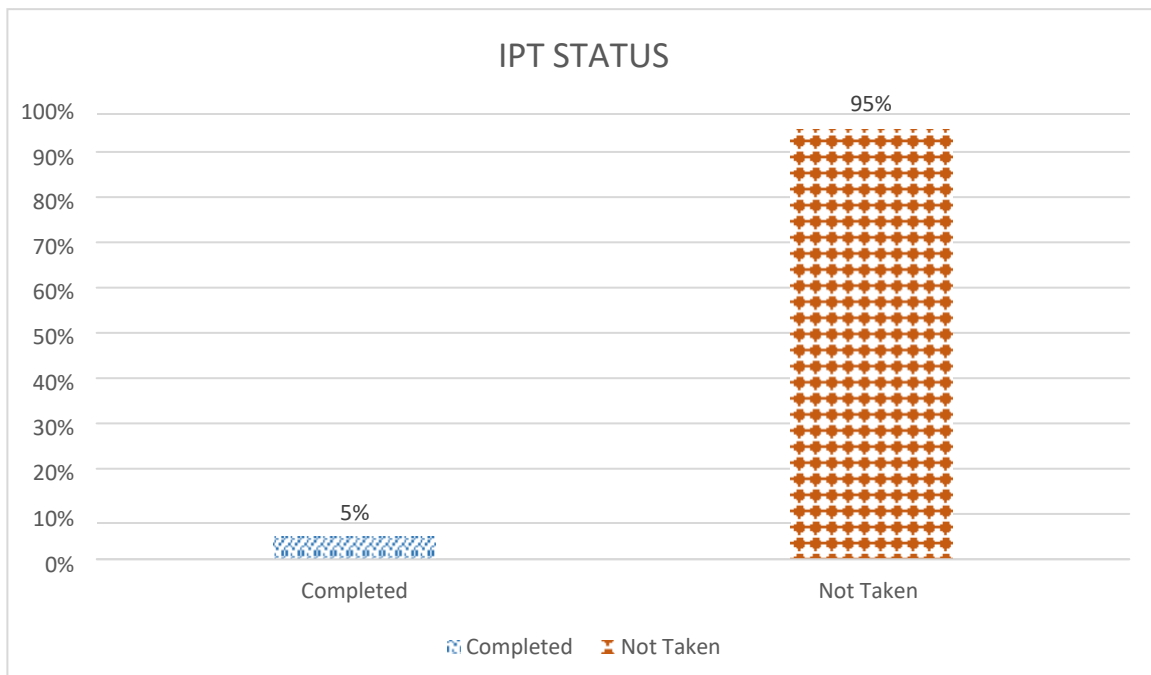
management for this demographic. The analysis further reveals that certain communities are disproportionately affected. Among PLHIV with new TB cases, Muslims accounted for the highest percentage (29%), Followed by Janjati communities (24%), And Madhesi communities (19%). These disparities call for community-centered interventions that are culturally sensitive and accessible, aiming to address the unique challenges faced by these groups. Services focusing on TB-HIV co-management for this demographic.

S.N	Type of TB (N-21)	Frequency	Percentage
	Extra Pulmonary	9	43%
	Pulmonary	12	57%



The study revealed that 57% of TB cases were pulmonary, which is the more commonly known form of the disease affecting the lungs. However, a surprising 43% of the cases were extra-pulmonary TB, a less recognized but equally severe form that affects other parts of the body, including the lymph nodes, bones, or even the brain.

S.N	IPT status	Frequency	Percentage (N-21)
	Completed	2	5%
	Not Taken	19	95%



Data show that, only 5% had completed IPT % of newly diagnosed TB cases among individuals on antiretroviral therapy. The remaining 95% of these individuals, who eventually developed active TB, had not received IPT. This gap highlights a critical missed opportunity in Nepal's fight against TB.

S.N	ART initiation time	Frequency	Percentage (N-21)
	Below 6 months	6	28.5%
	6month -1 year	6	28.6%
	1 Year-2 year	1	4.8%
	2-3 Years	5	23.8%
	3-4 Years	0	
	4-5 years	1	4.8%
	5 years	2	9.5%

Most of the cases developed TB within the early time intervals, with the highest frequencies observed in the "Below 6 months" (28.5 %) and "6 months - 1 year" (28.6%) categories, each recording six cases. This suggests a notable clustering of cases during the initial stages of the timeline, potentially highlighting critical periods for targeted interventions and early diagnosis of HIV cases.

DISCUSSION:

The findings of this study provide critical insights into the burden and distribution of tuberculosis (TB) among people living with HIV (PLHIV) receiving antiretroviral therapy (ART) at Bheri Hospital. The disproportionate representation of men, who constitute 62% of new TB cases, underscores the need for targeted interventions addressing gender-specific barriers. These barriers may include stigma, limited access to health services, or delayed health-seeking behavior. Enhanced outreach and awareness programs tailored specifically for men could play a vital role in improving early diagnosis and treatment outcomes.

The data revealing that 72% of new TB cases occurred in adults aged 14–49 years is particularly concerning. This working-age population represents a vital segment of the community, both socially and economically, and the dual burden of TB and HIV compromises their health and productivity. The findings emphasize the urgent need for integrated healthcare services that prioritize TB-HIV co-management, ensuring early detection, effective treatment, and support for this demographic.

The study highlights significant disparities among various communities. Muslims (29%), Janjati (24%), and Madhesi (19%) groups bear a disproportionate burden of TB among PLHIV. These disparities underscore the need for culturally sensitive, community-centered interventions that address specific vulnerabilities and barriers faced by these populations. Tailored health education, accessible healthcare facilities, and collaboration with community leaders are essential for effective outreach and care delivery.

The distribution of TB forms among PLHIV also reveals an important narrative. While pulmonary TB remains the most common type at 57%, the considerable prevalence of extra-pulmonary TB (43%) is noteworthy. Extra-pulmonary TB, often overlooked in public health messaging, requires increased attention due to its severe implications and potential diagnostic challenges. Strengthening diagnostic capacity and awareness about

this form of TB is critical for timely and comprehensive care. One of the most striking findings is the significant gap in isoniazid preventive therapy (IPT) coverage. Only 5% of newly diagnosed TB cases among ART clients had completed IPT, while 95% had not received this preventive treatment. This represents a missed opportunity in preventing active TB cases, highlighting the need for systemic improvements in implementing IPT as part of routine HIV care in Nepal.

The clustering of TB cases in the early stages of ART initiation—28.5% within "Below 6 months" and 28.6% in "6 months - 1 year"—points to critical windows for intervention. Early initiation of preventive strategies, rigorous screening for latent TB, and prompt treatment at the onset of ART are essential to reduce the risk of TB development. These findings reinforce the need for strengthening early diagnostic capacity and integrating comprehensive TB-HIV care into routine services.

This study underscores the multifaceted nature of TB-HIV co-management and highlights actionable areas for intervention. Addressing these gaps through targeted, culturally informed, and integrated approaches is crucial to improving health outcomes for PLHIV and achieving progress in the fight against TB and HIV in Nepal.

CONCLUSION:

This study highlights critical gaps and disparities in tuberculosis (TB) management among people living with HIV (PLHIV) at Bheri Hospital. Men and adults aged 14–49 years bear a significant burden, underscoring the need for gender-sensitive and age-targeted interventions. Community disparities reveal the importance of culturally informed strategies to reach vulnerable populations. The high prevalence of extra-pulmonary TB and low isoniazid preventive therapy (IPT) coverage emphasize the necessity of strengthening diagnostics, preventive care, and integrated TB-HIV services. Addressing these challenges with early intervention and community-centered approaches is vital to improving outcomes and advancing Nepal's fight against TB and HIV.

REFERENCES:

1. <https://www.who.int/westernpacific/health-topics/hiv-aids/hiv-and-tuberculosis>
2. Emmanuel Ifeanyi Obeagu and Emmanuel Chinedu Onuoha. (2023). Tuberculosis among HIV Patients: A review of Prevalence and Associated Factors. *Int. J. Adv. Res. Biol. Sci.* 10(9): 128-134. DOI: <http://dx.doi.org/10.22192/ijarbs.2023.10.09.014>
3. WHO global lists of high burden countries for tuberculosis (TB), TB/HIV and multidrug/rifampicin-resistant TB (MDR/RR-TB) 2021–2025 <https://iris.who.int/bitstream/handle/10665/341980/9789240029439-eng.pdf>
4. Getu A, Wolde HF, Animut Y, Kibret AA (2022) Incidence and predictors of Tuberculosis among patients enrolled in Anti-Retroviral Therapy after universal test and treat program, Addis Ababa, Ethiopia. A retrospective follow-up study. *PLOS ONE* 17(8): e0272358. <https://doi.org/10.1371/journal.pone.0272358>
5. Geremew, D., Melku, M., Endalamaw, A., Woldu, B., Fasil, A., Negash, M., Baynes, H., Geremew, H., Teklu, T., Deressa, T., Tessema, B., & Sack, U. (2020). Tuberculosis and its association with CD4+ T cell count among adult HIV positive patients in Ethiopian settings: a systematic review and meta-analysis. *BMC Infectious Diseases*, 20. <https://doi.org/10.1186/s12879-020-05040-4>.
6. Getu, A., Wolde, H., Animut, Y., & Kibret, A. (2022). Incidence and predictors of Tuberculosis among patients enrolled in Anti-Retroviral Therapy after universal test and treat program, Addis Ababa, Ethiopia. A retrospective follow-up study. *PLoS ONE*, 17. <https://doi.org/10.1371/journal.pone.0272358>.
7. Liu, E., Makubi, A., Drain, P., Spiegelman, D., Sando, D., Li, N., Chalamilla, G., Sudfeld, C., Hertzmark, E., & Fawzi, W. (2015). Tuberculosis incidence rate and risk factors among HIV-infected adults with access to antiretroviral therapy. *AIDS*, 29, 1391–1399. <https://doi.org/10.1097/QAD.0000000000000705>.
8. World Health Organization. (2021). Global Tuberculosis Report. National Tuberculosis Program, Nepal. (2023). Annual Report on TB. Banke District Health Office. (2024). Health Services Review.
9. ART Center Banke. (2024). Patient Records and Service Data. <https://consensus.app/results/?q=provide%20me%20introduction%20part%20for%20an%20article%20named%20analysis%20of%20TB%20among%20ART%20clients&pro=on>
10. Emmanuel Ifeanyi Obeagu and Emmanuel Chinedu Onuoha. (2023). Tuberculosis among HIV Patients: A review of Prevalence and Associated Factors. *Int. J. Adv. Res. Biol. Sci.* 10(9): 128-134. DOI: <http://dx.doi.org/10.22192/ijarbs.2023.10.09.014>
11. International Journal of STD & AIDS 2021, Vol. 32(9) 780–753 HIV-associated tuberculosis, Yohhei Hamada, MD, MPH, Institute for Global Health, University College London, 30 Guilford Street, London WC1N 1EH, UK <https://journals.sagepub.com/doi/pdf/10.1177/0956462421992257>
12. Relationship between HIV viral suppression and multidrug resistant tuberculosis treatment outcomes
13. Geiger K, Patil A, Budhathoki C, Dooley KE, Lowensen K, et al. (2024) Relationship between HIV viral suppression and multidrug resistant tuberculosis treatment outcomes. *PLOS Global Public Health* 4(5): e0002714. <https://doi.org/10.1371/journal.pgph.0002714>
14. Rewari, B. B., Kumar, A., Mandal, P. P., & Puri, A. K. (2021). HIV TB coinfection - perspectives from India. *Expert Review of Respiratory Medicine*, 15(7), 911–930. <https://doi.org/10.1080/17476348.2021.1921577>