# THE DOUBLE BURDEN OF TB AND HIV CO-INFECTION IN SUB SAHARAN AFRICA

*Article Review by Abdu Abdullahi Adamu, Nigeria*
*(MBBS, MMSc-HIV Medicine Student of Texila American University)*
*Email: - audu86@yahoo.com*

## SOURCE

Cantwell MF, Mckenna MT, McCray E, Onorato IM. Tuberculosis and race/ethnicity in United States: impact of socioeconomic status. Am J Respir Crit Care Med. 1998;157:1016–20.[PubMed]

## REVIEW OF LITERATURE

Those infected with *M. tuberculosis* carry live tubercle bacilli, however, the number of this bacilli and its latency state affect infectivity. Disease usually occurs when the bacteria multiply, overcome immune defenses, and become numerous enough to cause obvious clinical symptoms. Patients with pulmonary tuberculosis (PTB) are the most important source of infection. They transmit the disease in aerosolized droplets. These droplet nuclei contain the infectious particles from respiratory secretions and are usually less than 5 micrometers. When people with active pulmonary tuberculosis cough, sneeze or spit, they expel these droplets and when inhaled, transmission occur. They can remain suspended in the air for long periods of time. A single cough can produce 3,000 infectious droplet nuclei. [1]

Patients with sputum smear-positive tuberculosis are much more infectious than those with smear-negative sputum [2].The risk of infection is determined by the infectiousness of the source; that is, how many tubercle bacilli are being released into the air, the closeness of contact, light and humidity, and the immune status of the host[3,4]. Following infection, the tubercle bacilli multiply in the lungs, spread to the local lymph nodes, and other body tissues but after about six weeks after this primary infection, the body develops an immune response to the tubercle bacilli called delayed hypersensitivity. In the majority of cases, the immune response stops the further multiplication of the tubercle bacilli, and the only evidence of infection is a positive response to an immunological test, of which the most commonly used is the tuberculin skin test [5,6]

The proportion of any population infected depends on the rate and duration of exposure and this varies from one group of people to another. Although the infection rates in boys and girls are usually the same, adult men show higher infection rates than adult women [7].

## PATHOGENESIS

The amount of the tubercle bacilli and the integrity of the immune system of the host are important determinants of the risk of progression from infection to disease [7] When infection progresses to disease, it is manifest as infiltrates and lesions within the lung tissue, enlarged lymph nodes within the chest, pleural effusion, or disease disseminated in other parts of the body. The immune response of the patient results in a pathological lesion, which is characteristically localized, often with extensive tissue destruction and cavitation. These cavitating lesions occur most commonly in the lungs and contain many actively dividing bacilli. Sputum from patients with these lesions is usually smear positive.

If the primary infection resolves, small numbers of tubercle bacilli can remain dormant in scarred areas of the body for many years. Post-primary TB may then occur by the process of endogenous reactivation, and it may arise in any other organ system to which the tubercle bacilli were seeded during the primary infection. Active disease can also follow from secondary or exogenous re-infection in a person who already has a latent infection. HIV infection is an important factor. The life time risk of developing tuberculosis in individual who are HIV seronegative is about 5 to 10%, and is about 50% or higher with an annual risk of 5 – 15% for individuals who are HIV seropositive. [7,8]

Other factors that can increase an individual's risk of developing TB following infection include malnutrition, tobacco use, alcohol, corticosteroids, immunosuppressive drugs and other diseases like diabetes mellitus, silicosis, leukemia, measles, and whooping cough in children but none is as important as HIV [7,8]

## CLINICAL MANIFESTATION

The clinical manifestation of TB can be divided into pulmonary and extra pulmonary. Patients with pulmonary TB present with a chronic productive cough, fever, and weight loss. The common signs or forms of extrapulmonary TB (EPTB) are pleural effusion, lymphadenopathy, pericardial effusion, miliary disease, and meningitis. [9]

## HIV/TB

The relationship between HIV and tuberculosis has been established in several researches. The Human Immunodeficiency Virus causes a progressive decline in the number of CD4+ T lymphocytes and these CD4+ cells are vital in the body's defense against tubercle bacilli as such HIV Infection increases an individual's risk of developing disease, re-infection with tuberculosis, and rapid progression to overt disease. [10,11]

## GLOBAL BURDEN OF TB

Tuberculosis is a leading cause of morbidity and mortality in developing countries despite all the extensive control efforts. The advent of anti tuberculosis drugs in the 1940s and the later adoption of the short course regime in the 1980s were landmark achievements that were believed will reverse the impact of the disease; although significant achievements was recorded in developed countries, such can't be said for developing countries [12]. In developing countries, about 7% of all deaths are attributed to TB which is the most common cause of death from a single source of infection among adults [13] In fact; it ranks as the second leading cause of death from an infectious disease worldwide. The WHO estimated 9 million new cases in 2011 and 1.4 million TB deaths. It is also estimated that more than 90% of new TB cases and deaths occur in developing countries. It is the first infectious disease declared by the World Health Organization (WHO) as a global health emergency [14] Asia and Africa alone constitute 86% of all cases [15]

## TUBERCULOSIS: THE NIGERIAN SITUATION

In 2010, the WHO estimated that 210,000 new cases of TB occurred in Nigeria; thus ranking it 10th amongst the 22 high burden TB countries in the world. Lagos, Kano, and Oyo have the highest TB prevalence rate. The prevalence of TB in Benue State is also high but this might be attributed to the high HIV prevalence. The Nigeria TB Control program is making great effort to fight the scourge of the disease in the country, however, problems of poor health infrastructure, poor referral system, and sub optimal coverage still sets it back.

## TB AND POVERTY

Strong associations exists between poverty and tuberculosis, as the highest rates of TB are found in the poorest section of the community [16] Studies have established that the disease frequently occur in low-income people living in overcrowded areas and persons with low level of education. [17] Poverty promotes the development of active tuberculosis because of poor nutrition which may be associated with a weaker immune system. On the other hand, poverty also result in overcrowded living conditions, poor ventilation, and poor hygiene which is likely to increase the risk of transmission of TB [18]

## INTRODUCTION

Tuberculosis as a disease have been with human for several thousands of years now and earliest evidence of the disease is said to have been found in a Bison dating back 17,000 years. However, the bacillus causing the disease was identified by Robert Koch in 1882.

Tuberculosis is caused by *Mycobacterium tuberculosis*; an aerobic bacillus [1]. It has very high lipid content in its cell wall and this is responsible for its unique clinical features [1]. The *M. tuberculosis* complex includes five species: *M. tuberculosis, M. bovis* (and bacillus Calmette-Guérin), *M. canetti, M. africanum,* and *M. microti.* Within the species complex, most human

disease is due to *M. tuberculosis* sensu stricto. Important to note is *M. bovis;* it accounts for a small fraction of human TB cases and is naturally resistant to the drug pyrazinamide [1]

# ARTICLE SUMMARY

The article started with an introduction which described briefly how Robert Koch discovered tuberculosis. This introduction is then followed by a description of how tuberculosis is transmitted stating clearly that the amount of the tubercle bacilli and the integrity of the immune system of the host are important determinants of the risk of progression from infection to disease.

The pathogenesis and clinical manifestation of tuberculosis was also described stating clearly the cardinal symptoms tuberculosis which include cough lasting more than 2 weeks, drenching night sweats, low grade fever and weight loss. The link between this symptoms and the pathogenesis was also described.

HIV is a main driver of Tuberculosis and this was clearly mentioned in the article. The immunosuppression caused by HIV infection predispose individuals to tuberculosis infection.

The article clearly described the strong associations that exists between poverty and tuberculosis, as the highest rates of TB are found in the poorest section of the community. The study have established that the disease frequently occur in low-income people living in overcrowded areas and persons with low level of education.

# ARTICLE STRUCTURE

The article was presented in a standard format with an abstract which gave an overview of the article. The abstract structured into various segments containing introduction, methodology, results and conclusion. The article was well elaborated with charts and statistical analysis summarized in tables. It gave an overview of tuberculosis before proceeding into the main topic which is the impact of socioeconomic status.

# ARTICLE CRITIQUE

## *AUTHORITY*

The article is published in the American Journal of Respiratory Medicine and Critical Care which is a highly respectable journal with a good impact factor. The article is an authentic one as it is backed with robust references. The article is authentic and funders are clearly stated.

## *ACCURACY*

Information contained in the article is accurate and all of them are well referenced.

*PERIOD*

The article was published in 1998. Data was collected over a 20 weeks period within same year.

*RELEVANCY*

The article was conducted alongside a team of expert all with very sound academic background. It is a relevant article as it aimed to link tuberculosis, HIV and poverty while considering various variables like race.

*OBJECTIVITY*

The information contained in the article is evidence based.

*STABILITY*

The article is published in a journal with international reputation and has been cited in several other articles.

*RECENT ADVANCES RELATED TO THE TOPIC*

A recent study published in 2012 reiterated the significant of cigarette smoking as an established cause of pulmonary impairment and was significantly more prevalent among non-Hispanic Whites compared to other racial/ethnic groups. The proportion of non-Hispanic Whites impaired among never-smokers was 70% compared to 78% among ever-smokers. This alongside poverty, HIV infections among others are now established risk factors for tuberculosis.

## CONCLUSION

This age old disease that traces back to 17,000 years ago is still one of the biggest killer infectious diseases till date. Its association with poverty has since been established and still exists till today especially in sub Saharan Africa, however, the biggest driver of this disease is the HIV pandemic.

## REFERENCES

1. Cantwell MF, Mckenna MT, McCray E, Onorato IM. Tuberculosis and race/ethnicity in United States: impact of socioeconomic status. Am J Respir Crit Care Med. 1998;157:1016–20.[PubMed]

2. Chadha VK. Progress towards Millennium Development Goals for TB control in seven Asian countries. Indian J Tuberc. 2009;56:30–43.[PubMed]

3. Daley C. L. Tuberculosis Recurrence in Africa: True Relapse or Re-infection? Lancet. 1993;342:756–57 [PubMed]

4.  Davies PD. Tuberculosis: the global epidemic. J Ind Med Assoc. 2000;98:100–02.[PubMed]

5.  Di Perri G., Cruciani M., Danzi M. C., Luzzati R., De Checchi G., Malena M., Pizzighella S. et al. Nosocomial Epidemic of Active Tuberculosis in HIV Infected Patients. Lancet. 1989;2:1502–4.

6.  Ewer K., Deeks J., Alvarez L., Bryant G., Waller S., Andersen P., Monk P., Lalvani A. Comparison of T-Cell-Based Assay with Tuberculin Skin Test for Diagnosis of Mycobacterium Tuberculosis Infection in a School Tuberculosis Outbreak. Lancet. 2003;361:1168–73. [PubMed]

7.  Gerald L. Mandell, John E. Bennett, Raphael (2010). Mandell, Douglas, and Bennett's principles and practice of infectious diseases (7th ed.). Philadelphia, PA: Churchill Livingstone/Elsevier. pp. Chapter 250. ISBN 978-0-443-06839-3.

8.  Hargreaves N. J., Kadzakumanja O., Phiri S., Lee C. H., Tang X., Salaniponi F. M., Harries A. D., Squire S. B. What Causes Smear-Negative Pulmonary Tuberculosis in Malawi, an Area of High HIV Seroprevalence? International Journal of Tuberculosis and Lung Disease. 2001;5:1–10. [PubMed]

9.  Kaye K, Frieden TR. Tuberculosis control: the relevance of classic principles in an era of acquired immunodeficiency syndrome and multidrug resistance. Epidemiol Rev. 1996;18:52–63.[PubMed]

10. Kochi A. The global tuberculosis situation and the new control strategy of the World Health Organization. Tubercle. 1991;71:1–6.[PubMed]

11. Mazurek G. H., Villarino M. E. Guidelines for Using the QuantiFERON-TB Test for Diagnosing Latent Mycobacterium Tuberculosis Infection. Morbidity and Mortality Weekly Report. 2003;52(RR-2):15–18. [PubMed]

12. Rieder, H. L. 1999. *Tuberculosis Epidemiology.* 1st ed. Paris: IUATLD.

13. Rieder H. L., Cauthen G. M., Comstock G. W., Snider D. E. Epidemiology of Tuberculosis in the United States. Epidemiologic Reviews. 1989;11:79–98. [PubMed]

14. Richter C., Ndosi B., Mwammy A. S., Mbwambo R. K. Extrapulmonary Tuberculosis—a Simple Diagnosis? Tropical and Geographical Medicine. 1991;43:375–78. [PubMed]

15. Spence DP, Hotchkiss J, Williams CSD, Davies PD. Tuberculosis and poverty. BMJ. 1993;307:759–61.

16. Styblo, K. 1991. *Epidemiology of Tuberculosis. Selected Papers.* Vol. 24. The Hague: Royal Netherlands Tuberculosis Association KNCV.

17. Sutherland I. Recent Studies in the Epidemiology of Tuberculosis, Based on the Risk of Being Infected with Tubercle Bacilli. Advances in Tuberculosis Research. 1976;19:1–63. [PubMed]

18. World Health Organization Global tuberculosis control 2009: epidemiology, strategy, financing: WHO report 2009. Geneva: World Health Organization; 2009. p. 303. (WHO/HTM/TB/2009.411).