International Journal of Research in Medical Sciences
*Srinivas HD. Int J Res Med Sci. 2024 Jul;12(7):2346-2349*
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20241881

**Original Research Article**

# Analysis of 100 sputum positive pulmonary tuberculosis patients: a retrospective study

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**Received:** 25 December 2023
**Revised:** 01 January 2024
**Accepted:** 10 June 2024

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## ABSTRACT

**Background:** The bacterium *Mycobacterium tuberculosis* causes tuberculosis (TB), a contagious, airborne infection that destroys body tissue. Pulmonary TB occurs when M. tuberculosis primarily attacks the lungs. However, it can spread from there to other organs. Pulmonary TB is curable with an early diagnosis and antibiotic treatment.
**Methods:** The present study was conducted at Adichunchanagiri Institute of Medical Sciences, Mandya with total of 100 sputum positive TB cases. The analysis was done between January 2023 to June 2023.
**Results:** The proportion of sputum positive pulmonary tuberculosis and sputum positivity was highest in 20 to 40 years age group. The number of sputum positive pulmonary tuberculosis was three times more common in male compares to female.
**Conclusions:** The highest burden of sputum positive pulmonary tuberculosis and maximum sputum positivity rate was found in productive age group. The proportion of sputum positive PTB was more in male than female patients. All age group except in patient between 0-19 year's ratio between male and female were almost equal.

**Keywords:** Acid-fast bacillus, Pulmonary tuberculosis, Revised national tuberculosis control program, Sputum positive

## INTRODUCTION

The bacterium *Mycobacterium tuberculosis* causes tuberculosis (TB), a contagious, airborne infection that destroys body tissue. Pulmonary TB occurs when M. tuberculosis primarily attacks the lungs. However, it can spread from there to other organs. Pulmonary TB is curable with an early diagnosis and antibiotic treatment.[1]

Pulmonary TB, also known as consumption, spread widely as an epidemic during the 18th and 19th centuries in North America and Europe. After the discovery of antibiotics like streptomycin and especially isoniazid, along with improved living standards, doctors were better able to treat and control the spread of TB. Since that time, TB has been in decline in most industrialized nations. However, TB remains in the top 10 causes of death worldwide, according to the World Health Organization (WHO) trusted source, with an estimated 95 percent of TB diagnoses as well as TB-related deaths occur in developing countries. That said, it's important to protect yourself against TB. Over 9.6 million people have an active form of the disease, according to the American Lung Association (ALA). If left untreated, the disease can cause life-threatening complications like permanent lung damage. The risk for getting pulmonary TB is highest for people who are in close contact with those who have TB.[2]

Diagnosis of pulmonary tuberculosis (TB) in low-income, high-burden countries often relies on direct sputum smear microscopy for acid-fast bacillus (AFB).

Since the policy change in Revised National Tuberculosis Control Program (RNTCP) in April 2009, diagnosis of pulmonary TB in India requires smear microscopy examination of two sputum samples: one spot and another morning sample, switching from earlier three sputum sample collection over 2 days. From TB program point of view, this approach saves time and cost while providing similar diagnostic efficacy. However, the patients still have to come to health center on 2 consecutive days; the time and economic savings for the patient appears negligible. World Health Organization (WHO) in its policy statement of May 2011 has advocated for implementation of single-day approach for diagnosis of pulmonary TB in countries which have successfully implemented the two sputum specimens' case finding strategy, especially in settings where patients are likely to default from diagnostic process. This study was conducted with an objective to assess the feasibility of diagnosing pulmonary TB by examining two spot sputum samples in 1 day and to compare this approach with the current RNTCP protocol.[3] The objective of this retrospective study was to analyses of sputum positive pulmonary tuberculosis patients.

## METHODS

### *Study type, study place and period*

The present retrospective study was conducted at Adichunchanagiri Institute of Medical Sciences, Mandya with total of 100 sputum positive TB cases. The analysis was done between January to June 2023.

### *Sputum positive PTB*

Patients with at-least two sputum specimens positive for acid–fast bacilli.

### *Inclusion criteria*

All persons diagnosed with bacteriologically confirmed pulmonary TB were included.

### *Exclusion criteria*

Persons whose response to TB treatment was not monitored using sputum smear microscopy, namely persons with clinically diagnosed and extrapulmonary TB and, persons whose sputum smear monitoring status could not be established, either because they were transferred to another health facility or were lost to follow-up were excluded.

### *Procedure of the study*

Statistics were analysed with Epi info software version 3.5.4 from the Center for Disease Control and Prevention (CDC). Chi square or Fisher's exact tests were used to compare proportions. A backward logistic regression was used to identify the independent risk factors for bacteriological non-conversion at the end of the intensive phase of treatment. The same logistic regression method was used to assess the effects of sputum smear non-conversion, at the end of the intensive phase of treatment, on patients' outcomes. A p-value <0.05 was used to characterize significant results.

The statistical analysis was done by Epi Info software.

## RESULTS

Information on patients' socio-demographic characteristics, cough duration in days or weeks and sputum results were studied. The proportion, sputum positivity in pulmonary TB suspect and socio demographic trend of patients coming from rural area was analyzed.

**Table 1: Age and sex wise distribution of sputum positive pulmonary TB cases.**

| Year | 0-19 | | 20-39 | | 40-59 | | >60 | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | M | F | M | F | M | F | M | F | M | F |
| **2022** | 15 | 5 | 21 | 10 | 19 | 7 | 16 | 7 | **71** | **29** |

The proportion of sputum positive pulmonary tuberculosis and sputum positivity was highest in 20 to 40 years age group. The number of sputum positive pulmonary tuberculosis was three times more common in male compares to female (Table 1 and 2).

**Table 2: Distribution of cases based on diagnosis confirmation technique.**

| Diagnosis confirmation technique | | |
|---|---|---|
| | **Number** | **Percentage** |
| **Sputum analysis** | 62 | 62 |
| **Bronchial aspirate** | 23 | 23 |
| **Bronchoalveolar lavage** | 07 | 07 |
| **Lung biopsy** | 08 | 08 |
| **Total** | 100 cases | 100 |

The TB diagnosis is firstly based on clinical suspicion. In these TB DTCs, patients are first of all classified according to the anatomical site of TB. In this way, pulmonary and extra-pulmonary TB are distinguished. Pulmonary TB cases are subsequently classified according to bacteriological results. Bacteriology refers to the smear status of cases. Smear examination is done through microscopic observation of *M. tuberculosis* after staining using Ziehl Neelsen's technique. After this, pulmonary TB cases are classified into smear-negative pulmonary TB (smear contains no AFB in 100 fields) and smear-positive pulmonary TB (SPPTB) groups. Smear grading of SPPTB cases is as follows: 1+ (10–99 acid-fast bacilli (AFB) in 100 fields), 2+ (1–9 AFB/field in at least 50 fields), and 3+ (>10 AFB/field in at least 20 fields).

Whatever the clinical form of TB, all patients should undergo two phases of treatment: intensive/initiation phase and continuation phase. The length of the intensive phase depends on patients' previous history of anti-tuberculosis treatment (2 months for new patients and 3 months for previously treated patients).

The national program recommends to provide drugs to patients on a weekly basis during the intensive phase and on a monthly basis during the continuation phase of the treatment. Treatment consists of a two-month intensive phase of daily rifampicin (R), isoniazid (H), pyrazinamide (Z) and ethambutol (E), followed by a four-month continuation phase of daily R and H on outpatient basis. However, a very limited number of patients are hospitalized during the intensive phase of treatment. At the end of the intensive phase of treatment, smears examination should be done for each SPPTB case.

Depending on the results, patients can be classified into two groups: (1) Sputum smear conversion at the end of the intensive phase of treatment and (2) Sputum smear non-conversion at the end of the intensive phase of treatment (patients with persistently positive smears). Also, smear examination can be done during treatment to assess response to treatment.

## DISCUSSION

In the preset study, the proportion of sputum positive pulmonary Tuberculosis and sputum positivity was highest in 20 to 40 years age group. The number of sputum positive Pulmonary Tuberculosis was three times more common in male compares to female. Our finding suggests that sputum positive pulmonary tuberculosis was more in male than female patients except in patient between 0-19 years where ratio between male and female were almost equal this finding was similar to previous studies. The proportion of sputum positive PTB were almost equal between male and female patients in 0-19 age group this was a different finding in compare to other study. The reason for this is not known, but one study interprets that women have inability to produce good and quality sputum.[10] Nevertheless this indicates that expanding TB case detection activities to maternal and child health clinics, antenatal and family planning clinics may lead to detection of more females' suspects. In this study highest burden of sputum positive pulmonary Tuberculosis and maximum sputum positivity rate was found in productive age group which is similar to earlier studies.

The microscopic staining technique is one of the earliest methods used for detecting *Mycobacterium tuberculosis* and it remains a standard procedure for the diagnosis of tuberculosis because it is swift, cheap and has a high positive predictive value. On the other-hand, microbiological identification of the bacilli by culture remains the gold-standard for the diagnosis of tuberculosis.[4]

Regarding conventional microscopy, the examination of concentrated sputum offered higher diagnostic yield when compared with direct smear. Also, there was an increase in the sensitivity values when considering two or three sputum samples rather than just one. However, the greatest gain was obtained when adding a second sputum sample, while the third sputum sample offered a less substantial sensitivity increment.

Our results agree with the most consensual documented studies that show an incremental yield on more than one sputum examination and with more recent and controversial small trials claiming the relative inefficiency of the third smear and the burden it carries in undeveloped areas.[5]

The overall sensitivity of sputum smear microscopy, culture analysis and all forms of microbiological analysis together remained low and did not exceed 28.8%, 55.4% and 63.2%. As predicted, higher sensitivity rates were achieved among tuberculosis patients with pulmonary cavitation, ranging from 58.6% for the first specimen to 67.7% for the third specimen.[6-8]

Low sensitivity rates may be due to pauci-bacillary disease where only a small number of *Mycobacterium tuberculosis* organisms are present in the respiratory specimens, and/or to technical problems. During the actual decontamination and concentration process there is tuberculosis bacilli damage that can decrease the sensitivity rates of tuberculosis detection, particularly in pauci-bacillary specimens.

One other possible explanation for a low count of bacilli disease in the tuberculosis patients observed in this study is related to the particular features of the patients observed in the PDC. In fact, the overwhelming majority was highly symptomatic and many had previously gone to their general physician or the hospital, where they had been diagnosed with pneumonia and medicated with antibiotics such as quinolones.[9,10]

An additional methodological limitation needs to be addressed. Sputum microscopy was performed with traditional ZN microscopy but fluorescent LED microscopy could have provided higher sensitivity rates. However, and despite the fact that the WHO recommends a switch to this more sensitive procedure, this technique was not available at the PDC.

When sputum microscopy and culture are both negative, clinical diagnosis of active tuberculosis may have to rely in other conventional diagnostic methods while novel diagnostic tools and further investigation may be required to enhance the identification of *Mycobacterium tuberculosis* from biological specimens.[11,12]

This study has few limitations. TB treatment outcomes are usually reported by drug sensitivity. As such, these outcomes are a summary measure of all TB patients

without stratification by drug sensitivity or resistance. Due to missing data, the full multivariable model only included about three-quarters of the total patient population. While sensitivity analyses were performed showing very similar patterns, all models could be subject to selection bias. Finally, the reasons behind loss to follow-up could not be adjudicated. This requires further study.

## CONCLUSION

The highest burden of sputum positive pulmonary Tuberculosis and maximum sputum positivity rate was found in productive age group. The proportion of sputum positive PTB was more in male than female patients. All age group except in patient between 0-19 year's ratio between male and female were almost equal. The number of suspects required for detection of one sputum positive PTB was also influenced by change in PTB suspect definition and number of sputum positive PTB.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. World health Organization. Global tuberculosis report 2013, 2013. Available at: http://www.who.int/tb/publications/global_report/en/</inter-ref>. Accessed 01 December 2023.
2. Clarridge 3rd JE, Shawar RM, Shinnick TM, Plikaytis BB. Large-scale use of polymerase chain reaction for detection of Mycobacterium tuberculosis in a routine mycobacteriology laboratory. J Clin Microbiol. 1993;31(8):2049-56.
3. Saceanu CA, Pfeiffer NC, McLEAN TR. Evaluation of sputum smears concentrated by cytocentrifugation for detection of acid-fast bacilli. J Clin Microbiol. 1993;31(9):2371-4.
4. Reisner BS, Gatson AM, Woods GL. Use of Gen-Probe AccuProbes to identify Mycobacterium avium complex, Mycobacterium tuberculosis complex. Mycobacterium kansasii, and Mycobacterium gordonae directly from BACTEC TB broth cultures. J Clin Microbiol. 1994;32(12):2995-8.
5. Jost Jr KC, Dunbar DF, Barth SS, Headley VL, Elliott LB. Identification of Mycobacterium tuberculosis and M. avium complex directly from smear-positive sputum specimens and BACTEC 12B cultures by high-performance liquid chromatography with fluorescence detection and computer-driven pattern recognition models. J Clin Microbiol. 1995;33(5):1270-7.
6. Carroll KC, Pfaller MA, Karlowsky JA, Landry ML, Mcdam AJ, Patel R, et al. Manual of clinical microbiology. 13th ed. Amer Society for Microbiology; 1999:1773.
7. Shinnick TM, Good RC. Diagnostic mycobacteriology laboratory practices. Clin Infect Dis. 199;21(2):291-9.
8. De Cock KM. Tuberculosis control in resource-poor settings with high rates of HIV infection. Am J Public Health. 1996;86(8_pt_1):1071-3.
9. Izudi J, Tamwesigire IK, Bajunirwe F. Treatment supporters and level of health facility influence completion of sputum smear monitoring among tuberculosis patients in rural Uganda: a mixed-methods study. Int J Infect Dis. 2020;91:149-55.
10. Harries A, Gausi F, Salaniponi F. When are follow-up sputum smears actually examined in patients treated for new smear-positive pulmonary tuberculosis? Int J Tuberc Lung Dis. 2004;8(4):440-4.
11. Nakaggwa P, Odeke R, Kirenga B, Bloss E. Incomplete sputum smear microscopy monitoring among smear-positive tuberculosis patients in Uganda. Int J Tuberc Lung Dis. 2016;20(5):594-9.
12. Kayigamba FR, Bakker MI, Mugisha V, Gasana M, van der Loeff MFS. Sputum completion and conversion rates after intensive phase of tuberculosis treatment: an assessment of the Rwandan control program. BMC Res Notes. 2012;5(1):1-7.

**Cite this article as:** Srinivas HD. Analysis of 100 sputum positive pulmonary tuberculosis patients: a retrospective study. Int J Res Med Sci 2024;12:2346-9.