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Prevalence of Pulmonary Tuberculosis among Different Age Groups and Sex

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Abstract: ***Tuberculosis (TB) is one of the oldest diseases known to mankind. According to the WHO, TB is a worldwide pandemic. It is a leading cause of death among HIV-infected people. Today, India's DOTS (directly observed treatment short course) program is the fastest-expanding and largest program in terms of patients initiated on treatment. Mycobacterium tuberculosis was discovered by Robert Koch, and for this discovery, he was awarded the Nobel Prize in physiology or medicine in 1905. Although it can affect people of any age, individuals with impaired immune systems, e. g., HIV-infected people, are at increased risk. Diabetes mellitus also increases the risk of TB. This study was conducted to determine the prevalence of tuberculosis among different age groups and sexes. The research concluded that men are more commonly affected than women, and the age analysis shows that peak incidence is observed in adults above the age of 40.***

Keywords: Tuberculosis, Mycobacterium tuberculosis, Diabetes mellitus, Zeihl Neelson staining, sputum

1. Introduction

Tuberculosis, as a communicable disease, is an ongoing global epidemic that accounts for a high burden of global mortality and morbidity[1]. Prior to the start of the Coronavirus (COVID-19) pandemic, TB was by far the most common infectious disease-related cause of death, surpassing HIV/AIDS. M. tuberculosis infects almost one-fourth of the world's population. Tuberculosis (TB) is an infectious disease usually caused by Mycobacterium tuberculosis (MTB) bacteria. Tuberculosis generally affects the lungs but can also affect other parts of the body. Most infections show no symptoms, in which case they are known as latent tuberculosis. Tuberculosis is spread from one person to the next through the air when people who have active TB in their lungs cough, spit, speak, or sneeze. People with latent TB do not spread the disease. Active infection occurs more often in people with HIV/AIDS and in those who smoke[2].

According to data from India, despite the widespread usage of masks, there was only a temporary drop in TB diagnoses around the time of India's two main COVID-19 waves, and the numbers had actually recovered. As a result, the number of TB patients notified in 2021 increased by 19% from the previous year; there were 19, 33, 381 new and relapsed TB patients notified in 2021 as opposed to 16, 28, 161 in 2020.3

India has more tuberculosis (TB) cases annually than any other country globally, with an estimated disease prevalence of 256 per 100, 000 population, an incidence of 185 per 100, 000, and deaths of 26 per 100, 000.[4]

In order to combat tuberculosis, a serious public health issue, the Indian government established the "National TB Programme" in 1962 as a District TB Center model that included BCG vaccination and TB treatment. Since then, the tuberculosis control program has advanced significantly and changed significantly in recent years. The "National Strategic Plan" for Tuberculosis Elimination (2017–25), created by the Ministry of Health and Family Welfare, outlines the audacious and ground-breaking measures necessary to eradicate TB in India by 2025, five years earlier than the global targets. By 2020, it was obvious that the NSP-2017-25 would not be able to achieve these goals, and a new NSP India 2025 was thus introduced.[2]

The government of India's public health initiative that coordinates its anti-tuberculosis activities is called the National Tuberculosis Elimination Programme (NTEP), formerly known as the Revised National Tuberculosis Control Programme (RNTCP). It serves as a focal point of the National Health Mission (NHM) and oversees the technical and administrative aspects of national anti-tuberculosis initiatives.

Under the NTEP, any person presenting with a cough lasting more than two weeks is screened for pulmonary TB (PTB) by two sputum smear examinations (one spot and one morning sample) at Designated MicroscopicCenters (DMC). Treatment of TB patients is based on the internationally recommended directly observed treatment short course (DOTS) strategy. Newly diagnosed smear-positive TB patients are treated with a 6-month thrice weekly regimen (Category I); 2 months isoniazid (H), rifampicin (R), pyrazinamide (Z), and ethambutol (E) (HRZE) (4 months HR); and retreatment patients with an 8-month thrice weekly regimen (Category II); 2 months HRZES (S streptomycin) /1month HRZE/5 months HRE [5].

MDR-TB is a type of tuberculosis brought on by bacteria that are resistant to rifampicin and isoniazid, the two most potent first-line anti-TB medications. Second-line medications can be used to treat and even eradicate MDR-TB. Second-line treatment options, however, are scarce and call for prolonged treatment (up to 2 years of treatment) using pricey and hazardous drugs. More severe drug resistance may occur in specific circumstances. Patients with TB caused by bacteria that do not react to the best second-

line anti-TB medications may be without further options for therapy.[6]

TB is treatable and avoidable.85% of those who develop TB can be successfully treated with 6-month medication regimens. In order to guarantee that everyone with the disease has access to these therapies, universal health coverage (UHC) is required. To significantly lower the number of new cases each year (TB incidence) over the world, research breakthroughs are required (e. g., better medications, faster rapid diagnostic procedures, and vaccines).

Until the age of 40, tuberculosis prevalence rates in China were generally stable and low, but from the age of 40 to the age of 75, the prevalence more than quadruples. Chinese men showed the highest incidence of this age-related rise in tuberculosis. According to register-based data from Hunan Province in China, older persons (65 and older) had a higher frequency of tuberculosis than younger adults (15–64).

Older adults in India, which has the greatest percentage of tuberculosis infections worldwide, experience additional challenges due to the presence of drug-resistant strains of tuberculosis, according to a national tuberculosis prevalence survey done in China in 2010 that indicated relatively steady numbers.7 According to estimates, 14% of tuberculosis patients in some parts of India are old, and they are more likely than younger adults to experience unfavourable outcomes because of drug-related adverse events, increased co-morbidity, and a higher proportion of poverty.[8]

Numerous studies have demonstrated that DM raises the risk of TB. Diabetes increases the risk of tuberculosis by three times and increases the likelihood that tuberculosis treatment would have unfavourable effects, such as mortality. People with DM are known to be more susceptible to these dangers, especially if their blood glucose levels are high.[9]

HIV and tuberculosis (TB) have a close relationship. Conversely, those who have strong immune systems may not get sick from latent TB infection, which occurs when a person has TB but shows no symptoms. Low CD4 count HIV-positive individuals are substantially more vulnerable to active TB (when TB infection results in disease). In fact, compared to those who are HIV-negative, those living with HIV are at a 20 times higher risk of having active TB.[10]

10 million people had active TB in 2017and 9% of them also had HIV. The World Health Organization (WHO) estimates that around one-third of the 36.9 million persons living with HIV and AIDS globally also have TB. The most severely affected area is Sub-Saharan Africa, which is home to 70% of all people worldwide who have HIV and TB co-infection.[11]

Due to differences in social roles, risky behaviours and activities, gender can have an impact on M. tuberculosis exposure. Males are more likely to travel more frequently, have more social contacts, spend more time in environments that may facilitate transmission like bars, and work in occupations like mining that are linked to a higher risk for tuberculosis.[12] In contrast, home contact with an infected person is a significant risk factor for tuberculosis in both high-and low-income nations.[13] Men are still more likely than women to contract tuberculosis from household contact despite spending less time there.[14]

Molecular approaches are now being used instead of traditional microscopy to diagnose tuberculosis, boosting sensitivity from 65% to 85%.[2]

TrueNat MTB and RIF Plus-The TruenatTM testing system is a quick test that uses battery-operated, portable devices to quickly detect rifampicin resistance and Mycobacterium tuberculosis complex bacteria (MTBC) even in remote laboratories with limited infrastructure. WHO recommends use of Truenat MTB or MTB Plus on sputum specimens as the initial diagnostic test for TB rather than smear microscopy or culture in adults and children.[15]

CB-NAAT/GeneXpert [Cartridge Based Nucleic Acid Amplification Test]-It is an automated cartridge-based molecular approach. It has been approved by the WHO as a first diagnostic test for children suspected of having tuberculosis in both pulmonary and specific forms of extra-pulmonary tuberculosis, as well as for adults and children suspected of having TB or MDR-TB who also have HIV. It can detect Mycobacterium tuberculosis as well as rifampicin resistance within two hours. All other extra-pulmonary sample types in paediatric patients can now be tested for TB using CB-NAAT.

The Revised National Tuberculosis Control Programme (RNTCP) of India uses the Line Probe Assay (LPA), a quick method based on polymerase chain reaction (PCR), to identify the Mycobacterium tuberculosis (MTB) complex as well as drug sensitivity to rifampicin (RPM) and isoniazid (INH). Under appropriate circumstances, it is used to identify drug-resistant tuberculosis. LPA only tests sputum samples that have an acid-fast bacilli (AFB) smear positive result.[16]

This study's objective is to examine the incidence of tuberculosis among various age and sex categories**.**

2. Materials and Methods

Hospital based cross sectional descriptive study was conducted which employed quantitative method of data collection to determine the prevalence of TB infection. A total number of 633 samples were considered. Among them 59 TB cases were reported.

Collection of Sputum Specimen

- The sputum specimens were collected from patients in the hospital.
- Two sputum samples are collected. One spot sample and one morning sample.
- The specimens are collected in the morning before any meal after rinsing mouth with water.
- If possible, go outside or open a window before collecting the sputum sample. This helps protect other people from TB germs when the patient cough.
- If sputum is scanty, a 24hour sample may be tested.

- Sputum sampling on 3 days increases the chance of detection.
- Direct sputum sample smears are prepared from the thick part of the sputum.

Minimum quantity required is 2ml.

Sputum container should be:

- Wide mouthed, screw capped leak-proof, transparent, clean, disposable, and biodegradable and eco-friendly-polypropylene or polystyrene container. Size 4.5cmx3.5cm diameter.
- Label properly the sample container with patient's complete name, date and time of collection.

Collection method

1) Inhale deeply
2) Hold air for 5 seconds
3) Slowly exhale
4) Repeat the above process 3 times
5) Then cough hard until sputum comesup into the mouth
    - Carefully transfer the sample into the container.
    - Close the container tightly.
    - Wash hands properly.

Good sputum sample

Thick, muco-purulent sputum without much saliva coloured or blood stained, in sufficient quantity.

Acid Fast Bacilli Staining (AFB Staining) Zeihl-Neelson Staining Technique

Principle

Ziehl-Neelsen Staining is a type of acid-fast staining technique, and it is an important differential staining procedure used to differentiate between acid-fast and non-acid fast bacteria. It was initially developed by Zeihl and modified by Neelson, hence the name Zeihl Neelson staining.

- The Zeihl Neelson stain uses Carbol fuchsin and phenol compounds to stain the cell wall of Mycobacterium spp.
- Mycobacteria do not bind readily to simple stains.
- Use of heat along with Carbol fuchsin and phenol allows the penetration through the bacterial cell.
- Mycolic acid on the cell wall of Mycobacteria making it waxy, hydrophobic and impermeable.

Smear preparation:

- Always use new, grease free and clean slides, correctly label slides with stylus or lead pencil.
- Fish out yellowish portion from sputum container and place on slide with the rough end of the stick.
- Spread material evenly in an approximate area of 2cm×1cm so that newsprint is readable on drying.
- Air dry smear completely and then heat fix smear in a flame.
- Always keep smeared portion upwards.

Reagents:

1) 1% Carbol fuchsin – primary stain
2) 25% Sulphuric acid-decolourizer
3) 0.1% Methylene blue-counter stain

Procedure:

- Arrange the slides on the staining rack without touching each other.
- Pour filtered 1% Carbol fuchsin to cover entire slide.
- Gently heat the underside of slide with Carbol fuchsin on it until steam rises. Do not boil.
- Leave the Carbol fuchsin on the slide for 5 minutes.
- Rinse gently with water until all free Carbol fuchsin is washed.
- Tilt the slide to drain off excess water.
- Cover the entire slide with 25% sulphuric acid and let it stand for 3 minutes.
- Wash thoroughly with water. If the slide is not decolourised properly, repeat the decolourisation step for additional 1-3 minutes.
- Drain the water well.
- Counter stain with 0.1% methylene blue stain for 30 seconds.
- Drain the counter stain.
- Wash with water. Wipe the backside of slides with tissue paper.
- Air dry the slides in arack.
- Observe under oil immersion objective.

Gradind of Slides in AFB Microscopy

AFB Counts	Recording/ Reporting
No AFB in atleast 100 fields	NEGATIVE
1 to 9 AFB in 100 fields	Scanty with exact number of AFB is seen
10 to 99 AFB in 100 fields	1+
1 to 10 AFB per field in at least 50fields	2+
Greater than 10 AFB per field in at least 20 fields	3+

3. Observations and Results

The study was conducted to know the prevalence of tuberculosis among different age groups and sex. Total number of 633 samples were examined, among them 59 cases of sputum were positive for tuberculosis.

Percentage distribution of patients

a) Based on Sex

Sex	Cases	Percentage
Male	36	61
Female	23	39

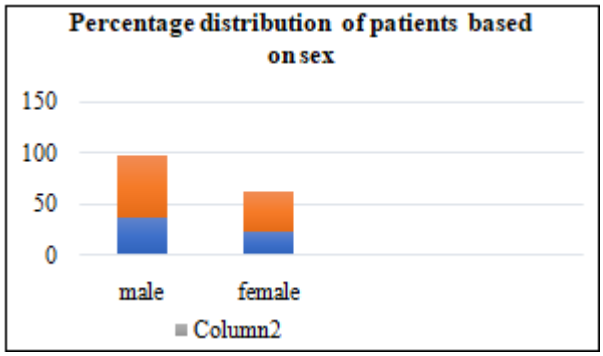


Figure 1: Bar diagram showing percentage distribution of patients based on sex

The study population consists of 59 patients with tuberculosis. It includes 36 males (61%) and 23 females (39%). It shows that males are more affected by TB than females.

b) Based on Age

Age	Positive	Percentage
0-14 (Children)	0	0
15-24 (youth)	5	9
25-64 (Adult)	35	59
65 and above (Senior Adult)	19	32

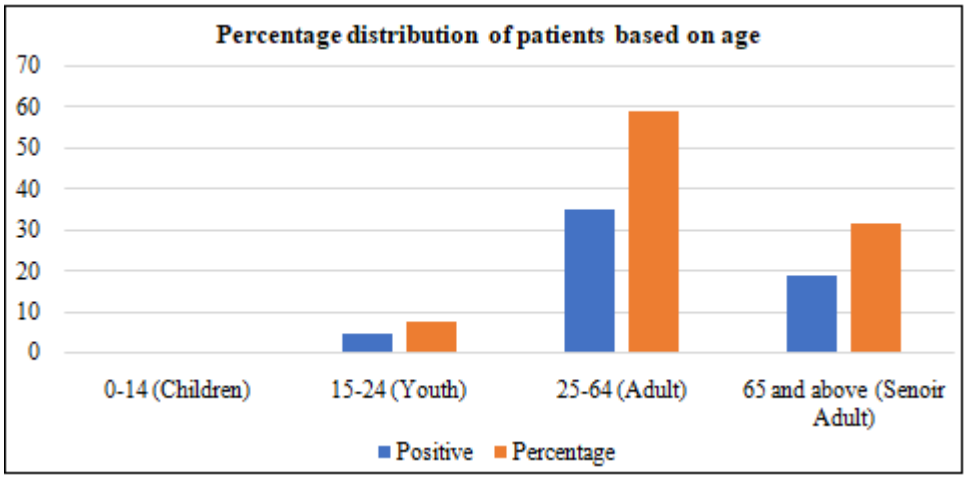
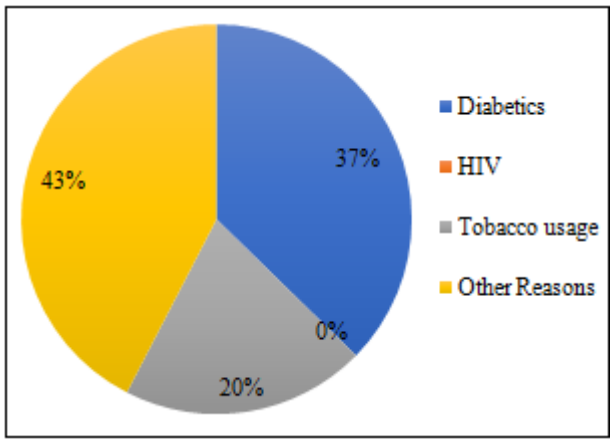


Figure 2: Bar diagram showing percentage distribution of patients based on age.

Among different age groups, the age analysis shows that peak incidence of Tuberculosis is observed in adults. About 59% of TB patients are above the age of 30.

c) Based on risk factors

Risk Factors	No: of cases	Percentage
Diabetic	22	37
HIV	0	0
Tobacco Usage	12	20
Other Reasons**	25	43



**Other reasons: migrants, contact of TB, alcohol usage, prisoners etc

Figure 3: Pie chart showing percentage distribution of patients based on risk factors.

Based on the risk factors, prevalence of tuberculosis is more in patients with other reasons. The other reasons may be migrants, contact of TB, alcohol user, prisoners etc. Diabetes mellitus should also be considered as an important risk factor for the reactivation of tuberculosis.

4. Discussion

In this study, patients with tuberculosis consisting of 36 males (61%) and 23 females (39%). It shows that males are more affected by tuberculosis than females. One explanation for the excess cases among men is that they have greater access to health care than women. Generally, men smoke more than women. Consequently, smoking and alcohol abuse is largely contributed to tuberculosis disease burden for men.

Study of Vikas G. Rao, Jyothi Bhat, Rajiv Vadav shows that higher prevalence levels of TB disease were observed among those who smoke tobacco or consumed alcohol. According to the majority of research, men are more likely than women to develop TB.

The age analysis in this study showed that, the adults are more infected with TB.

About 59% of TB patients are above the age 30. Weaker immune system makes the elderly more susceptible to tuberculosis. Other risk factors are HIV infection and imprisonment histories were more frequent in that age.

The research was led by Kathryn snow from the department of paediatrics at the University of Melbourne, estimated that tuberculosis increases dramatically during adolescence and this group with TB can hinder their ability to study, find work or care of their families.

Study conducted by Denholms, Sawyer and Grams shows that adolescence is highly dynamic period with regard to TB epidemiology.

Based on risk factors, prevalence of TB is also seen in patients with diabetic mellitus. Diabetic mellitus should be considered as an important risk factor for the reactivation of tuberculosis.

Based on the study of Viswanathan et al, diabetics was more Prevailing in male TB patients. The higher prevalence of DM among men than women might be an accumulative effect of other risk factors such as tobacco use. Smoking and alcohol consumption, which impact both TB and DM.

5. Conclusion

In this study, prevalence of pulmonary TB disease is significantly higher in adolescence, and gender wise classification reveals that males are more prone to tuberculosis than females

The significantly higher prevalence observed in males could be due to fact that men are more exposed to wider world as compared with women (especially in rural areas, with resultant greater social interactions with other people and greater risk of exposure to persons with TB disease, and thus higher chance of becoming infected.

The higher prevalence of tobacco smoking and alcohol consumption among males, as observed in present study, could also be additional factors for the higher risk of TB disease among males.

There is an urgent need to develop and implement culturally appropriate targeted awareness raising activities in order to support efforts to control TB in the population.

Based on my findings I recommended the following measures to reduce the risk of tuberculosis;

- Stay home: Don't go to work or school or sleep in a room with other people during the first few weeks of treatment.
- Ventilate the room: tuberculosis germs spread more easily in small closed spaces where air doesn't move. If it is not too cold outdoors, open the windows and use a fan to blow indoor air outside.
- Cover your mouth: use a tissue to cover your mouth anytime you laugh, sneeze, or cough. Put dirty tissues in a bag, seal it and throw it away.
- Wear face mask: wearing a face mask when you are around other people during the first three weeks of treatment may help lessen the risk of transmission.

References

[1] Deepak Dhamnetiya, Priyanka Patel, Ravi Prakash Jha, Neha Shri, Mayank Singh & Krittika Bhattacharyya Trends in incidence and mortality of tuberculosis in India over past three decades: a joinpoint and age–period–cohort analysis.
[2] Ashwani Khanna, Rumpa Saha**,** and Nadeem AhmadIndian National TB elimination programme-What has changed. J Med Microbiol. 2023 March-April; 42: 103to107. Publishedonline2022Nov16. Doi: 10.1016/j. ijmmb.2022.10.008.
[3] India TB Report2022.
[4] Baskaran Dhanaraj, Mohan Kumar Papanna, Srividya Adinarayanan, ChandrasekaranVedachalam, Vijayaraj Sundaram, Shivakumar Shanmugam, Gomathi Sekar, Pradeep Aravindan Menon, Fraser Wares, Soumya Swaminathan, Prevalence and Risk Factors for Adult Pulmonary Tuberculosis in a Metropolitan City of South India.
[5] R. Ananthakrishnan, K. Kumar, M. Ganesh, A. M. Kumar, N. Krishnan, S. Swaminathan, et al. The profile and treatment outcomes of the older (aged 60 years and above) tuberculosis patients in Tamilnadu, South India PloS one., 8 (7) (2013), p.6728 24. Tuberculosis and airflow obstruction: evidence from the PLATINO study in Latin America, The European respiratory journal., 30 (6) (2007Dec), pp.1180-1185
[6] C. R. Stevenson, J. A. Critchley, N. G. Forouhi et al., "Diabetes and the risk of tuberculosis: a neglected threat to public health?" Chronic Illness, vol.3, no.3, pp.228-245, 2007.49. World Health Organization (2018) HIV-Associated Tuberculosis:
[7] Bazin H. Vaccination: a history. Montrouge: John Libbey Eurotext; 2011
[8] UNAIDS (2018) Ending tuberculosis and AIDS: a joint response in the era of the Sustainable Development Goals-country submissions'p.6 [pdf]
[9] B. I Restrepo and L. S. Schlesinger, Impact of diabetes on the natural history of tuberculosis, Diabetes Research and ClinicalPractice, vol 106, no.2 pp.191-199, 2014
[10] World Health Organization (2018) HIV-Associated Tuberculosis factsheet [pdf].
[11] UNAIDS (2018) Ending Tuberculosis and AIDS: a joint response in the era of Sustainable Development Goals-country submissions p.6 [pdf]
[12] Narasimhan P, Wood J, Macintyre CR, Mathai D. Risk factors for tuberculosis, Pulm Med, 2013, vol.2013 pg.828939
[13] Lienhardt C, Fielding K, Sillah JS, et al. Investigation of the risk factors for tuberculosis: a case-control study in three countries in West Africa, Int J Epidemiology, 2005, vol.34 (pg.914-23)
[14] Fox GJ, Barry SE, Britton WJ, Marks GB. Contact investigation for tuberculosis: a systematic review and meta-analysis, Eur Respir J.41 (pg 140-56) 2013, vol
[15] https://stoptb. org/assets/documents/resources/publications/sd/Truenat_Implementation_Guide. pdf.
[16] Guidelines on Programmatic Management of Drug Resistant TB (PMDT) in India. Revised National Tuberculosis Control Programme, Central TB

Division, Directorate General of Health Services, Ministry of Health and Family Welfare, May. New Delhi, India: 2012. [accessed on December 17, 2014]. Available from: http://www.tbc. india. gov. in/WriteReadData/l892s/8320929355Guidelines for PMDT in India-May 2012. pdf.