

## **Overcoming the disparity in TB Treatment : An Extensive analysis of DOTS Efficacy in Urban and Tertiary settings**

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### **ABSTRACT:**

#### **BACKGROUND:**

Of the world's population of well over 6 billion, it affects one-third, and 8.8 million people get active disease. Every year, TB kills over 2 million people worldwide. Following this disaster, the World Health Organization's (WHO) global tuberculosis program declared tuberculosis a worldwide emergency in 1993. India is one of the highest TB burden country accounting for approximately 1/5th of global TB burden.<sup>6</sup> By March 2006, the entire country had access to the Revised National Tuberculosis Control Programme (RNTCP), which was based on the DOTS (Directly Observed Treatment-Short course) method, in order to address this issue. Numerous risk factors were assessed, including age, weight, gender, TB type (P/EP), and co-morbidity, in relation to treatment failure.<sup>5</sup> Alcohol misuse and homelessness were the only risk factors for noncompliance.<sup>11</sup> DOT envisions rigorous oversight, adherence, and high compliance, which leads to high cure rates and a lower chance of drug resistance developing. Consequently, the DOTS approach prioritizes treatment over detection. Additionally, DOT-treated patients had reduced default and death rates.<sup>8</sup>

#### **KEYWORDS:**

**Tuberculosis, Direct observation therapy, SAT, TBCU, RNTCP, WHO, NTI, TRC, IUATLD.**

## INTRODUCTION

TB was once referred to as "a disease that does not forgive" (o boal a care nu iart a), a term that was widely dreaded in Romania due to its fatality and significant stigma for afflicted persons and families.<sup>1</sup> One of the principal diseases causing morbidity and death worldwide is still tuberculosis (TB). Globally, one in three people, or two to three billion There are people who have Mycobacterium tuberculosis (M. tuberculosis), and 5–15% of them are likely to become active TB disease at some point in their lives.<sup>2</sup>

The World Health Organization (WHO) adopted the Directly Observed Therapy Short-course (DOTS) Strategy in 1994. It was based on five pillars: political will, direct observation, microscopy-based case detection, a consistent supply of anti-TB medications, and a standardized recording and reporting system (WHO 1994).<sup>3</sup> Of all the countries in the world, India has the most TB cases. It is involved in around 20% of cases worldwide. India also has extremely high rates of tuberculosis-related morbidity and mortality.<sup>4</sup> By March 2006, the entire nation had access to the DOTS (Directly Observed Treatment-Short course) strategy-based Revised National Tuberculosis Control Programme (RNTCP), which was created to address this issue.<sup>5</sup>

Romania serves as a clear example of how DOT must only be applied in a rights-based, person-centered approach that evaluates its efficacy in a particular setting and eliminates burdensome obstacles for TB patients. DOT was significant because it provided a chance to track drug reactions and progress. Additionally, because some of this monitoring involved laboratory testing and technologies like EKGs and audiometry equipment, it was simpler to perform DOT in a clinic.<sup>1</sup>

DOTS has 5 key components as identified by WHO:

Government dedication to ongoing efforts to combat TB.

- Sputum smear microscopy is used to detect cases in patients who exhibit symptoms.
- A standardized 6- to 8-month treatment plan, involving DOTS for at least the first two months, is required for at least all confirmed sputum smear-positive cases.
- A consistent, unbroken supply of all necessary anti-TB medications. A uniform system of documentation and reporting that enables evaluation of treatment.

The DOTS approach ensures that the right drugs are administered at the right times and in the

right dosages by having patients take anti-tuberculosis drugs while being watched over by a health professional (DOT). Additionally, DOTS promotes sputum smear microscopy, which lowers the spread of tuberculosis and improves the accuracy of tuberculosis diagnosis.<sup>6</sup>

Infectious Disease Act, which mandates that all patients infected with TB complete the 6–9 months of DOT. Patients are often diagnosed and commence their prescribed anti-TB medication by physicians at the Tuberculosis Control Unit (TBCU). Once they are stabilized, they will be followed up in primary care under a shared care program between TBCU and polyclinics. Approximately 60% of them are referred to the polyclinics for continuity of DOT.<sup>7</sup>

DOTS program uses two success outcomes. They have finished their treatment, and the second one has been cured. Patients are considered cured if their sputum tests negative for tubercle bacilli at the conclusion of the intensive phase of treatment, as well as at the conclusion of the six-month period or when the course of treatment is finished. Two kinds of bacilli exist. One is for slow growers, and the other is for quick growers. Multidrug-resistant tuberculosis is mostly caused by slow-growing tubercle bacilli. Although DOTS makes sure to treat both kinds of tubercle bacilli, it occasionally doesn't work.<sup>4</sup>

The National Tuberculosis Institute (NTI) in Bangalore and the Tuberculosis Research Centre (TRC) in Chennai have demonstrated over 80% cure rates using high-quality TB control programs. Research indicates that when compared to self-administered therapy, treatment provided under DOTS has significantly greater cure rates and significantly lower default rates. The World Health Organization and other top international organizations recommend directly observed treatment (DOT), in which patients are watched as they take each dose of an anti-tuberculosis medication, as the standard of care for treating tuberculosis in order to increase adherence to treatment.<sup>8</sup>

Aside from being feasible, ambulatory treatment was the only practical choice in nations with limited resources due to the scarcity of hospital beds for tuberculosis. In an examination of a Medical Research Council study conducted in Madras, Wallace Fox emphasized the challenges associated with achieving high treatment compliance rates among ambulatory patients. This resulted in DOT testing even in environments with limited resources and showed that "long term daily supervised administration can be organised under special circumstances, even in developing countries." Following this, supervised intermittent therapy was implemented. Attempts at supervised treatment were also made in London and Hong Kong. Beginning in the

early 1960s, selective DOT programs were implemented in the USA, but only for "unreliable or questionably reliable individuals." The twice-weekly supervised program was later expanded by Sbarbaro, who by the late 1970s was promoting DOT for everyone. In the past, intermittent DOT was often used and only recommended for challenging patients.<sup>9</sup>

Based on clinical records, the percentage of Baltimore TB patients who received care from the BCHD's DOT program each year, the percentage of cases that finished conventional therapy and INH preventative therapy, and the percentage of patients who had culture-negative sputum after three months of treatment were calculated. Between 1981 and 1992, compared to the other five research cities with populations above 250,000, Baltimore experienced the highest drop in serum TB solute and relative TB case rates.<sup>10</sup>

In 1992, a trial program for Directly Observed Treatment, Short Course (DOTS), a standardized TB preventive and control program, was launched in Ethiopia's Arsi zone of the Oromia region. On a national scale, the DOTS approach was then expanded and implemented. Compared to 90% for geographic coverage, only 75% of DOTS health institutions are currently covered geographically.<sup>1</sup> A recent DOT research in Bangladesh found that the DOT package includes free medications, a nationwide microscopy service, community health worker mobilization, comprehensive health education, population screening, a written contract, and a five-day wage "incentive bonus" paid by the patient.<sup>9</sup>

In 2011, there were six new MDR-TB cases in Singapore, compared to just three in 2010. MDR-TB frequently arises from noncompliance with anti-TB treatment, which leads to the inability to obtain a "microbiological cure." Even longer courses of DOT are necessary for the development of MDR-TB, which may lead to long-term social isolation, job loss, and negative socioeconomic and psychological impacts.<sup>7</sup> In 2011, India reported 88% success rates and cure rates among new smear-positive cases. The International Union Against Tuberculosis and Lung Disease (WHO/IUATLD) considers cure, treatment completion, treatment failure, death, default, and transfer out as treatment outcome criteria. A slightly altered version of WHO/IUATLD also adds success rate and unsuccessful rate. Tuberculosis was designated a notifiable disease by the Indian government on May 7, 2012. Private health professionals' knowledge is demonstrated by the increase in the number of TB cases covered by RNTCP, which ensures full treatment, and the DTC notification of cases by the private sector, which increased from 534 instances to 1438 cases between 2013 and 2015.<sup>5</sup>

We defined noncompliance with outpatient DOT as fulfilling at least one of the following criteria: (1) greater than the Two consecutive weeks of therapy were missed; (2) treatment took longer than expected due to missed doses; or (3) the tuberculosis control program imprisoned the patient for posing an urgent public health risk. A patient was considered to have defaulted from therapy if they missed more than two consecutive months of DOT; the analysis of the original course of DOT did not include any additional antituberculosis therapy that these patients received.<sup>11</sup>

A Delhi study found that non-compliance was influenced by occupational position and salary loss. Another urban study conducted in Delhi identified patients' unmet need for accessible clinic hours. The majority of patients who opted for evening DOTS sessions were either students, employed, or had family members who worked during the day accompany them to the DOTS center. The scheduling of taking DOTS was convenient, according to all attendees of nighttime DOTS and around 91% of those attending daytime DOTS. Fifteen percent of normal DOTS patients experienced unfavorable outcomes, such as treatment failure, loss to follow-up, and death, whereas all evening DOTS patients experienced favorable consequences.<sup>6</sup>

The COVID-19 epidemic has compelled numerous TB programs to modify their DOT strategies. Lockdowns, transportation and personnel issues, and people's concerns about catching COVID-19 while visiting made clinic-based DOT difficult or even impossible, thus some have switched to community, in-home, or technology-assisted approaches.<sup>3</sup>

## DISCUSSION

Research indicates that when compared to self-administered therapy, treatment provided under DOTS the cure rates for TB patients treated with DOT at the beginning of treatment were much greater than those treated with SAT at the beginning. Additionally, DOT-treated patients had reduced rates of default and fatality.<sup>8</sup> Nineteen individuals were extrapulmonary, while forty-one were pulmonary. Only seven of the 37 patients were sputum positive at the conclusion of the intense phase; this number dropped to three at the end of the extended intensive phase of therapy, and then to two at the end of the two-month continuation phase. However, by the time the continuation phase was over, one more case—a failed case—became sputum positive,

bringing the total to three. In both pulmonary and extrapulmonary instances, it was observed that there was a notable increase in weight over time. 78% of cases were cured. One patient passed away. Three were failure cases, and two defaulted. Still, a significant 22% gap exists in the current situation, which must be addressed thoroughly and universally in order to stop multidrug-resistant tuberculosis.<sup>4</sup>

The TB case rate per 100,000 people in Baltimore decreased from 35.6 in 1981 (five-city average, 52.4; 20-city average, 34.1), to 17.2 in 1992 (five-city average, 53.5; 20-city average, 33.6). This compares with a mean increase of 1.8% among the 19 cities and a mean increase of 2.1% among the five-city group. Baltimore rated sixth for TB in 1981, but by 1992, it was ranked 28th. Between 1985 and 1992, Baltimore had the largest annual rise in AIDS case rates (+171.5%). Baltimore has one of the worst AIDS mortality rates in the country, with AIDS being the primary cause of death for women aged 15 to 44. However, we have previously demonstrated that DOT for HIV-infected TB patients is linked to a reduced mortality rate than self-administered medication, with no relapses seen. In a population known to have a high rate of TB infection, the rising prevalence of HIV infection should have led to an increase in TB morbidity rather than the observed decrease.<sup>10</sup>

Poor patient compliance with therapy and the prolonged delivery of treatment were highlighted as the two factors in Professor Fox's assessments of physician practice and patient compliance. From 1978/9, through the 1980s and 1993, studies conducted in England and Wales have repeatedly demonstrated that a majority or a considerable minority of patients receive therapy for longer than necessary, which may increase non-compliance on the part of the patients. Three groups were created: those with high treatment completion (>90%), those with intermediate completion (70–89%), and those with low completion (<70%). For the whole study population, the median 12-month treatment completion rate in 1990 was 80%, and the median estimated DOT rate was 16.8%. All three completion rate cohorts saw gains, with those rates rising to 87% and 49%, respectively, by 1994. The authors acknowledged that in countries with historically low completion rates, DOT had a significant influence. Though they acknowledged going into the study with the preconception that more DOT was automatically better, they noted that treatment completion rates of over 90% might be achieved with DOT proportions much lower than those suggested by proponents of universal DOT.<sup>9</sup>

A total of 356 patients were gathered between May 2013 and April 2014 from the nine polyclinics. 22% of them were Malay, 7% were Indian, 48% were Chinese, and 23% were from

other ethnic groups, including Eurasia and other foreigners. Migrant workers from the area who had work permits and employment passes made up about 35% of the patients. At the time of research enrollment, the patients in this sample had varying lengths of DOT. This study's use of WHOQOL-BREF enables comparisons between the quality of life (QOL) of local DOT patients and similarly impacted individuals in other areas. The study's scores were lower in the "Social Relationship" domain (14.4 vs. 13.4/20) than in Dhuria et al.,<sup>14</sup> but higher in the "Physical Health" (9.3 vs. 13.3/20), "Psychological" (9.8 vs. 12.6/20), and "Environment" (11.4 vs. 12.3/20) domains. Given that the Indian study's population was more homogeneous, the lower score may have resulted from Singapore's patients being more ethnically and culturally varied. Foreign nationals, who might not have blended in with the local community, made up nearly 25% of the study's patients.<sup>7</sup>

There were still 294 patients for the outpatient DOT compliance analysis. 52 (18%) of the 294 patients who were evaluated fit the criteria for noncompliance. Thirty-three patients did not show up two weeks of DOT in a row; three patients were imprisoned for posing an immediate risk to public safety; sixteen other patients did not miss extended periods of therapy but missed enough doses to extend treatment for more than thirty days. All three of these patients had just been diagnosed with pulmonary tuberculosis that was sputum smear-positive, and they had not missed more than two weeks of treatment in a row. They were also routinely not adhering to outpatient DOT. Among patients receiving DOT, there was a significant correlation between alcohol addiction and homelessness; 51 out of 55 homeless patients also had a history of alcohol misuse. In a 1967 study of relapses in New York City, drunkenness was the most prevalent component; in 1991, there was a high correlation between alcoholism and homelessness and noncompliance. Similarly, alcoholism was found to be the primary factor linked to noncompliance and treatment failure for tuberculosis in studies conducted in England, Ireland, Denmark, and Chile. Despite the fact that hazardous effects from TB treatment.<sup>11</sup>

The age range of 15–44 years, female gender, category 1 and pulmonary patients had the highest success rate. A statistically significant correlation was found between cure rate and weight improvement. Those who had lost weight during therapy and those in the geriatric age group ( $\geq 65$  years) were statistically significantly linked to an unsuccessful outcome in this study. Additional research by Kadeangadi DM et al., Ahmad SR et al., and Akinola A et al. supports the idea that tuberculosis affects people at the same productive age. Males were more impacted than females in the current study (M: F ratio was 3.75:1). Comparing the P/EP case ratio to the

projected RNTCP norm of 10:1-19, it was lower at 3.75:1. The national figure, which indicates that 10–15% of cases are extrapulmonary tuberculosis and 85–90% of cases are pulmonary tuberculosis, is different from this data. In the current investigation, there were more reported pulmonary TB cases (78.95%) than extrapulmonary cases (21.04%). The expected treatment outcome norm set by RNTCP (cure rate > 90%, failure rate <4%, death rate <4%, default rate <5%, smear conversion rate >90%) were achieved in the present study.<sup>5</sup>

Murali and Udaya used a randomized trial design to examine the therapeutic efficacy of DOTS and non-DOTS therapies in the treatment of tuberculosis in India. 306 individuals with pulmonary tuberculosis were divided into two research groups at random for this investigation: 153 were placed in the DOTS group and 153 were placed in the non-DOTS group. After six months of treatment, 91% of the DOTS group and 53% of the non-DOTS group were found to be smear negative, indicating a statistically significant difference in result. The results showed that DOTS had a better prognosis for TB patients than self-administered regimens.<sup>12</sup>

## CONCLUSION

DOTS has low default rates and high cure rates, it remains an essential part of TB control.<sup>8</sup> Evening DOTS is meant to make DOTS more patient-friendly, which will increase its reach and enhance treatment results in a city environment.<sup>6</sup> DOT should start treating patients who are at high risk of non-adherence in order to have the biggest impact on public health.<sup>8</sup> Reduced rates of medication resistance, relapse, and treatment failure have been linked to the implementation of DOT.<sup>11</sup> The foundation of a patient-centered approach to TB treatment is DOT, which increases the chance that therapy will be successfully completed.<sup>8</sup>

## REFERENCES

1. Derege Teka, Sahilu Assegid, Ahmed J, Debella A, Eyobel Amentie, Girma Alemu Wami, et al. Determinants of Unsuccessful TB Treatment Outcomes Among Patients on Directly Observed Treatment Short Course in Jimma Town Health Facilities, Southwest Ethiopia: A Case-Control Study. *Infection and Drug Resistance*. 2023 Sep 1;Volume 16:6427–35.



2. DANIEL BELLA DEVALEENAL, LAVANYA JEYABAL, NAIR D, MAHALINGAM V, RADHAKRISHNAN R, BINNY PRISCILLA REBECCA, et al. Improving treatment adherence among tuberculosis patients through evening DOTS in Chennai, India. National medical journal of India. 2024 Mar 11;36:219–23.
3. Akhtar Md, Bhargava Rakesh, Zuber A, Pandey D, Naveed S, Khurshid D. To study the effectiveness of DOTS at J N Medical College Aligarh. Lung India [Internet]. 2007 [cited 2025 Jul 15];24(4):128–31. Available from: <https://doaj.org/article/50a2b3e4ee5a4a84bc88d96e4c366a26>
4. Jahnvi K, T. Sreenivasulu. Effectiveness of DOTS regime in terms of cure, failure, default and relapse in the treatment of TB patients. International Journal of Advances in Medicine [Internet]. 2018 Jan 18 [cited 2025 Jul 15];5(1):170–0. Available from: <https://www.ijmedicine.com/index.php/ijam/article/view/915>
5. admin. TREATMENT OUTCOME OF TUBERCULOSIS PATIENTS ON DOTS THERAPY FOR CATEGORY 1 AND 2 AT DISTRICT TUBERCULOSIS CENTRE | INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH [Internet]. INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH | IJPSR. 2016 [cited 2025 Jul 15]. Available from: <https://ijpsr.com/bft-article/treatment-outcome-of-tuberculosis-patients-on-dots-therapy-for-category-1-and-2-at-district-tuberculosis-centre/>
6. Out AA. Is the directly observed therapy short course (DOTS) an effective strategy for tuberculosis control in a developing country? Asian Pacific Journal of Tropical Disease [Internet]. 2013 Jun 1;3(3):227–31. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4027301/#b12>
7. Lee HK, Teo SSH, Barbier S, Tang SC, Yeo GH, Tan NC. The impact of direct observed therapy on daily living activities, quality of life and socioeconomic burden on patients with tuberculosis in primary care in Singapore. Proceedings of Singapore Healthcare. 2016 Jul 31;25(4):235–42.
8. Akhtar M, Bhargava R, Ahmad Z, Pandey D, Shah N, Dar K. To study the effectiveness of DOTS at J N Medical College Aligarh. Lung India. 2007;24(4):128.

9. Ormerod LP. Directly observed therapy (DOT) for tuberculosis: why, when, how and if? *Thorax*. 1999 Aug 1;54(Supplement 2):S42–5.
10. Chaulk CP, Moore-Rice K, Rizzo R, Chaisson RE. Eleven years of community-based directly observed therapy for tuberculosis. *JAMA* [Internet]. 1995;274(12):945–51. Available from: <https://pubmed.ncbi.nlm.nih.gov/7674524/>
11. Burman WJ, Cohn DL, Rietmeijer CA, Judson FN, Reves RR, Sbarbaro JA. Noncompliance With Directly Observed Therapy for Tuberculosis. *Chest*. 1997 May;111(5):1168–73.
12. Kamolratanakul P, Sawert H, Lertmaharit S, Kasetjaroen Y, Akksilp S, Tulaporn C, et al. Randomized controlled trial of directly observed treatment (DOT) for patients with pulmonary tuberculosis in Thailand. *Transactions of the Royal Society of Tropical Medicine and Hygiene* [Internet]. 1999 Sep 1 [cited 2022 May 2];93(5):552–7. Available from: <https://pubmed.ncbi.nlm.nih.gov/10696421/>
13. Murali MS, Udaya KN. A comparative study of dots and non dots interventions in tuberculosis cure. *Indian J Commu Med* 2004; 29(1): 18-19.