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## MEDICATION ADHERENCE IN TUBERCULOSIS PATIENTS: A CHALLENGE TO THE HEALTHCARE TEAM

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### ABSTRACT

Adherence to tuberculosis (TB) treatment is crucial for the successful management of the disease. While the daily dose regimen is the standard of care for the treatment of TB, it has several disadvantages that can impact a patient's ability to adhere to the treatment regimen and successfully manage the disease. Adherence to TB treatment can be measured in several ways. New technologies, such as mobile health apps and text messaging systems, can provide reminders and support to patients to help them stay on track with their treatment. It's important to note that no single method of measuring adherence is perfect, and a combination of subjective and objective adherence methods may be used to provide a more accurate picture of a patient's adherence to treatment. A multi-faceted approach that addresses patient education, support systems, technology, monitoring, and collaboration is needed to improve adherence and effectively control TB.

**Keywords: 99DOTS, DOTS, NTEP, compliance, resistance**

### INTRODUCTION

TB is curable if therapy is started immediately, appropriately and continues throughout the treatment period. However, non-adherence to medication due to various reasons contribute to poor treatment

outcomes. TB patients with low medication adherence have a greater rate of TB recurrence and death. In high-burden countries, lowering non-adherence to ATT

may have a greater epidemiological impact on TB incidence [1].

### **SUBJECTIVE MEASURES**

Adherence to TB can be measured either subjectively or objectively. Subjective adherence measures refer to methods for assessing a patient's adherence to TB treatment that rely on the patient's self-report of their behavior and attitudes towards their treatment regimen. Some common subjective adherence measures for TB include: (a) Patient self-report: This involves asking the patient about the number of doses they have taken as prescribed and whether they have missed any doses. (b) Visual Analog Scale (VAS): The VAS is a scale that ranges from 0 to 100, with 0 representing no adherence and 100 representing perfect adherence. The patient is asked to indicate their level of adherence by marking a line on the scale. (c) Likert scale: This is a type of survey that asks the patient to rate their level of agreement with a series of statements about their adherence to treatment, such as "I always take my TB medication as directed." (d) Interviews: Qualitative interviews with the patient can provide more in-depth information about their experiences and attitudes towards their treatment regimen [2, 3].

Subjective adherence measures have the advantage of being easy to administer and can provide valuable information about the patient's attitudes and motivations

towards their treatment. However, they can also be subject to bias and may not accurately reflect the patient's actual behavior. As such, it is important to use a combination of both subjective and objective measures such as pill counts or measurement of drug levels in the blood or urine to get a more complete picture of a patient's adherence to TB treatment.

### **OBJECTIVE MEASURES**

Objective adherence measures are methods for assessing a patient's adherence to TB treatment that do not rely on self-report and instead use tangible evidence of the patient's behavior. Some common objective adherence measures for TB include: (a) Pill counts: This involves counting the number of doses of medication that have been taken by the patient and comparing it to the number of doses that should have been taken. (b) Electronic Monitoring Devices: These devices can be attached to medication bottles or blister packs and record the date and time each dose is taken. (c) Dried Blood Spot (DBS) testing: This involves taking a small blood sample from the patient and analyzing it for the presence of the TB medication. (d) Direct observation therapy (DOT): This involves a health care worker observing the patient taking their medication. (e) Drug level testing: This involves taking a blood or urine from the patient and testing it for the

presence of specific TB drugs or their metabolites [4, 5].

Objective adherence measures provide concrete evidence of a patient's behavior and can help to reduce the potential for bias or inaccuracies in self-reported data. However, they can also be time-consuming and may not provide information about the patient's attitudes and motivations towards their treatment. As such, it is important to use a combination of both subjective and objective measures to get a more complete picture of a patient's adherence to TB treatment.

### **99DOTS**

Many TB programs have historically monitored adherence using DOT. In light of growing concerns about the ethics, feasibility, and effectiveness of DOT, TB programs in India and other countries have increasingly shifted toward use of digital adherence technologies or self-administered therapy, that is, patients taking medications themselves at home or in another preferred setting. Shifts by TB programs away from DOT have only accelerated in the context of the coronavirus disease 2019 (COVID-19) pandemic, as in-person observation of dose ingestion has become more challenging. With the transition away from DOT, healthcare professionals face challenges in measuring adherence.

In 2014, the National TB Elimination Program (NTEP) adopted daily

medication dosing in India replacing the previous thrice-weekly dosing protocol. While the daily dose regimen for treating TB is an important component of a comprehensive treatment plan, it does have some drawbacks. The most important drawback is that patients are not directly monitored by healthcare professionals, which may result in low adherence and eventual resistance. The NTEP in India has adopted the "99DOTS" program as part of its efforts to improve treatment adherence and outcomes for TB patients.

99DOTS (Directly Observed Treatment, Short-Course) is a mobile health platform designed to improve adherence to tuberculosis (TB) treatment. The platform was developed as a response to the challenge of ensuring that patients with TB, complete their full course of treatment. The "99" in "99DOTS" refers to the recommended minimum of 99% adherence to TB treatment in order to ensure a cure.

Patient medication is packaged in custom secondary envelopes which add dosage instruction, and a series of hidden numbers behind the pills. Each time a patient takes a dose of medication, a hidden number is revealed which is unpredictable to the patient. The revealed number completes a phone number, where the first part of the number is printed on the front side of the envelope. The patient will have to call on the toll-free phone number and will get a call

from the centralized telephone operator. A large array of phone numbers are maintained and packaged in an unpredictable way to the patients, and the only way for a patient to call the correct number is to dispense the pills. Therefore, it is conformed that they have taken their medication for the day. If the call is not received on the centralized server, the patient will get a call reminder asking them to take their medicine.

The calls are toll-free, so patients do not have any additional costs. Most patients have access to a mobile phone and can make a call, so 99DOTS reaches the maximum number of users. Once a patient interacts with 99DOTS, other services are also offered to improve adherence, including daily reminders, incentive structures, or custom-tailored medical advice or counseling if necessary.

Like any other technology or system, 99DOTS has some limitations and challenges: (a) the major drawback of 99DOTS, is that patients could telephone the toll-free number without taking their pills. The healthcare team faces a significant issue in figuring out whether patients called the number while taking their medications or not. Adherence to the treatment regime is still dependent on the patient's commitment and ability to take their medication and report symptoms as directed. (b) 99DOTS relies on patients having access to a mobile phone and being able to use it, which may

not be possible for some individuals in certain communities or regions. (c) Additionally, 99DOTS gathers and keeps track of private medical data. According to research published in the American Journal of Translational Research, users of digital health applications had serious privacy and security concerns. (d) 99DOTS is designed to support standard dosing schedules and may not be suitable for individuals who require non-standard drug regimens. Digital medication adherence programs often struggle to support non-standard drug regimens and this can be a barrier to their adoption. (e) 99DOTS is effective in improving medication adherence in some studies, but there is limited evidence to support its effectiveness in a wide range of populations and clinical settings [6-10]. Despite these challenges, 99DOTS has the potential to improve TB treatment adherence and reduce the risk of drug-resistant TB, but its impact will depend on effective implementation and addressing the limitations mentioned above.

## CONCLUSION

In conclusion, medication adherence remains a critical, yet understudied, factor influencing outcomes of TB therapy. TB programs should evaluate the feasibility of integrating more accurate, more convenient, more reliable, and less costly objective measures into routine TB care, potentially

including urine testing or measurement of drug metabolites in other specimens.

## REFERENCES

- [1] Thamineni R, Peraman R, Chenniah J, Meka G, Munagala AK, Mahalingam VT, Ganesan RM. Level of adherence to anti-tubercular treatment among drug-sensitive tuberculosis patients on a newly introduced daily dose regimen in South India: A cross-sectional study. *Trop Med Int Health*. 2022;27(11):1013-1023.
- [2] World Health Organization. (2019). Adherence to long-term therapies: Evidence for action. Geneva, Switzerland: World Health Organization.
- [3] Diwan, V. K., Johnson, J. L., & Menzies, D. (2010). Adherence to tuberculosis treatment: a systematic review of qualitative research. *PLoS medicine*;7(2), e1000208.
- [4] Beckert, S., Streichert, T., Weber, R., Hölscher, M., & Nienhaus, A. (2017). Adherence monitoring with electronic monitoring devices: a systematic review. *Journal of medical systems*, 41(5), 173-186.
- [5] Koczkowski, P., & Rustomjee, R. (2018). Drug level monitoring in tuberculosis: A review. *American Journal of Respiratory and Critical Care Medicine*, 197(6), 776-782.
- [6] "99DOTS: A novel solution for improving tuberculosis treatment adherence." World Health Organization. <https://www.who.int/campaigns/end-tb/innovations/99dots/en/>
- [7] "Adherence monitoring in tuberculosis treatment: a systematic review of interventions using mobile technology." *BMJ Open*, 2017.
- [8] "Digital health interventions for tuberculosis treatment: a systematic review." *Journal of Medical Internet Research*, 2019.
- [9] Rajavardhana T, Koushik MR, Jayakumar C, Ramalingam P, Geethavani M, Kumar MA, Rajanandh MG. Adherence to treatment on a daily-dose regimen for TB. *Int J Tuberc Lung Dis*. 2023;27(10):778-780.
- [10] Nageswari AD, Rajanandh MG, Uday MKRA, Nasreen RJ, Pujitha RR, Prathiksha G. Effect of rifampin with bio-enhancer in the treatment of newly diagnosed sputum positive pulmonary tuberculosis patients: A double-center study. *J Clin Tuberc Other Mycobact Dis*. 2018;12:73-77.