

# Review and critique of the World Health Organization's DOTS Programme: Recommendations to improve patient compliance in the treatment of TB and MDR TB in low-resource settings

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## Abstract

Tuberculosis, and its more serious forms, including Multi-drug Resistant Tuberculosis (MDR TB), represent serious health threats, especially in developing areas of the world such as India. Present in more than 100 nations, it is estimated that there are greater than four hundred thousand new cases of MDR TB each year worldwide. With approximately 1.7 million deaths each year from MDR TB, TB and MDR TB are the leading cause of death for immunocompromised patients, such as those who are HIV positive. Treatment for all forms of TB is most successful in high income settings with adequate access to healthcare providers and sources of medication. However, most cases occur in resource poor settings, thus suggesting a need for further analysis of current DOTS programs to determine areas of potential improvement. The World Health Organization (WHO) currently recommends that treatment for TB as well as MDR TB involve a course of drugs which are

directly administered to patients by healthcare professionals. However, there are several problems with this approach, as patients must often travel long distances to obtain the medicine away from their homes, work and family. This burden results in low adherence, and hence an increase in the number of cases of TB and MDR TB in these areas of the world. This review will look at alternatives to this approach that uses individuals from the community who are trained to administer the medications in the home community of the individual. Because these community health workers are part of the community they are trusted, and because they administer the medications locally, they remove the burdens of travel and time away from work for patients.

**Keywords:** Multi-drug Resistant Tuberculosis, MDR TB, Tuberculosis, TB, community health workers, epidemiology, HIV, immunocompromised, opportunistic infections, social determinants of health, DOTS, WHO, community health

## Introduction

Tuberculosis, including MDR TB, represents a significant public health threat in the developing world. Present in more than 100 nations, it is estimated that there are greater than 400,000 new cases of MDR TB each year worldwide.<sup>1,2</sup> With approximately 1.7 million deaths each year from MDR TB, TB and MDR TB are the leading cause of death for immunocompromised patients, such as those who are HIV positive.<sup>1</sup> Treatment for all forms of TB is most successful in high income settings with adequate access to healthcare providers and sources of medication.<sup>1</sup> However, most cases occur in resource poor settings, thus suggesting a need for further analysis of current Directly Observed Treatment Short Course (DOTS) programs to determine areas of potential improvement.

The objective of this review is to determine areas in the current DOTS program that will require changes in order to improve their efficacy. Articles selected for this review are taken from high-quality, peer-

reviewed journals, as well as other reputable sources, such as the WHO via Medline search focusing on critiques of nation-level DOTS programs, with a special emphasis on programs in India and Southeast Asia. Articles were reviewed based on the efficacy of traditional as well as novel approaches, such as the use of community health workers to deliver medication to at-risk patient panels within their communities. The review of several studies shows that DOTS programs which use community health workers to deliver medications and other DOTS-based materials, such as health education, to patient panels in their home communities could overcome many of the issues associated with traditional DOTS programs, such as the need for patients to travel long-distances to secure medications on a daily basis.<sup>2,3</sup> The results of these reviews show that programs which utilize community health workers, as well as other novel approaches, such as the use of media, had increased patient adherence to the DOTS protocol. This suggests that increased adherence to the DOTS protocol by patient panels being cared for under the community health worker model results in decreased drug resistant forms of TB, including MDR TB. Despite

this, additional studies are needed to ascertain the applicability of community-based health worker DOTS programs in other situations in which a high proportion of the population suffers from TB or MDR TB before such programs can be placed into wide-scale practice.

## Background

MDR TB represents a significant public health threat in both the developing as well as developed world.<sup>2</sup> MDR TB is defined as TB which is resistant to the two primary medications currently used to treat the disease. Currently, MDR TB is present in over 100 nations worldwide, and is expected to continue to spread until it is represented in all global populations.<sup>2</sup> There are a wide range of reasons for the development of antibiotic resistant strains of tuberculosis, which include both biomedical as well as sociocultural reasons. For instance, while actual resistance is developed at the biochemical level through genetic alteration of the mycobacterium<sup>4,5</sup>, additional reasons for this change are related to socioeconomic and political reasons.<sup>6</sup> Poor adherence to treatment by patients who can only afford a portion of their treatment doses, or who sell these doses to others, in combination with difficulty of accessing medications has resulted in a situation in which drug resistance continues to develop and thrive in those settings with limited resources available to address this problem. Resistance results in a situation in which countries with a high burden of the disease, such as India, must rely on second-line medications, which are more expensive and available in limited quantities to developing nations due to current patents on them.<sup>1</sup>

With over 2 million new cases of TB worldwide each year, MDR TB now represents 4.3% of all new cases, thus suggesting a growing risk in terms of available treatment.<sup>2</sup> Most new cases of MDR TB are found in developing nations such as India, China and the Russian Federation (2008). India, which has the highest burden of TB and MDR TB in the world, represents one-fifth of the global burden of TB, including MDR TB.<sup>7</sup> The Revised National Tuberculosis Control Programme (RNTCP) currently participates in the WHO recommended DOTS program, in an effort to achieve 100% DOTS coverage for all infected patients in the next decade.<sup>7</sup> Despite this, the rapidly expanding number of cases, together with other socioeconomic and logistical issues, has resulted in significant hurdles that need to be overcome in order to achieve this goal.<sup>7</sup>

## Objectives of the review

The purpose of this review is to analyze the current WHO recommended DOTS program, whose overall goal is to achieve 100% DOTS coverage for all infected patients worldwide in the next decade.<sup>7</sup> This review will approach the DOTS program as presented in India from the standpoint of efficiency in determining which elements of the program are currently working, and are therefore applicable in other circumstances, such as other areas of the Southeast Asia which also bear a high burden of TB. It will also show which areas require additional revision to sustain program growth in current program areas, as well as others.

## Selection criteria

The types of studies selected were those which used a variety of methods to evaluate the efficacy of DOTS programs in India, such as the use of community health workers. The types of interventions chosen were those which expanded on traditional WHO-recommended DOTS approaches to enhance the capacity of national-level programs to deliver TB medications in the community setting as opposed to traditional healthcare settings, such as village health posts. The

outcome measures were based on the ability of these programs to deliver the DOTS program to TB and MDR TB patients in their home communities through the use of community health workers as well as traditional approaches.

## Identification of studies

Studies were identified using a Medline search based on search terms surrounding the DOTS program, with a special emphasis on those studies which critique current DOTS interventions in areas such as India and Southeast Asia for efficacy, as well showcasing alternate delivery methods for the DOTS program, including the use of community health workers. Studies were only drawn from reputable, peer-reviewed journals such as The Indian Journal of Tuberculosis and the British Medical Journal, as well as other sources such as the WHO website.<sup>1,8-14</sup>

## Review method

Data was analyzed from the standpoint of efficacy in increasing adherence to the DOTS program among at-risk populations, with special emphasis being placed on programs in India. Quality of the studies was assessed based on the number of participants included in the study, the program study design, and the statistical analysis used in determining increased efficacy.

## Review of studies

As the incidence of MDR TB continues to grow, there is evidence to support a need to revise the current WHO-recommended DOTS treatment protocol. DOTS currently prescribes that patients suffering from TB undergo a directly-observed treatment protocol of medications lasting approximately six months.<sup>14</sup> One of the problems associated with such an approach is that patients must undergo treatment under the direct supervision of healthcare providers in most instances.<sup>14</sup> While many programs exist, particularly in India and some areas of South America, which bring specially trained community health workers directly to the communities of at-risk patients to administer this treatment<sup>3</sup>, many others continue to require that patients travel to health posts, which may be located at a significant distance from their home and work.<sup>8</sup> Such an approach places economic strain on patients, reduces compliance, and results in increased resistance through incomplete courses of antibiotics.

In attempting to elicit reasons for this non-compliance, Jaggarajamma, et al.<sup>13</sup>, reviewed the DOTS-based TB control program in India, known as the Revised National Tuberculosis Control Programme (RNTCP) in Southern India. Semi-structured interviews were conducted with 186 patients to determine their reasons for non-compliance with the DOTS program.<sup>13</sup> The authors found that the primary reason for default were problems related to securing an adequate supply of pharmaceuticals from the DOTS clinics which were generally located at some distance from towns and villages where the majority of patients lived (42%). About 31% had migrated away from where they were initially enrolled in the DOTS program and failed to re-enroll at a new site due to a variety of reasons, such as inability to locate a new DOTS clinic. Other reasons given for default were interference with employment (15%) and issues with alcoholism which prevented continuing treatment.<sup>13</sup> Patients frequently cited that DOTS adherence was inconvenient due to the need to travel long distances to undergo treatment.<sup>13</sup> The authors<sup>13</sup>, also found that those programs which utilized community health workers to deliver medications directly in the community, as well as to provide motivation and counselling to patient panels had higher levels of success in maintaining adherence than did other programs.

The use of community health workers as a way of increasing adherence to the DOTS protocol was echoed by.<sup>8</sup> The authors found that those communities which made use of specially trained community health workers in India to deliver medications and observe their use directly in the villages and homes of patients had 35% less default than those which did not.<sup>8</sup> Smart<sup>11</sup>, suggests that since HIV programs in South Africa use self-monitored dosing of HIV patients with considerable success, that such programs be combined with TB control programs to allow patients ready access to medications which they then take at home under their own direction.<sup>10</sup> found that such programs which combine self-directed HIV and TB treatment required patients to be seen only once per month in the follow-up clinic, and were more successful than those which did not. Such an approach recognizes the inherently close relationship between HIV and TB and an opportunistic infection, with TB being the leading cause of death among HIV patients. However, they would need to be combined with educational programs to increase understanding of the need of such programs for complete treatment by patients.

Gopi, et al.<sup>12</sup> found similar issues in terms of adherence to the directly observed treatment protocols advocated by the DOTS program. The authors conducted a retrospective study of TB and MDR TB patients living in a rural area of South India in 209 rural villages and nine urban areas.<sup>12</sup> In this study, authors interviewed 1,666 patients, or which 67% had completed the DOTS program, and 33% had failed to comply with the entire course of treatment.<sup>12</sup> The most frequent reason given for failure to comply with entire course of the program was difficulty accessing health centre (57%). Travelling to the health centre was considered difficult and interfered with daily activities (42%); fear of lost wages and unemployment for taking time to travel to the health centre (28%); and difficulty understanding educational materials intended to stress the need to complete the entire DOTS course due to a lack of education (30%) or illiteracy (39%).<sup>12</sup> It is important to note that patients were allowed to choose multiple reasons for their non-compliance. In comparison, majority of those patients who successfully completed the course of treatment were those who came from areas where they had more direct access to either government or privately-run DOTS health centre, thus alleviating the need to travel long distances, disrupting both work and other duties to secure treatment.<sup>12</sup>

However, ready access to treatment centres does not guarantee success either, as Vijay, et al.<sup>9</sup>, found that even in urban areas, such as Bangalore City, with ready access to health centres, treatment compliance remained below 60% overall, with the most frequent reason given being that securing treatment was a disruption of daily activities, including employment. In addition to issues with direct access to DOTS programs in a patient's home community, additional studies have looked at the issue of non-adherence to treatment among patients who after initially defaulting from the treatment program, were re-registered for either continued treatment of TB or treatment of MDR TB associated with incomplete prior treatment.<sup>15</sup> Only 23% of those who defaulted from the studied DOTS program in the Tiruvallur District of India, were re-enrolled at a future date, placing these patients, and those around them, at increased risk for developing MDR TB at a future date.<sup>15</sup> Additionally, the authors found that patients who had defaulted from a DOTS program, and who subsequently re-registered for additional treatment, were at increased risk of being MDR TB positive (15%); and that only 38% of re-registered patients went on to successfully complete the second round of treatment.<sup>15</sup>

## Methodological quality

The internal validity of included studies was of high-quality, both in terms of selected populations, as well as appropriate statistical analysis to arrive at the conclusion that community-based DOTS programs which utilize community health workers deliver higher rates of adherence than the traditional programs. The only potential area of concern is the need for additional studies looking at community health workers as central components of DOTS programs in order to increase the statistical power of these studies, and hence their applicability to additional DOTS programs in at risk populations. Additional studies are also needed to determine why patients who leave treatment fail to re-enrol at a later date despite continued symptoms.

## Review results

The included studies demonstrate the concern that current DOTS programs in areas such as India, which bears the largest global burden of TB disease, is failing to meet the needs of its target audience. The primary reason for this is an inability to overcome socioeconomic and other hurdles in the delivery of the TB control program to this at-risk population. Specific issues revolve around limited access to DOTS clinics in the home communities of TB patients, thus requiring long-distance travel to health clinics; the inconvenience of participating in a program which requires direct observation of the medication being taken; fear of lost wages or employment for those who travel to health centres on a regular basis; and a lack of appropriate educational materials to meet the needs of illiterate or undereducated patients who must be convinced of the need to engage in the full-course of DOTS treatment protocol. Such hurdles contribute to a high rate of default among TB patients undergoing DOTS treatment, which in turn results in increased incidence of MDR TB, at a significant cost to both individuals and the world. Potential answers to such issues include the use of community health workers to deliver medications directly in the community; the use of self-directed medication protocols combined with HIV treatment, where applicable; and finally, additional effort to educate TB patients on the need for complete treatment, and the need to identify and re-enrol program defaulters as soon as possible.

## Discussion

As the scale of worldwide TB epidemic, including the emergence of drug resistant forms, continues to pose a serious public health threat, there is a need to develop adequate programs to address the needs of those with and at risk of TB. Numerous factors have emerged which must be addressed if the issue of TB/MDR TB and adherence to treatment is to be successfully addressed. Chandrasekaran, et al.<sup>15</sup> concluded that meeting the goal of treatment will require emphasizing two points, first, the need to ensure a high percentage of adherence by first time DOTS patients; and second, to ensure that defaulters were contacted and re-enrolled in an appropriate program as soon as possible. However, the authors acknowledge that further studies are needed to determine why patients do not seek to re-enrol at a later date even with the advent of continued symptomologies.

Other researchers suggest that, the need to ensure high rates of adherence among both first time and re-enrolled DOTS patients was contingent on understanding and addressing the risk factors associated with non-adherence, including addressing alcohol abuse and other co-morbid medical conditions in TB patients which make completion of the full course of treatment difficult.<sup>13</sup> While doing so, the authors suggest that educational strategies address these issues in



an appropriate manner, including gender-specific protocols.<sup>13</sup> Gopi<sup>12</sup> echoes this need, stating that because education was found to be a barrier in helping patients understand the need for treatment, that it was necessary to develop educational materials to meet needs of illiterate patients. In addition to this, there is a need to provide better access to care in the home community of patients.

Overall, the results of these studies indicate that there is a significant gap between the needs of TB patients in developing world, and those needs being met through current DOTS protocols. As such, future programs should focus on addressing the needs of patients in their home community, as well as associated medical conditions.

## Conclusion & recommendations

Two types of conclusions and recommendations can be drawn from the review of efficacy of DOTS programs for the control of TB and MDR TB in India, for those who deal with future research, or with implications for the practice of public health in the control of TB in such settings. Studies have established the linkage between disenrollment from a DOTS program and ready access to clinics to obtain the required medications, as well as the financial and employment implications associated with such for the individual patient. Therefore, the research must now consider how to overcome these hurdles to increase the program adherence, including increased access to DOTS clinics in villages and urban centres with high rates of TB, and the benefits of either self-administered or community health worker administered medication protocols to increase adherence.

In terms of the practice of TB control in such settings, change should be implemented to increase adherence to DOTS protocols, such as up-scaling educational materials to meet the needs of under-educated and illiterate populations, who represent the largest at-risk group in terms of the potential to not adhere to the full course of treatment. Such programs must emphasize the need of adherence to entire protocol not just that which is convenient based on travel and economic constraints. As such, it may become necessary until such time as additional research is completed to support the use of community health workers, to provide some form of assistance to those who complete the entire course of treatment, such as cash or food subsidy. Of course, additional studies would be needed from cost-benefit analysis standpoint to determine if the cost of such would be less than the cost of re-treatment for those who default.

In conclusion, DOTS programs must re-evaluate their current approach to TB control to address the current shortcomings in it, as well as to support enhanced research and determine the gold standard of practice that will meet the biomedical requirements of the DOTS program, while also ensuring that the sociocultural and economic needs of target audience which may serve as an obstacle to completion are addressed.

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