Is DOTS an effective strategy for TB control in a developing country?

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Tuberculosis (TB) is the leading cause of death due to an infectious agent; it is both preventable and treatable.[1] Globally, there are more cases of TB today than in previous epochs of human history. TB and HIV/AIDS co-infection and increasing multi-drug resistance are greatly responsible for TB assuming almost epidemic proportions.[2] It affects one-third of the world's population of well over 6 billion people.[3] Globally, TB causes about 2 million deaths per year.[4] In response to this catastrophe, the World Health Organization's (WHO's) Global Tuberculosis Programme in 1993 declared TB a global emergency and began promoting a management strategy called directly observed therapy short course (DOTS).[5] DOTS has five key components as identified by WHO.[5]

1. Government commitment to sustained TB control activities.
2. Case detection by sputum smear microscopy among symptomatic patients.
3. Standardised treatment regimen of 6 to 8 months for at least all confirmed sputum smear-positive cases, with DOTS for at least the initial 2 months.
4. A regular, uninterrupted supply of all essential anti-TB drugs.
5. A standardised recording and reporting system that allows assessment of treatment.[5]

Under the DOTS strategy, anti-TB medications are swallowed by patients under the supervision of a health worker, thereby ensuring that proper medications are given at proper intervals and at the right doses. Also, DOTS increases the accuracy of diagnosis of tuberculosis by advocating sputum smear microscopy thereby reducing the spread of tuberculosis. Indigent patients are catered for under the DOTS programme as free medications are provided and the duration of illness is reduced. Ultimately, the social stigma associated with DOTS is reduced thereby encouraging symptomatic persons to present for medical care. Between 1995 and 2008, 36 million patients with TB were treated using the DOTS strategy and this averted up to 6 million deaths.[6] China recorded massive success with DOTS as the number of detected TB patients rose from 835 in 1990 to about 130 000 in 1995; about 91% of those who started treatment in 1993 were cured. Bangladesh has also recorded similar success with DOTS. About 72 000 cases of TB are reported in Bangladesh every year with DOTS covering 90% of the population and achieving a treatment success rate of 80%.[6]

A study by Dosumu[7] supports the use of DOTS. This study among 500 Nigerians on DOTS aimed to determine their compliance with anti-TB drugs. Total (100%) compliance and cure rate were recorded with the use of DOTS and TB home visitor in this study. These results affirm the effectiveness of DOT in enhancing compliance and hence cure of TB.

A structured review of 27 articles on DOTS with treatment completion as the primary outcome was carried out to develop public health guidelines for TB treatment.[8] This review showed that treatment completion rates were most likely to exceed 90% when treatment was based on a patient-centred approach using DOTS. Also, DOTS, when compared with self-administered therapy, appeared to be cost-effective. Its cost-effectiveness is supported by Baltussen et al,[2] whose analysis of DOTS in sub-Saharan Africa and south-east Asia put the cost per DALY (disability-adjusted life year) averted at below US$2.

Favorov et al[9] also documented significant success in the TB control programme in Kazakhstan following implementation of DOTS in 1998. This study compared the TB mortality rate (MR) and case fatality rate (CFR) in Kazakhstan for 1998–2003 with those of Uzbekistan and four adjacent Russian Federation states that had not introduced DOTS. The MR from TB in Kazakhstan decreased markedly, but remained stable or increased in neighbouring territories. Similarly, Kazakhstan recorded a marked decrease in CFRs while Uzbekistan showed a marginal decrease; these rates increased in other neighbouring regions. DOTS appeared to have helped avert approximately 17 800 deaths in Kazakhstan from 1998 to 2004. The deaths averted were considered to be an indicator of DOTS effectiveness.

The main criticism of DOTS derives from analysis of its direct observation component (DOC). Some studies have compared the direct observation of TB patients receiving medications with self-administration of treatment. A Cochrane review of 11 trials with 55 609 participants showed no statistically significant difference between

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DOTS and self-administration in terms of cure (relative risk (RR) 1.02, 95% confidence interval (CI) 0.86 to 1.2) or treatment completion in people receiving treatment for TB.[10] These findings are further supported by Walley et al[11] who studied 497 adults in Pakistan with TB. These patients were assigned to one of three groups namely:

- DOTS with direct observation of treatment by health workers;
- DOTS with direct observation of treatment by family members;
- self-administered treatment.

The main outcome measures were cure, and cure or treatment completion. None of the three strategies tested was shown to be superior to the others, and cure rates did not improve with DOTS. Walley et al concluded that 'The effectiveness of direct observation of treatment remains unclear, and further operational research is needed.'[11] Literature from African studies also support this position. Sanneh and Pollock[12] did a quantitative cross-sectional study of TB patients in the western division of Gambia; they compared patients treated before introduction of DOTS with those treated using DOTS. There was no statistically significant difference between the treatment outcomes of the two medication policies. Another study from Africa by Zwarenstein et al[13] reported unique findings. This was a randomised controlled trial involving newly diagnosed and retreatment cases of TB who were randomised into two groups for therapy: DOT and self-supervision. Self-supervised patients had more successful treatment outcomes when compared with DOTS patients (difference between groups 6% (90% CI -5.1 to 17.0). Also, retreatment patients who were self-supervised had significantly more successful treatment outcomes when compared to those on DOTS (difference between groups 32% (11%–52%).

A major factor that has adversely affected DOTS is multi drug-resistant TB (MDR-TB) which is linked to the global HIV epidemic; this refers to resistance to rifampicin and isoniazid which are the most effective anti-TB drugs.[6] In response to the threat posed by MDR-TB, WHO, along with its partner agencies launched the DOTS-PLUS strategy in 1999 to replace DOTS. DOTS-PLUS is based on the same guiding principles as DOTS. However, DOTS-PLUS advocates the use of sputum cultures and drug susceptibility tests for diagnosis with use of second-line as well as first-line drugs for treatment.[2] The need for this paradigm shift was reiterated by Dauda[14] who studied 1692 TB patients treated with DOTS; of these 650 (38.4%) had HIV/TB co-infection. Only 40% of the patients were cured by DOTS, falling short of the WHO target of 85% cure. Dauda concluded by advocating for new regimens and administration protocols for TB.

Conclusion

It is clear that TB constitutes a grave public health issue which requires an efficient control strategy. DOTS has significantly mitigated the global effect of TB but it has its weaknesses. The most criticised component of DOTS has been the supervised treatment of TB patients. However, in spite of concerns about its effectiveness, DOTS as a whole will remain the cornerstone of TB control in developing countries and indeed globally. In the setting of high HIV infection rates and HIV/TB co-infection, there is a pressing need to modify DOTS to make it more relevant. This has been achieved by infusing more accurate diagnostic methods and more efficacious drugs into the DOTS-PLUS strategy.

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