World Health Organization

World Health Organization Project
"Cost-effectiveness of TB control in the Russian Federation"

policy brief number 1

The efficiency of the WHO TB control strategy in the Russian Federation: the case of Orel Oblast

Summary of findings

- Pilot implementation of DOTS, the World Health Organization's (WHO) control strategy for tuberculosis (TB), improved the effectiveness and cost-effectiveness of TB case management in Orel Oblast. Orel was one of the first oblasts in the Russian Federation to implement the DOTS strategy, with implementation starting in October 1999.
- The effectiveness of passive case-finding by smear microscopy increased following the introduction of DOTS. The share of sputum smear-positive patients among all new TB patients increased from 49% in 1999 to 63% in 2004.
- The treatment success rate in sputum smear-positive patients increased from 69% in 1999 to 81% in 2003.
- The average cost per bacteriologically-positive patient cured decreased from US$ 1004 in 1999 to US$ 866 in 2002.
- Given evidence from economic evaluations in other oblasts (regions within the Russian Federation), it is likely that nationwide implementation of the WHO strategy will improve treatment outcomes and reduce costs.
- Inpatient care constitutes a large share of the costs of the DOTS strategy as implemented in Orel Oblast. A long term policy to reprofile existing TB beds would produce further cost savings.
- Major determinants of the effectiveness and efficiency of DOTS in Orel Oblast are technical assistance, provision of social support to improve treatment adherence (e.g. food parcels and protein supplements), training and supervision.
- Additional investment of US$ 0.5 million was required for implementation of the WHO TB control strategy in Orel Oblast during the period 2000-2004.

The World Health Organization's (WHO) basic tuberculosis (TB) control strategy is known as DOTS, and is recommended by the WHO for national TB control programmes throughout the world.

In October 1999, the health authorities in Orel Oblast began pilot implementation of the WHO strategy. Orel Oblast was one of the first regions in the Russian Federation where the DOTS strategy was evaluated from a cost and cost-effectiveness point of view. This policy brief reports on the costs, effectiveness and cost-effectiveness of TB control in Orel Oblast in 2002 (Post-DOTS implementation) and in 1999 (Pre-DOTS implementation). Recommendations for country-wide DOTS implementation from an efficiency point of view are also provided.

Methodology

Generic protocols for cost and cost-effectiveness analysis of TB control programmes, based on standard methods for the economic evaluation of health care programmes, were adapted for the Russian Federation [1]. For the Pre-DOTS period in 1999, a comprehensive and detailed costing of all TB facilities in Orel Oblast was undertaken. Costs were broken down according to: (a) the major inputs required (e.g. staff, buildings and equipment, land, drugs, food, utilities); (b) facility type; and (c) type of service or activity. All costs were assessed in year 1999 prices, in both roubles and US dollars. To allow meaningful analysis of both recurrent costs (i.e. costs that are incurred every year, such as staff salaries) and capital costs (i.e. the cost of items with a lifetime of more than one year, such as buildings and equipment), capital costs were converted into average annual values, using standard economic methods. The standard methods used to annualize capital costs are based on three variables: the purchase price new of an item (i.e. its current replacement cost); expected years of useful life; and a discount rate (typically 3% according to existing international guidelines). It was assumed that the life expectancy of buildings was 50 years, of bacteriological and X-ray equipment five to ten years depending on the item, and for vehicles 12.5 years. Additional equipment, (not including equipment used for X-rays and bacteriological laboratory tests) was estimated at 15% of building replacement costs, according to Russian norms [2].

Once total costs in Orel Oblast had been estimated, the average unit costs of different components of diagnosis and treatment were calculated. This was done by dividing total costs by the relevant total units of output. For example, the cost per day in hospital was calculated as the total annual cost of inpatient care divided by the total annual number of hospital bed days.

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DFID-funded Project
March 2005

Since it would have been very time-consuming to collect data for all categories of patient, the cost per patient treated and the cost-effectiveness component of the evaluation focused on BK+ patients only (BK+ indicates smear-positive and/or culture-positive cases). This group of patients was considered to be indicative of the impact of DOTS implementation on costs, effectiveness and cost-effectiveness, and is the most important from an epidemiological point of view because new BK+ patients are the most infectious.

To assess the cost per BK+ patient treated Pre-DOTS, data on the use of services by a random sample of 100 patients registered in 1999 were collected from patient files. This involved the recording of the number of days spent in hospital, the number of outpatient visits, and the number of different types of laboratory tests and X-rays performed during treatment. Utilization of services was considered from treatment registration until 18 months after registration as a TB case. A cut-off of 18 months was used because this is consistent with available treatment outcome data prior to the introduction of DOTS, in which treatment outcomes are recorded on average after 18 months of treatment. The cost of treatment until 18 months post-registration was then calculated by multiplying the quantity of each component of treatment used (e.g. number of days in hospital) by the relevant unit cost (e.g. cost per day in hospital). Cost-effectiveness was calculated as the cost per BK+ patient cured (i.e. the cost per patient treated x 100 ÷ cure rate). The cure rate for patients registered during 1999 was calculated using standard WHO definitions for recording and reporting of treatment outcomes. These outcomes are recorded six to eight months after the start of chemotherapy.

For costing the DOTS programme the same methodology was used, i.e. the average unit cost of different components of diagnosis and treatment from 1999 were multiplied by the number of times each component was used by BK+ patients treated according to the DOTS strategy in 2002. In addition, the costs of new activities such as technical assistance, management, training and supervision were calculated. As for the Pre-DOTS strategy, cure rates were calculated based on data from the WHO recording and reporting system used in DOTS programmes.

Results

Total costs of TB control in Orel Oblast in 1999

Orel Oblast had a cost per capita for TB control of US$1.5 in 1999. This was similar to Ivanovo and Samara Oblasts, but lower than Kemerovo Oblast (these were the other three oblasts considered in the study undertaken for costs Pre-DOTS). In combination with notification and case-finding indicators, this indicator could be used for monitoring and for budget allocation purposes in future (Figure 1).

Staff costs represented a relatively small (30%) share of total costs (Figure 2). According to international standards, staff usually account for about two thirds or more of total costs [3]. This reflects relatively low salary levels in 1999 compared to those in the mid-1990s. If the costs of operating inpatient care facilities were increased in line with costs in other middle-income countries and there was no change in the extent to which inpatient care was used for TB patients, the overall cost of TB control would approximately double.

Inpatient care in Orel Oblast TB dispensary and sanatoria accounted for 75% of the total cost of TB control in 1999, while outpatient polyclinics and TB posts accounted for 25% (Figure 3). According to international standards this cost structure makes

Figure 1

Total cost per capita, Orel Oblast 1999

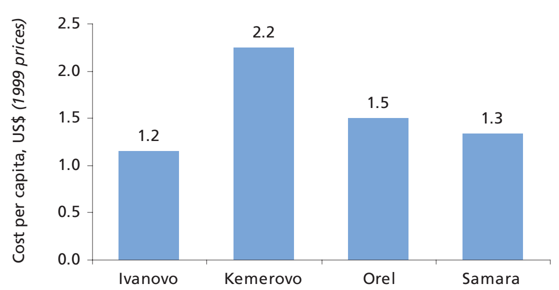


Figure 2

Total cost by input, Orel Oblast 1999

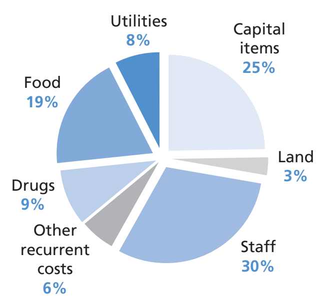


Figure 3

Total cost by facility type, Orel Oblast 1999

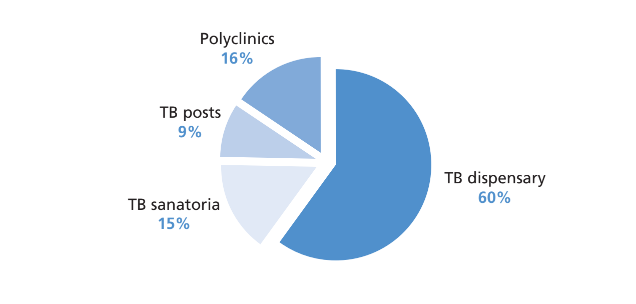


Figure 4

Total cost by activity, Orel Oblast 1999

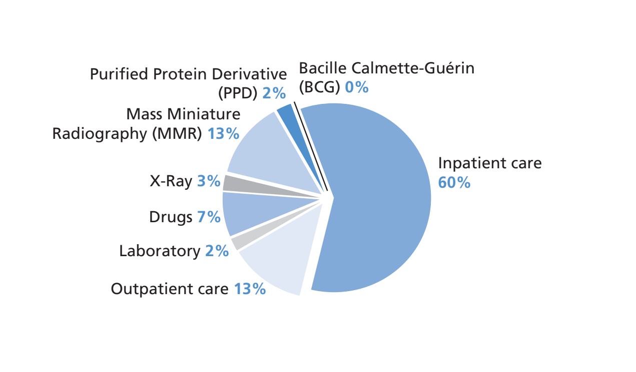


Figure 5

Cost per BK+ patient treated, 1999

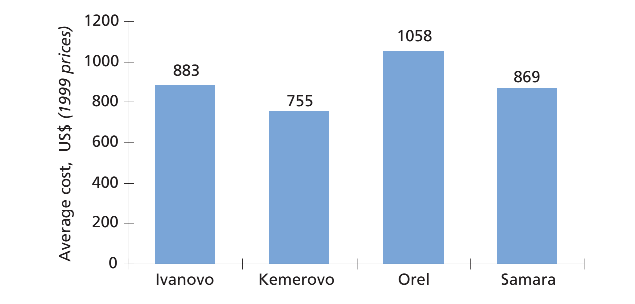
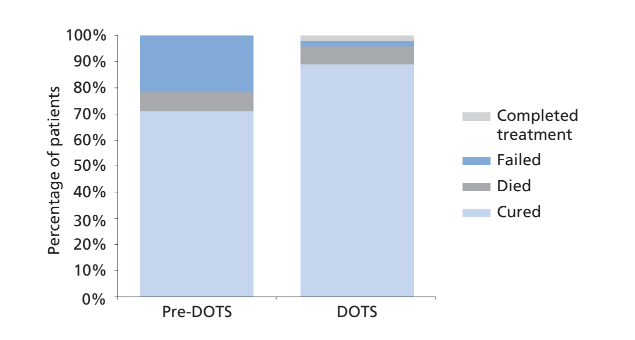


Figure 6

Treatment outcomes for Pre-DOTS (1999) and DOTS strategy (2002) for BK+ patients in Orel Oblast



the system expensive [4,5]. Gradually more investments are needed to strengthen outpatient care, and the financial system should be used to encourage such changes.

Figure 4 presents total costs by activity or service area. Compared to international standards a relatively small amount of resources was spent on drugs and laboratory services (7% and 2% respectively) while active case-finding (MMR – Mass Miniature Radiography) accounted for 13% [3]. Gradually active case-finding should be limited to risk groups.

Cost per BK+ patient treated

Treatment costs per BK+ patient in Orel Oblast in 1999 were relatively high compared to other oblasts, due to longer hospitalization and the higher costs of active detection (Figure 5). Potential savings (on MMR and reduced hospitalization) should be reinvested to improve staff motivation (salary system), to improve outpatient care, to ensure adequate financing of essential inpatient facilities, and to allow implementation of incentive programmes to improve patient adherence [5].

Cost, effectiveness and cost-effectiveness of DOTS and Pre-DOTS strategies

Programme effectiveness as measured by the cure rate among BK+ patients improved from 69% under the Pre-DOTS strategy in 1999 to 89% under the DOTS programme in 2002 (Figure 6). The failure rate fell dramatically, from 21% with the Pre-DOTS strategy to 2% with the DOTS strategy.

The cure rate among sputum smear-positive patients was lower, reaching 76% in 2002 and 81% in 2003 compared to the WHO TB control target of 85% (Table 1).

The average cost of treatment per BK+ patient increased from US$ 693 for Pre-DOTS to US$ 897 after DOTS was introduced (Table 2). The average length of hospitalization fell from 182 days Pre-DOTS to 121 days after DOTS was introduced. Although compared to international standards this is a positive trend, it is still relatively high [4, 5]. Inpatient care constituted a large share of the average cost per patient treated in both treatment strategies. These findings are consistent with other studies in the Russian Federation [4,5].

The costs for new activities introduced as part of DOTS implementation during the start-up period were

Table 1

Case-finding effectiveness by smear microscopy and treatment outcomes, Orel Oblast

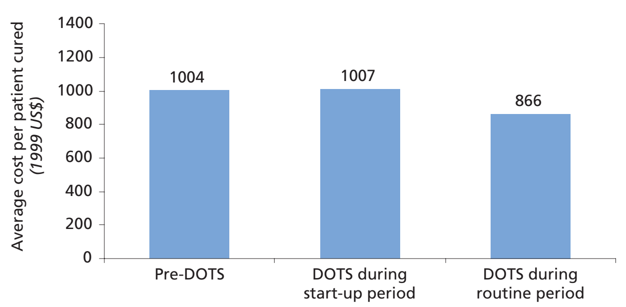
	1999	2000	2001	2002	2003	2004
New TB cases	500	531	540	506	444	428
New pulmonary TB cases	465	505	510	488	428	404
% of new pulmonary cases that were smear-positive	44%	42%	44%	56%	58%	57%
Treatment success (%), BK+, official statistics	85%	89%	89%	93%	91%	91%
Treatment success (%), BK+, sample, n=100	69%	NA	NA	89%	NA	NA
Treatment success (%), for sputum smear-positive cases, cohort analysis	73%	77%	75%	76%	81%	NA

relatively high, accounting for 30% of the average cost per patient treated. This can largely be explained by extensive investments in the first year for logistics, management and training. Over time and with routine implementation, these costs can be reduced. In addition, country-wide and large-scale implementation should further reduce unit costs as only effective and standardized procedures are applied.

The cost per patient cured should be used as an indicator for monitoring programme effectiveness. In terms of cost-effectiveness, the average cost per BK+ patient cured remained about the same for DOTS during the start-up period and Pre-DOTS, i.e. around US$ 1000 per patient cured excluding detection costs (Figure 7). However, efficiency improvements may be gained during routine and country-wide implementation when involvement of international experts in technical assistance and WHO activities related to programme management, training and supervision can be reduced.

Figure 7

Cost-effectiveness of DOTS during the start up and routine implementation* period compared to the Pre-DOTS strategy in Orel Oblast, excluding case detection costs



(*note: routine DOTS implementation does not include international technical assistance and WHO activities related to programme management, training and supervision)

Table 2

Average cost per BK+ patient in 1999 US dollars

Item	DOTS		Pre-DOTS	
Treatment cost				
Inpatient days at US$ 3.50 per day	444	(37%)	625	(62%)
TB drugs	93	(8%)	38	(4%)
Food parcels and other protein supplements	71	(6%)	NA	NA
WHO management, training and supervision	68	(6%)	NA	NA
Technical assistance	58	(5%)	NA	NA
CTRI management, training and supervision	29	(2%)	NA	NA
Day stay care, inpatient facility at US$ 1.75 per day	22	(2%)	NA	NA
X-rays at US$ 1.80 each	20	(2%)	10	(1%)
DOT visits at US$ 0.50 per visit	20	(2%)	1	(0%)
Other management, training and supervision	20	(2%)	NA	NA
Outpatient visits at US$ 1.35 per visit	14	(1%)	4	(0%)
Laboratory equipment and supplies	13	(1%)	NA	NA
Sputum cultures at US$ 0.70 per test	9	(1%)	8	(1%)
DST at US$ 4.30 per test	8	(1%)	5	(0%)
Other DOTS programme related costs	4	(0%)	NA	NA
Sputum smears at US$ 0.20 per smear	3	(0%)	2	(0%)
Total treatment cost	**897**	**(74%)**	**693**	**(69%)**
Case detection cost				
Fluography at US$ 0.40 each	314	(26%)	307	(31%)
Smear microscopy at US$ 0.20 per smear	4	(0%)	3	(0%)
Total detection costs	**318**	**(26%)**	**310**	**(31%)**
Overall treatment and detection cost	**1214**	**(100%)**	**1003**	**(100%)**

CTRI = Central Tuberculosis Research Institute.
DST = Drug Susceptibility Test.

This would improve the cost-effectiveness ratio to US$ 866 per BK+ patient cured (Figure 7).

When including detection costs it is apparent from Table 2 that both strategies rely heavily on active case detection: active case detection accounted for 26% and 31% of the total cost per BK+ patient treated for DOTS and Pre-DOTS respectively. Additional efficiency gains could be achieved by shifting resources from active case detection to case-finding among people with TB symptoms who self-refer to health care facilities i.e. passive case-finding, and better targeting of risk groups.

Policy recommendations

- The WHO-recommended TB control strategy as introduced in Orel Oblast improves treatment outcomes, saves resources, and is cost-effective compared to the system in place before DOTS was introduced. It should be recommended for country-wide implementation.
- The cost-effectiveness of the DOTS strategy in the Russian Federation could be further improved by reducing reliance on inpatient care provided there are simultaneous improvements in the quality of outpatient care and social support.
- Potential savings should be reinvested to improve motivation of staff (salary system), to strengthen

outpatient care, and to implement incentive programmes to encourage patient adherence to treatment. They should also be reinvested in remaining inpatient facilities to increase the quality of inpatient care.

- The effectiveness with which new TB cases are managed in Orel Oblast increased significantly following DOTS implementation, but results are still suboptimal. Further study is needed to identify how treatment effectiveness could be improved, for example through social support and incentives programmes.
- The cost of technical assistance to support DOTS implementation was relatively high in Orel Oblast. This should be reduced as DOTS is expanded throughout the country. Additional efficiency gains could be realized through limiting international involvement in technical assistance, introducing routine and effective standardized procedures and through economies of scale.
- Active case-finding costs (MMR) should be reduced by concentrating on risk groups in the medium-term, once the quality of passive case-finding by smear microscopy is assured.
- Monitoring of cost and cost-effectiveness indicators should be gradually introduced, e.g. TB budget per capita, cost per patient cured, cost per patient detected and the share of inpatient and outpatient care in total costs.

Comment

In addition to federal and regional resources, the World Bank loan (US$ 100 million) and a Global Fund to fight Aids, Tuberculosis and Malaria (GFATM) grant (US$ 91 million) provide a unique opportunity to introduce cost-effective TB control strategies country wide [6]. Investments in TB infrastructure and programme management should be used to implement

(3) World Health Organization WHO project on Cost-effective TB control in the Russian Federation. Moscow; WHO 2002.
(4) Floyd et al. *Health systems efficiency in the Russian Federation: the case of tuberculosis control.* Submitted.
(5) Atun et al. *Barriers to sustainable TB control in the Russian Federation health system.* Bulletin of the WHO, March 2005, 83(3).
(6) GFATM Round 4 proposal, Promoting a Strategic Response to HIV/AIDS and TB treatment and Care for Vulnerable Population in the Russian Federation, 2005.

Acknowledgements

We would like to thank the Orel Oblast TB authorities for their contribution and collaboration. This study was financially supported by the UK Government's Department for International Development (DFID).