INT J TUBERC LUNG DIS 6(12):1083–1090

Cost-effectiveness of different treatment strategies for tuberculosis in Egypt and Syria

A. Vassall,* S. Bagdadi,† H. Bashour,‡ H. Zaher,§ P. V. Maaren*

*** KITHEALTH, Royal Tropical Institute, Amsterdam, The Netherlands; † National Tuberculosis Programme, Ministry of Health, Damascus, ‡ Department of Community Medicine, Damascus University, Damascus, Syria; § National Tuberculosis Programme, Ministry of Health, Cairo, Egypt**

SUMMARY

SETTING: The National Tuberculosis Programmes in Egypt and Syria.

OBJECTIVES: To calculate the costs and effectiveness of alternative ways of implementing TB control in Egypt and Syria, in order to illustrate the factors influencing the cost-effectiveness of TB treatment in middle-income countries.

DESIGN: We compared the costs and cure rates in Egypt and Syria of the World Health Organization recommended directly observed treatment, short-course (DOTS) strategy and alternative strategies. The study included costs both to the health services and to the patient.

RESULTS: In Egypt and Syria, the cost-effectiveness of DOTS implemented through the primary health care (PHC) system was respectively $258 and $243 per patient cured. This compares to a cost per patient cured of $297 (Egypt) and $693 (Syria) for alternative strategies implemented through specialist clinics. In Egypt, when DOTS is implemented through specialist chest clinics it costs $585 per patient cured. Hospitalisation costs either $1490, $1621 or $1699 per patient cured, depending on treatment delivery in the continuation phase.

CONCLUSION: This study demonstrates that the move towards DOTS integrated at the PHC level has substantially improved the effectiveness of TB treatment in Egypt and Syria, without substantially increasing costs. An analysis of the different costs and effectiveness of the variety of TB treatment strategies has enabled both National Tuberculosis Programmes to expand DOTS and implement it in a way that takes into account limited resources and local health systems.

KEY WORDS: tuberculosis; Egypt; Syria; economics; cost-effectiveness

TUBERCULOSIS (TB) is an increasing public health problem, presently accounting for 3% of global mortality.[1] To tackle this problem, the World Health Organization (WHO) recommends the directly observed treatment, short course (DOTS) TB control strategy, which entails the use of short-course regimens of effective drug combinations, direct supervision of treatment for at least the first 2 months, and evaluation of treatment for each patient.[2] As a broad TB control strategy, DOTS also includes drug supply, monitoring and case detection based on microscopy. Directly observed treatment (DOT), as opposed to DOTS, refers to the treatment component alone.

Briefly, the two main aspects of DOT that substantially determine cost and are therefore likely to substantially influence cost-effectiveness are: 1) where treatment is delivered, and 2) the number of visits or level of observation. Generally, TB treatment is delivered either on a fully ambulatory basis or with an initial stay in hospital followed by ambulatory care. Ambulatory care can be integrated or delivered through specialist centres, with varying degrees of observation. Most studies to date have found that ambulatory TB treatment, even with a high frequency of observation, is less costly to health services,[2–9] and to the patient,[3,4,8] than treatment involving an initial stay in hospital. The broad DOTS strategy, through a combination of observation and improved management, has shown its potential to be highly effective in ambulatory settings.[1] It has therefore been assumed that for countries moving from a strategy of hospitalised or specialist care to a strategy of ambulatory-based DOTS, improvements in both costs and effectiveness can be made. Additional gains may also be made through integration with other general health services from economies of scope.

As a preparation to implementing DOTS, several studies have tried to predict the costs of DOTS using estimated average costs and assuming increased cure rates.[10–13] These have predicted that despite the number

Correspondence to: Anna Vassall MSc, KITHEALTH, Royal Tropical Institute, Mauritskade 63, PO Box 95001, 1090 HA Amsterdam, The Netherlands. Tel: (+31) 20-568 8342. Fax: (+31) 20 568 8444. e-mail: a.vassall@kit.nl

Article submitted 1 March 2002. Final version accepted 10 August 2002.

Table 1 Alternative strategies compared

TB diagnosis and treatment strategies	Regimen	Initial phase supervision frequency	Continuation phase supervision frequency
Syria			
DOTS through the PHC system	2EHRZ/4HR	Daily	Weekly
Non-DOTS through TB centres	2EHRZ/4HR	Monthly	Monthly
Egypt			
DOTS through the PHC system	2EHRZ/4HR	Daily	Weekly
DOTS through specialist centres	2EHRZ/4HR	Daily	Weekly
DOTS, hospitalised initial phase; continuation through specialist centres	2EHRZ/4HR	Daily	Weekly
DOTS, hospitalised initial phase; continuation through PHC	2EHRZ/4HR	Daily	Weekly
Non-DOTS, all through specialist centres	2EHRZ/10HE	Monthly	Monthly
Non-DOTS, hospitalised initial phase; continuation phase through specialist centres	2EHRZ/6HE	Daily	Monthly

E = ethambutol; H = isoniazid; Z = pyrazinamide; R = rifampicin; DOTS = directly observed treatment, short-course; PHC = primary health care.

of visits, the cost of ambulatory-based DOTS is still likely to remain below that of the previous alternatives of hospitalisation or specialised care. However, to date little is known about whether these low costs can be achieved in practice on a large scale or about the actual costs and cost-effectiveness (*ex post*) of implementing ambulatory DOTS.

This study sets out to verify these models by measuring the costs and effectiveness of TB treatment before and after the move to ambulatory DOTS in two middle-income countries, Egypt and Syria. Before the early 1990s, TB treatment was given on a hospitalised basis in Egypt, while in Syria, TB treatment was delivered on an ambulatory basis through a network of specialist TB centres. Both countries were successful in achieving cure rates of only 50–60%. In the mid-1990s both countries decided to implement the DOTS strategy, which provided them with the basis to integrate TB treatment into the network of primary health care (PHC) centres. We present here data on the costs and effectiveness of integrated DOTS and the previous alternatives, in order to establish the extent to which the move towards PHC-based DOTS improved the cost-effectiveness of TB control. By making this comparison, this study illustrates the relationship between different delivery strategies and the cost-effectiveness of TB treatment.

METHODS

We used data collected by the National Tuberculosis Programmes (NTP) of Egypt and Syria. At the time of the study both countries were halfway through their implementation of a DOTS strategy integrated at the PHC level. This provided the opportunity to compare the effectiveness of the large-scale implementation of PHC DOTS with the previous strategies at the same point in time.

The study compares several different treatment strategies, summarised in Table 1. In Egypt, in addition to strengthened programme management, DOTS is based on a treatment strategy of 2 months of daily EHRZ followed by 4 months of daily HR.* Treatment is observed on a daily basis in the initial phase, and on a weekly basis in the continuation phase (DOT). Treatment is delivered mainly through the PHC system. However, where the PHC system is considered inadequate, DOT can also be provided in chest clinics located in each district, or the initial phase can be provided in hospital. The non-DOT treatment strategy consists of 2 months of daily EHRZ followed by either 6 or 10 months of daily HE. The initial phase can be either self-administered or supervised in hospital. The continuation phase is self-administered, with the drugs delivered to the patients on a monthly basis. In Syria, DOT (2EHRZ/4HR) is delivered through the PHC system. Non-DOT (also 2EHRZ/4HR) is self-administered, with treatment being delivered on a monthly basis through a network of specialised TB centres.

Health service costs were estimated by collecting expenditure data from sampled facilities in both DOTS and non-DOTS areas. It is common in costing studies to use stratified sampling techniques to achieve representativeness. The sampling of facilities had two stages: the first stage selected provinces of Egypt and Syria, and the second stage selected facilities within these provinces. Provinces were selected to obtain a representative mix of geographical and population conditions. Within provinces the selection of facilities was based on population density and utilisation. Clinics with no current TB cases were excluded, as patient cost data could not be collected from our facility-based survey.

The average incremental cost of diagnosis and treatment was calculated per patient. Health service costs are divided into two types, fixed and variable:

* E = ethambutol; H = isoniazid; R = rifampicin; Z = pyrazinamide.

fixed costs are those costs that do not vary when the level of output rises, while variable costs are those that do. The relevant cost with which to compare cost-effectiveness is the average additional (incremental) cost per patient of each strategy.[2,14,15] The incremental cost associated with TB treatment is the sum of the fixed costs whose primary purpose is TB treatment and the variable costs of TB treatment.[2] If there is no spare capacity in the existing health system and all the resources required to treat TB are additional, then the incremental and total costs of TB treatment will be equal. If the resources used for TB treatment can be found from the spare capacity in the existing health system, then incremental costs will be less than total costs, as not all of the additional resources will require additional financing.

For the main comparisons and results of this study, it was assumed that the PHC system had sufficient spare capacity in terms of fixed costs to absorb DOT. We therefore excluded these items from our incremental cost calculations, as their primary purpose was not TB. This assumption was based on the fact that TB treatment does not represent a substantial proportion of PHC activity (most PHC centres see on average five patients a year). This assumption was verified during the costing interviews. None of the PHC staff interviewed felt that extra staffing, buildings or equipment were required to add DOT to their existing activities. The main cost items included were therefore supervision, training, supplies and drugs. As this assumption is unlikely to apply in countries where the burden of TB is higher or the PHC system more stretched, and average costs were used for the specialised clinics, a sensitivity analysis was conducted using average PHC costs. All costs are shown in 1999 US$ (the exchange rate was 3.4 Egyptian Pounds = $1 and 46 Syrian Pounds = $1).

We defined TB treatment as the process from diagnosis of TB to confirmation of cure or the end of treatment. It therefore included the costs of the laboratory or X-ray used to diagnosis and confirm a case, all chemotherapy, and the costs of confirming cure. The basic cost items were similar for all facilities, and included capital and recurrent costs. Capital costs included building, equipment, furniture and vehicles, but excluded land. Recurrent costs included salaries, drugs, supplies and utilities. The overhead costs of training and supervision were also included. Technical support by external agencies was excluded, as these were not required for the normal running of activities. Where resources were provided free to the health service, their cost was estimated using market prices and added to expenditure to estimate total cost. Some cost items in facilities were shared between TB and non-TB activities. Costs to TB were allocated on the basis of usage or activity rates, and labour costs were allocated using time estimated from interviews with staff. The methodology for allocating overhead and shared costs in hospitals is the standard 'step-down' methodology, as described in Drummond et al.[14]

In order to measure the cost-effectiveness from a societal perspective, we included the costs of different strategies to the patient and their families in addition to health service costs. We included all monetary costs, including payment for treatment and travel and miscellaneous expenses; the opportunity costs of time spent travelling to and receiving treatment were also included. We valued the opportunity cost of patient time by using a low-middle national income average in Egypt, and the responses of patients in Syria. Due to time limitations we did not estimate the monetary cost of hospitalisation in Egypt; however, as hospital time costs were expected to be significantly higher than the time costs of ambulatory care, it was anticipated that this would not affect the comparison of results. Both the costs to the patient and to the persons accompanying the patient to receive treatment were included.

Patient costs were measured using a facility-based survey and a stratified sample of patients beginning TB treatment in the second half of 1998. The sample was representative in terms of age, sex and area of residence. In both countries patients were selected from the sampled facilities and were interviewed at the point of receiving treatment. In Syria, we interviewed a total of 135 patients from 595 total cases beginning treatment nationally. In Egypt, we interviewed 150 patients from an estimated total of 2500 beginning treatment nationally. The two countries used slightly different methods to collect patient costs, as data collection tools were designed taking into account patient privacy considerations. However, as the objective of the study is to make comparisons within countries, these differences should not affect the end conclusions. In Syria, the monetary cost includes the complementary expenditure made in the private sector.

We only measured the direct benefits that accrue, as a result of treatment, to the patient or the health services. We chose cure rate as the main measure of effectiveness; this is equivalent to the WHO measure of successfully treated patients. The cure rate is defined as the proportion of those patients whose cure was confirmed by sputum examination and found to be negative for TB bacilli and those who complete a full treatment regimen. Data on cure rates for nationally and for sampled facilities were obtained from national programme records.

Cure rate captures the direct health benefits of TB treatment, but not the non-health benefits or indirect benefits to others. However, higher cure rates will result in less transmission of TB, a lower requirement for second-line treatment and less multidrug resistance (MDR: defined as resistance to at least H and R). The benefits from reduced transmission are significant, and can represent up to 82% of health benefits

from treatment.[2] Although we did not have sufficient information to model transmission for Egypt and Syria, we did make an estimate of the potential savings to the health service of the different treatment strategies, using an international model.[2] An estimate of seven cases prevented over 18.5 years per case cured was used, and future costs were discounted at a rate of 3%. Our estimate does not include the cost savings from reduced MDR or second-line treatment. We did not estimate the direct and indirect benefits of preventing chronic TB cases or investigate other possible benefits of the DOTS strategy, such as increases in the proportion of smear-positive in comparison to smear-negative and extra-pulmonary tuberculosis. Cost-effectiveness was calculated by dividing total incremental cost by cases cured, to reach an average incremental cost per case cured.

Three sensitivity analyses were conducted. The first tested the impact of the allocation of salary costs to TB and non-TB activities. This was necessary, as salary expenditure is a significant proportion of cost and there is always some uncertainty about the accuracy of responses from staff interviewed about how they spend their time (although all responses were cross-checked with supervisors and patient records). The salary costs were halved for the chest clinics and hospitals in Egypt, as the cost-effectiveness ratios were found to be reasonably close to those at the PHC level. The test was unnecessary for the Syrian results, as all activities in the clinics were related to TB, and therefore staff were not required to estimate the proportion of time allocated to TB. A second sensitivity analysis examined the different impact of sampled and national cure rates on the cost-effectiveness ranking for Egypt, as these differed considerably (Table 2), indicating that we may have chosen underperforming DOTS areas and over-performing non-DOTS areas. The third sensitivity analysis tested the cost-effectiveness ranking if average rather than incremental costs were used for the PHC level, as this assumption, although it reflects reality, may not apply if the PHC service becomes fully utilised.

RESULTS

Health service costs per case treated

The average incremental health service costs per case treated for each strategy are shown in Table 2. DOTS implemented through the PHC network is the cheapest strategy in Syria, costing under $200 per case treated. In Syria, non-DOTS (no strengthened supervision, training and programme management, self-administered short-course therapy) is considerably more expensive, at around $350. The main explanation for this difference is the considerable difference in diagnostic and not treatment costs. The move towards integration of TB treatment at the PHC level has meant that general diagnostic facilities are used to diagnose TB. The previous specialist clinics had relatively few TB patients for the investment in diagnostic services. Treatment costs do not change, because although observation involves increased numbers of visits, the average cost per visit is lower.

In Egypt, DOTS integrated through the PHC system is the lowest cost option, at $164 per patient treated. This compares to the near-equivalent cost of $166 for standard therapy—self-administered therapy delivered through a specialised clinic. This is similar to the situation in Syria, whereby the lower average cost of the PHC level compensates for the increased level of observation. Where DOTS is implemented through specialist clinics it is, unsurprisingly, considerably more expensive than non-DOTS, at around $350. Treatment with the initial phase in hospital is considerably more expensive than the ambulatory options, costing $900–$1000 per case treated.

Interestingly, in both countries supervision and management costs also do not differ substantially between the DOTS and non-DOTS areas. This is

Table 2 Average incremental health service costs (US$) per case treated

TB diagnosis and treatment strategies	Health service costs			
	Diagnosis/ confirmation of cure	Treatment initial phase	Treatment continuation phase	Total
Syria				
DOTS/PHC	49	115*	19*	183
Non-DOTS/SC	223	92	38	353
Egypt				
DOTS/PHC	27	86*	51*	164
DOTS/SC	26	219	102	347
DOTS/Hospital/SC	105	774	102	981
DOTS/Hospital/PHC	105	774	58	937
Non-DOTS/SC	46	73	47	166
Non-DOTS/Hospital/SC	123	774	47	944

* The difference in costs of PHC DOTS in Egypt and Syria is primarily explained by differing drugs costs in each of the countries.
DOTS = directly observed treatment, short-course; PHC = primary health care; SC = specialised clinics.

Table 3 Patient costs (US$) per case treated

TB diagnosis and treatment strategies	Country	Patient costs		
		Time*	Monetary†	Total
DOTS/PHC	Syria	23	18	41
Non-DOTS/SC	Syria	23	19	42
DOTS/PHC	Egypt	19	3	22
DOTS/SC	Egypt	69	5	74
DOTS/hospital/SC	Egypt	240	2	242
DOTS/hospital/PHC	Egypt	229	1	230
Non-DOTS/SC	Egypt	19	2	21
Non-DOTS/hospital/SC	Egypt	232	1	233

* Time converted into dollars using patient responses (Syria) and low-middle income average (Egypt).
† Monetary costs are all costs where payment was made by the patient; includes travel fares, drugs costs, etc.
DOTS = directly observed treatment, short-course; PHC = primary health care; SC = spceialised clinics.

Table 4 Treatment outome—% cases cured national/sampled

TB diagnosis and treatment strategies	Country	Cure rate* sampled facilities (%)	Cure rate* national (%)
DOTS/PHC	Syria	92	88
Non-DOTS/SC	Syria	57	68
DOTS/PHC	Egypt	72	83
DOTS/SC	Egypt	72	83
DOTS/hospital/SC	Egypt	72	83
DOTS/hospital/PHC	Egypt	72	83
Non-DOTS/SC	Egypt	63	64
Non-DOTS/hospital/SC	Egypt	79	64

* Cure rate = % of patients cure confirmed and those completing treatment whose cure was not confirmed.
DOTS = directly observed treatment, short-course; PHC = primary health care; SC = spceialised clinics.

because although DOTS may increase supervision and management, this too is integrated, with the districts becoming increasingly involved. In the non-DOTS area, visits and training, although less frequent, cost more, as they often involve central level TB-specific staff.

Patient costs per case treated

Patient costs display a similar pattern to health service costs (Table 3). In both countries, patient costs are equivalent in areas where DOTS is implemented through the PHC system and areas where non-DOTS is implemented through the specialist clinics. For DOT delivered through the PHC system the patient has to make small payments often, while for self-administered therapy through the specialist clinics the patient has to make large payments that are relatively infrequent. When short-course therapy is observed and delivered through specialist clinics, the cost to the patient increases, as this requires frequent and costly visits. Hospitalisation is the most expensive option for the patient; it consumes comparatively large amounts of patients' time, which has a high opportunity cost in terms of income forgone.

Treatment outcome

Treatment outcomes both nationally and for the study sample are shown in Table 4. In the study sample, TB treatment in DOTS clinics is found to be more effective than non-DOTS. DOTS achieves a cure rate of 92% in Syria and 72% in Egypt (the national picture for DOTS is 88% in Syria and 83% in Egypt), while non-DOTS clinics in both countries achieve cure rates of between 60–70%. As stated in the methodology, it must be noted that specific conclusions about directly observed treatment (DOT) cannot be drawn from this comparison, as DOTS includes improved management.

In Egypt, where DOT patients are hospitalised, there is no increase in effectiveness on a national scale. Effectiveness seems to be primarily determined by the strategy used in the continuation phase, with DOTS being more successful than non-DOTS. However, in our sample from non-DOTS areas, we found a high cure rate for hospitalisation followed by self-administration. This is due to the influence of one large hospital that was achieving exceptional results, supervising patients more frequently in the continuation phase.

Cost-effectiveness

We combined average incremental costs with sampled cure rates to arrive at an average incremental cost per case cured (Table 5). In both Egypt and Syria, the most cost-effective strategy is DOTS, implemented through the PHC system, which improves effectiveness without increasing the cost either to the health service or to the patient, compared to the other strategies in Egypt and Syria.

Comparing treatment delivery through specialist clinics, however, reveals that DOTS is less cost-effective than non-DOTS at this level. In this case, improvements in effectiveness are only gained at an increased cost to the health service and to the patient. In this circumstance, where strategies are more expensive but more effective, the essential question facing decision-makers is whether curing extra patients is worth the additional cost. In Egypt, we estimated that the additional cost of curing one extra patient, if specialist clinics adopt a DOTS strategy compared to non-DOTS, is $2605.

Table 5 also shows the calculation for reduction in future cost savings. Using the model described above, our estimates of future savings show that all of the ambulatory strategies result in savings, whereas the strategies involving hospitalisation in the initial phase result in a net cost. The greatest savings in both countries are from the DOTS strategy delivered through the PHC system: for every $1 dollar spent, DOTS delivered through the PHC system saves $7.

Table 5 Cost per patient cured (US$)

TB diagnosis and treatment strategies	Total cost per case treated (a)	Cost per case cured	Future cost savings per case treated (present value) (b)	Net savings per case treated (present value) (b − a)
Syria				
DOTS/PHC	224	243	1853	1629
Non-DOTS/SC	395	693	1052	657
Egypt				
DOTS/PHC	186	258	683	497
DOTS/SC	421	585	683	262
Non-DOTS/SC	187	297	600	413
DOTS/hospital/SC	1223	1699	683	(540)
Non-DOTS/hospital/SC	1177	1490	755	(422)
DOTS/hospital/PHC	1167	1621	683	(484)

DOTS = directly observed treatment, short-course; PHC = primary health care; SC = specialised clinics.

Sensitivity analysis

The results of the main sensitivity analyses can be seen in Table 6. The first sensitivity analysis, halving the salary cost at the chest clinic, results in a change of cost-effectiveness ranking. Non-DOTS provided at the chest clinic level in Egypt becomes the most cost-effective option, with a cost per case cured of $241. However, taking into account the future prevention of cases, it is likely that in the long-term PHC DOTS remains the best option, as it will still generate the highest net savings due to its higher effectiveness. The second sensitivity test, using national cure rates in Egypt, increases the cost-effectiveness of the DOTS alternatives, with cost per patient cured with DOTS implemented at the PHC level costing $224 instead of $258. Therefore, the ranking of the alternatives did not change. The third test found that using average costs instead of average incremental costs for PHC activities lowers their cost-effectiveness. In Egypt, the cost per patient cured rises to $292, and in Syria it rises to $420. However, despite this increase there is no change in the ranking of alternatives. Nevertheless, it must be noted that in Egypt the cost-effectiveness of DOTS at the PHC level and self-administration at the chest clinic level ($297) are very similar.

DISCUSSION

The results of this study clearly show that DOTS implemented through the PHC system is the most cost-effective strategy in Egypt and Syria, compared to the alternatives evaluated. It increases effectiveness without increasing costs, compared to the previous non-DOTS self-administered strategies where treatment was delivered through specialist clinics and hospitals. The move in these countries towards DOTS implemented through the PHC level and away from a situation of self-administered therapy at specialist clinics and hospitals is therefore likely to improve the cost-effectiveness of TB treatment.

Most of the gains on the cost side are made from integration. Integrating DOTS into the PHC system reduces health service costs compared to DOTS at specialised clinics or hospitals. This finding applies

Table 6 Sensitivity analysis

TB diagnosis and treatment strategies	Cost per case cured			
	Cost per case cured	Halving salary cost at clinics—Egypt	National cure rates	Average costs at PHC level
Syria				
DOTS/PHC	243	NA	381	420
Non-DOTS/SC	693	NA	695	NA
Egypt				
DOTS/PHC	258	NA	224	292
DOTS/SC	585	414	507	NA
Non-DOTS/SC	297	241	292	NA
DOTS/hospital/SC	1699	NA	1473	NA
Non-DOTS/hospital/SC	1490	NA	1403	NA
DOTS/hospital/PHC	1621	NA	1839	NA

DOTS = directly observed treatment, short-course; PHC = primary health care; SC = specialised clinic.

whether average or average incremental costs are used. It also includes the costs of supervision, which did not increase, as programme management was incorporated into district management, rather than a national to district/region supervision structure whereby supervisors had to travel long distances to each specialised clinic. Despite the increased number of visits, average patient costs are also lower for DOT at the PHC level than at specialist clinics and hospitals. The patient therefore also gains from integration, as services are brought closer to home.

On the effectiveness side, the gains are likely to come from DOTS and do not appear to be affected by integration. Both in our sample and nationally, DOTS has achieved a substantially higher cure rate than the previous self-administered non-DOTS strategies in both Egypt and Syria. As we saw no difference in effectiveness of DOTS at the PHC level in Egypt compared to DOTS implemented at the specialist clinic or hospital level, integration is probably not a factor in improved effectiveness. However, we cannot draw any conclusions from our comparisons about whether the increased effectiveness associated with DOTS is due to higher rates of observation or improved programme management resulting in improvements in service quality. We do know, however, that patient costs were unlikely to be a factor, as they remained similar in DOTS and non-DOTS settings. In Egypt, a reduction in the length of treatment may also be a factor, as implementing DOTS involved a change from standard to short-course therapy.

Comparing DOTS with non-DOTS at the chest clinic level in Egypt illustrates the potential cost increase associated with observation where integration does not take place. In Egypt, where DOTS is delivered through specialist clinics, it was found to be less cost-effective than self-administration. Moving from monthly visits to DOTS increases the number of visits five-fold (from approximately 10 visits to 50), therefore, as no assumption of excess capacity was made, also increasing the incremental average cost five-fold. By comparison, cure rates are only increased by 20%. In these circumstances, although DOTS increases effectiveness, it increases costs by a greater proportion, and reduces the overall cost-effectiveness of TB treatment.

In part as a result of these findings, both countries have continued with their national expansion of DOTS. In addition, the programmes have further re-examined the different institutions involved in DOTS. In Egypt, delivery of DOTS through the chest clinics is being reduced to minimum, and is only permitted where the PHC system is not functioning. In addition, further studies have been commissioned to evaluate the efficiency and management of specialist clinics in general. These studies will assess whether the resource management in clinics can be improved and average costs reduced. In Syria, the role of the TB centres is also being re-examined, where it is expected that average costs are likely to rise further as a consequence of the reduced level of activity as TB treatment is moved to the PHC system.

The evidence provided by this study has also been used by the Egyptian National Tuberculosis Programme to encourage hospital managers, insurance organisations and clinicians to adhere to the standard protocols, and therefore to accept hospital admission only for the more serious TB cases. If hospital admission can be reduced, substantial savings should be generated to the health services, insurance organisations and patients. Finally, in the future, when DOTS is expanded, it may be advisable for the programme to ask whether the high rates of effectiveness achieved can be done so at a lower cost still, by reducing the level of observation at the PHC level, whilst maintaining effectiveness.

CONCLUSIONS

This study illustrates that the move towards DOTS integrated at the PHC level has substantially improved the effectiveness of TB treatment in Egypt and Syria, without substantially increasing costs. It confirms the predictions of previous models that countries moving away from hospital-based or self-administered specialised clinic-based treatment to PHC-based DOTS are likely to see improvements in the cost-effectiveness of TB treatment. On the cost side, most of the gains come from moving to integrated ambulatory care, and on the effectiveness side from DOT and/or improved quality resulting from programme management. This study cannot help us to draw any conclusions about observation or any other specific aspect of DOTS per se. This cost-effectiveness analysis has been successfully used by both NTPs to expand DOTS and has ensured that its implementation takes into account limited resources and local health service infrastructure.

References

1 World Health Organization. World Health Report 2000. Health systems: improving performance. WHO/CDS/ 2000.275. Geneva: WHO, 2000.

2 Murray C J L, DeJonghe E, Chum H J, Nyangulu D S, Salomao A, Styblo K. Cost effectiveness of chemotherapy for pulmonary tuberculosis in three sub-Saharan African countries. Lancet 1991; 338: 1305–1308.

3 Floyd K, Wilkinson D, Gilks C. Comparison of cost effectiveness of directly observed treatment (DOT) and conventionally delivered treatment for tuberculosis: experience from rural South Africa. BMJ 1997; 315: 1407–1411.

4 Fryatt R J. Review of published cost-effectiveness studies on tuberculosis treatment programmes. Int J Tuberc Lung Dis 1997; 1: 101–109.

5 Barnum H N. Cost savings from alternative treatments for tuberculosis. Soc Sci Med 1986; 23: 847–850.

6 Sawert H. Cost analysis and cost containment in tuberculosis control programmes: the case of Malawi. WHO/TFHE/96.1. Geneva: WHO, 1996.

7 Chunhaswasdikul B, Kamalratanakul P, Jittinandana A, Tang-

charoensathien V, Kuptawintu S, Pantumabamrung P. Anti-tuberculosis programs in Thailand: A cost analysis. Southern Asian J Trop Med Public Health 1992; 23: 195–199.
8 Ahlburg D. The economics impacts of tuberculosis. WHO/CDS/STB/2000.5. Geneva: WHO, 2000.
9 Murray C, Styblo K, Rouillon A. Tuberculosis. Disease control priorities in developing countries. A World Bank Book. Oxford: Oxford Medical Publications, 1993.
10 Migliori G B, Khomenko A G, Punga V V, et al. Cost-effectiveness analysis of tuberculosis control policies in Ivanovo oblast, Russian Federation. Bull World Health Organ 1998; 76: 475–483.
11 Saunderson P R. An economic evaluation of alternative programme designs for tuberculosis control in rural Uganda. Soc Sci Med 1995; 40 : 1203–1212.
12 Sawert H, Kongsin S, Payanandana V, Akarasewi P, Nunn P, Raviglione M C. Cost and benefits of improving tuberculosis control: the case of Thailand. Soc Sci Med 1997; 44: 1805–1816.
13 Joesoef M R, Remington P L, Tjiptoherijanto P. Epidemiological model and cost-effectiveness analysis of tuberculosis treatment programmes in Indonesia. Int J Epidemiol 1989; 18: 175–179.
14 Drummond M F, O'Brien B, Stoddart G L, Torrance G W. Methods for the economic evaluation of health care programmes. 2nd ed. Oxford, UK: Oxford Medical Publications, 1997.
15 Floyd K. Generic protocols for cost en cost-effectiveness analysis of tuberculosis diagnosis and treatment services. WHO/CDS/CPC/TB99.261. Geneva: WHO, 1999.

RÉSUMÉ

CONTEXTE : Les Programmes Nationaux de Tuberculose en Egypte et en Syrie.
OBJECTIFS : Calculer les coûts et efficiences de différents types de mise en œuvre de la lutte antituberculeuse en Egypte et en Syrie afin d'illustrer les facteurs influençant le rapport coût-efficience du traitement de la tuberculose dans des pays à revenus moyens.
SCHÉMA : Nous avons comparé en Egypte et en Syrie les coûts et les taux de guérison de la stratégie du traitement directement observé de courte durée (DOTS) recommandée par l'Organisation Mondiale de la Santé ainsi que les mêmes données pour des stratégies alternatives. L'étude a concerné les coûts à la fois pour les services de santé et pour le patient.
RÉSULTATS : Les rapports coût-efficience du DOTS mis en œuvre par le système de soins de santé primaire (PHC) ont été en Egypte et en Syrie, respectivement, de $258 et de $243 par patient guéri. Ceci se compare à un coût par patient guéri de $297 (Egypte) et de $693 (Syrie) pour les stratégies alternatives mises en œuvre au travers de dispensaires spécialisés. En Egypte, lorsque le DOTS est mis en œuvre dans des dispensaires thoraciques spécialisés, il coûte $585 par patient guéri. L'hospitalisation coûte toutefois respectivement $1.490, $1.621 ou $1.699 par patient guéri selon le type d'administration du traitement dans la phase de continuation.
CONCLUSION : Cette étude démontre que le transfert du DOTS par intégration au niveau des soins de santé primaires a amélioré substantiellement l'efficience du traitement TB en Egypte et en Syrie sans augmenter notablement les coûts. Une analyse des différents coûts et efficiences des diverses variantes des stratégies du traitement TB a permis d'une part aux Programmes Nationaux de Tuberculose d'étendre le DOTS et d'autre part de le mettre en œuvre d'une manière qui tienne en compte ses limitations de ressources et des systèmes de santé locaux.

RESUMEN

MARCO DE REFERENCIA: El Programa Nacional de Tuberculosis en Egipto y Siria.
OBJETIVO: Se calcularon los costos y la eficacia de vías alternativas de implementación del control de la tuberculosis (TB) en Egipto y Siria, para ilustrar los factores que influyen sobre la relación costo-eficacia del tratamiento de la TB en los países de ingresos medios.
DISEÑO: Comparar en Egipto y Siria los costos y las tasas de curación de la estrategia de tratamiento directamente observado de corta duración (DOTS) recomendada por la Organización Mundial de la Salud (OMS) y de estrategias alternativas. El estudio incluyó los costos tanto para los servicios de salud como para el paciente.
RESULTADOS: En Egipto y Siria, la relación costo-eficacia del DOTS implementado a través de la atención primaria de salud (PHC) era de $258 y $243 por paciente curado, respectivamente. Esto se compara al costo por paciente curado de $297 (Egipto) y $693 (Siria) para las estrategias alternativas implementadas a través de dispensarios especializados de enfermedades respiratorias. En Egipto, cuando el DOTS se implementa a través de dispensarios especializados, cuesta $585 por paciente curado. El costo de hospitalización es de, ya sea $1.490, $1.621 ó $1.699 por paciente curado, dependiendo del tratamiento administrado durante la fase de continuación.
CONCLUSIÓN: Este estudio demuestra que el cambio hacia el DOTS integrado al nivel PHC ha mejorado substancialmente la eficacia del tratamiento de la TB en Egipto y Siria, sin aumentar notablemente los costos. Un análisis de los diferentes costos y eficacias de diversas estrategias de tratamiento de la TB ha permitido a los Programas Nacionales de Tuberculosis extender el DOTS e implementarlo de una manera que tome en cuenta la limitación de los recursos y los sistemas locales de salud.