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Cost Analysis of Tuberculosis Directly Observed Treatment Strategy at Chest Dispensaries in Egypt

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ABSTRACT

Background: *The study aimed to help the National Tuberculosis Control Program in promotion of DOTS strategy in Egypt. The specific objectives were to calculate the annual costs per TB case treated and TB case cured at the chest dispensary service delivery mode.*

Materials and Methods: *The study was conducted in El-Dakahlia governorate at 5 chest dispensaries and the cross-sectional analytic research design was utilized to investigate the current research issue. As a prerequisite for the proper research design a survey of literature has been carried out and covered the various methodological approaches of epidemiological and health economics investigations. Also, an exploratory study was carried out during the research-planning phase. Four different types of data collection instruments were used (Clients' Flow, Capital, Recurrent, and Outcome Questionnaires) to collect the required data.*

Results: *Analysis of data revealed that the annual costs per treated TB case and cured TB case were LE 157±150 and 198±190 respectively.*

Conclusion: *The study concluded that the implementation of DOTS strategy required more resources than the routinely managed chest cases at the studied units. Recurrent cost was the most important element in the calculation of the final cost per outcome ratios especially those of drugs and chemicals followed by the annualized capital and personnel costs. We recommended the decision makers to conduct more studies at the different geographical areas and service delivery modes to get the full picture of DOTS strategy implementation in Egypt for future development and improvement.* ***(Tanaffos 2004; 3(11): 45-54)***

Key words: *Cost analysis, Tuberculosis, DOTS (Directly Observed Treatment Short Course)*

INTRODUCTION

Globally tuberculosis (TB) continues to be a major cause of disability and death. It has been estimated that one third of the worlds population is infected with the TB bacillus (1). Every year eight million people become sick and over two million people die from TB. The vast majority of these people live in developing countries, with profound implications for the economy of families, communities and nations. On average, a TB patient loses three to four months of work time, equivalent to 20-30% of annual household income. TB not only exacts a heavy cost on health and social services, the whole economy suffers because 75% of TB patients are men and women in the most economically active age group- between 15 and 54 years. The workforce is reduced productivity falls, revenues drop and

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markets are lost (2).

Morel clarified that there is a continuing need for tuberculosis research both to maximize the use of existing tools and strategies and to develop new and better ones to reduce its high burden. Meanwhile, global investment in research on infectious diseases that mainly affect the poor is a drop in the ocean in relation to the high disease burden involved (3).

The forty-fourth World Assembly (1991) recognized the growing importance of TB as a public health problem and the potential for cost-effective control using currently available tools (4).

TB is responsible for considerable direct and indirect costs on individuals and society. The economic dimension of TB control relates to reduction of these costs, alleviation of poverty and promotion of development (5).

The modern National Tuberculosis Program is based on the DOTS strategy (Directly Observed Treatment, Short-Course), promoted by the World Health Organization. This strategy has been based on the experience of the "International Union Against Tuberculosis and Lung Diseases" (IUATLD) and its partners (6).

The five elements of the DOTS strategy, considered essential for global TB control are: political commitment, case detection using sputum microscopy among persons seeking care for prolonged cough, standardized short course chemotherapy under proper case-management conditions including directly observed treatment, regular drug supply, and a standardized recording and reporting system that allows assessment of individual patients as well as overall program performance (7).

Maher et al. pointed out that an effective implementation of the DOTS strategy saves lives through decreased TB transmission, decreased risk of emergence of drug resistance, and decreased risk for individual TB patients of treatment failure, TB relapse, and death (8).

The strategy of DOTS has proven to be an effective control method for tuberculosis since the early 1990s. Certain factors that can aggravate the epidemiological situation of tuberculosis, such as population growth, urbanization and the HIV epidemic, are emerging simultaneously. Therefore, there is an urgent need to expand DOTS, especially in countries with a high prevalence of tuberculosis (9).

DOTS is considered as one of the most cost-effective controlling strategies due to the fact that it considerably lowers the indirect costs of TB to patients and it does not always need more funds- but rather reallocation of funds from currently less cost-effective programs. It can also halve the current potential national economic loss from TB; and it has a higher probability of treatment success and reduced probability of relapse (10).

Unfortunately, DOTS expansion is not proceeding at a rate rapid enough to achieve the global targets for 2005, and at the current rate of expansion these targets will not be reached before 2013. millions of TB sufferers worldwide are being denied effective treatment because DOTS is not available in their area. A massive scaling up of current efforts and innovative ways of motivating all possible contributors to the fight against TB are necessary in order to meet our targets (11).

The most commonly identified DOTS expansion constraints were a paucity of resources, a lack of qualified staff, a lack of management skills, and weak laboratory networks. The low access to health care services is a serious obstacle to achieving countrywide DOTS coverage. The private health care sector is unregulated is most countries and commonly does not comply with DOTS standards health sector reform. The decentralization of TB control activities was identified as a constraint. For each constraint identified, most national TB control programs have begun to implement activities to overcome them, generally through training, advocacy, and establishment of a laboratory network (12).

Tuberculosis is considered as the second most important public health problem in Egypt, after Bilharziasis. The Ministry of Health and Population (MOHP) has established the National Tuberculosis Control Programme (NTP) in 1979, it is a detailed plan of action for effective TB control. NTP current strategy for TB control is to provide standardized short- course chemotherapy (SCC) under direct observation at least during the initial phase of treatment to, at least, all identified smear-positive TB cases. Every year, NTP registers more than 12,000 new TB patients; with 6,000 of them having smear-positive pulmonary TB. Based on the annual risk of infection of 0.32%, it is estimated that another 6-8,000 people develop TB annually and could be detected outside the facilities of MOH. Concerning the magnitude and trend of tuberculosis in Egypt, there have been 4 national surveys in years 1951, 1982, 1997, and 2003; the incidence rate per 100k of population was 350, 70, 32 and 28 respectively, (13).

Yates showed that cost analyses are critically important for deciding how to allocate funds within a program and understanding the relationships between costs and outcomes (14). Examining cost figures for parts of the program is a basic form of cost analysis.

WHO added that a cost analysis is useful for assessing the affordability of a program (e.g. by comparing costs with the budget available for tuberculosis services or for the health sector as a whole), and guiding budgetary planning (12). Analysis of costs is also useful for assessing what the costs of expanding or contracting a particular service, program or intervention might be.

Sinanovic showed that in the economic sense, costs are the resources used up by the program. Costs are usually broken down into recurrent and capital costs. Recurrent costs refer to those resources used during the course of the year and that are purchased regularly (e.g salaries, contraceptives, maintenance). Capital costs relate to those resources that last longer than a year (e.g. building, vehicles, initial training) (15).

Seita (16) clarified that TB control program managers have to differentiate between two approaches: the program approach and the research approach. The former is dogmatic while the latter is flexible. At EMRO, they took the dogmatic rather than the research approach when they started DOTS promotion in 1995. DOTS all over was achieved in 20 countries by the end of 2001. Interestingly, the more progress we made in the dogmatic approach, the more we realized the importance of the research approach. He concluded that:

1. TB Operational Research (OR) should be initiated from program managers based on their needs;
2. A link between DOTS manages and national academic societies is a must for the implementation of OR;
3. A link between these national groups and international research facilities is critical to ensure the high quality of OR.

This triangle-program manager/ national academic society/ international research facility- is the key for successful OR.

STUDY OBJECTIVES

General Objective

The study aimed to help the National Tuberculosis Control Program in promotion of DOTS strategy at the service delivery level by economic evaluation of an important TB program outcome in Egypt.

Specific Objectives

The specific objectives of the study were to calculate the annual cost per TB case treated and TB case cured by DOTS strategy at the chest dispensary service delivery level.

MATERIAL AND METHODS

The study was conducted in El-Dakahlia Governorate at 5 chest dispensaries namely Aga, El-Sinbellawin, Mit-Ghamr, Belquas and Nabrooh. El-Dakahlia governorate has been chosen by the simple

random sampling technique from the sampling list of the 26 governorates of Egypt. It is located in Lower Egypt with a total population of 4.726.718 million and it has 5 chest units (Dispensaries), 6 chest hospitals and 376 primary health care units (13).

As a prerequisite for the proper research design a survey of literature has been carried out and covered the various methodological approaches of epidemiological and health economics investigation essentially the cost analysis of infectious diseases. Also, an exploratory study was carried out during the research-planning phase to examine the delivery of anti-tuberculosis services at the various types of primary health units.

The cross-sectional analytic research design was utilized to investigate the current research issue. The sampling design involved all the chest dispensaries in El-Dakahlia governorate (5 primary sampling units). The capital, recurrent and outcome elements of those units have been included in the study. Also, all the registered TB cases of those units were included and a sample size of 50 non-TB chest cases has been recruited from each primary sampling units for the clients' flow analysis part of the study i.e. 250 non-TB chest cases.

The study variables were classified into inputs, process and outcome elements as following:

I. Inputs (Cost Elements): capital variables (land, buildings, equipment) and recurrent variables (personnel, materials, supplies, consumable commodities, transportation, communications, and miscellaneous).
II. Process Elements: clients' flow within the study unit.
III. Outcome Elements: output (number of TB cases treated) and effect (number of TB cases cured).

The above-mentioned variables were obtained through the following study forms:

Form (a): Capital Costs Questionnaire
Form (b): Recurrent Costs Questionnaire
Form (c): Outcome Questionnaire
Form (d): Clients' Flow Analysis

Different approaches (record analysis interviewing, and direct observation) have been used to collect the required data and their quality were be ensured through a variety of mechanisms.

The collected data were computerized and sufficient statistical analysis has been made.

The data analysis involved the following steps:

I. Analysis of clients' flow within the study chest dispensaries to determine the cost allocation factor of tuberculosis and non-tuberculosis cases.
II. Capital costs analysis: Annualizing capital costs followed the following approach: estimate the expected years of useful life of the capital item; identify the purchase price new of the capital item; read off the relevant annualization factor for the expected years of useful life and discount rate chosen from annualization factor tables; and divide the purchase price new (i.e. current replacement cost) by the annualization factor identified from annualization factor tables (17).
III. Recurrent Cost analysis:
   1. Personnel: The sum of the total annual salaries, wages, bonuses and fringe benefits of all the units' staff were measured, allocated to DOTS services and analyzed
   2. Materials and Supplies: The market price of each consumable commodity was obtained allocated to DOTS services and analyzed.
   3. Travel and Transportation: The annual costs of travel and operating and maintaining vehicles were obtained, allocated to DOTS services, and analyzed.
   4. Other Direct Costs (communication and miscellaneous): the annual cost of the followings was obtained, allocated to DOTS, and analyzed:
IV. Total cost Analysis: the sum of the annual recurrent and capital costs allocated for DOTS strategy at each study unit have been calculated.
V. Outcome Analysis: The total annual numbers of TB case treatment and cured were obtained for the subsequent analysis. Also, the total number of non-TB chest cases was obtained, thereafter; the cost allocation factors have been determined.
VI. Cost per Outcome Ratios: This part of the

analysis involved the construction of two indicators, namely, the annual cost per TB case treated and the annual cost per TB case cured, it's done by relating the total annual costs to the output and effect indicators respectively.

RESULTS AND DISCUSSION

Table 1 and 2 showed the results of clients' flow analysis (TB cases and Non-TB chest cases). It is observed that the average total time (minutes) of TB cases at the studied units Aga (73.6±15.18),El-Sinbellawin (87.3±20.19), Mit-Ghamr (62.1±20.87), Belquas (96.1±21.2), and Nabrooh (90.2±17.2) was much longer than the non-TB chest case of the same units Aga (55.55±15.4), El-Sinbellawin (63.48±27.82), Mit-Ghamr (48.68±15.76), Belquas (67.0±20.4) and Nabrooh (64.4±18.8) respectively. The American Lung Association pointed out that introducing DOTS might initially increase costs to the health services depending upon the program it is replacing (10). Also, it's clear that DOTS required more activities and services to be performed by the study units and in turn consuming more time than the other types of patients. This finding addresses the importance of in-service training of all staff on the newly DOTS strategy for proper utilization of the currently available human and non- human resources.

Table 3 clarified the percent distribution cost-allocation factors among the studied chest dispensaries. The values of these factors, for DOTS strategy were 0.79% (Aga), 1.67% (El- Sinbellawin), 0.73% (Mit-Ghamr), 1.66% (Belquas), and 0.77% (Nabrooh). While, the equivalent values for the non-TB activities were 99.21% (Aga), 98.33% (El-Sinbellawin), 99.27% (Mit-Ghmar), 98.34% (Belquas), and 99.23% (Nabrooh). Given that the current incidence of TB in Egypt is about 28/100K (13), such findings indicated a very low utilization rate of tuberculosis cases by the current MOH services and we need more efforts to improve this problem.

Table 4 showed the distribution of capital, recurrent and total costs allocated for TB cases among the studied chest dispensaries. It's clear that recurrent costs are the most important element in the final costs estimate of DOTS strategy. The annual values of recurrent costs of the units were LE 7486.79 (Aga), 12817.4 (El- Sinbellawin), 9382.31 (Mit-Ghamr), 9030.63 (Belquas), and 6512.98 (Nabrooh). Also, it's very obvious that the annual values of drugs and chemicals occupied the top rank of the various costing elements.

Table 1. Time flow analysis (minutes) of tuberculosis cases within the studied chest dispensaries [A]

Chest unit / Activity	Aga (X±SD)	El-Sinbellawin (X±SD)	Mit-Ghamr (X±SD)	Belquas (X±SD)	Nabrooh (X±SD)
Waiting for Ticket	5.8±6.5	7.4±8.1	5.3±5.85	8.1±8.7	6.7±7.24
Ticket Obtaining	2.9±0.99	3.8±0.79	2.7±0.67	4.3±0.95	3.6±0.97
Waiting for examination	9.9±5.9	11.6±6.38	7.9±4.63	13.6±7.5	11.2±6.37
First examination	7.6±1.6	8.9±1.52	6.6±1.17	10.2±1.7	9.7±1.89
Laboratory investigation	5.4±4.0	6.5±4.72	4.7±3.43	7.1±5.1	6.8±5.01
Waiting for Results	12.8±9.1	13.6±9.56	10.1±7.03	14.6±10.1	13.9±9.75
X-Ray Investigation	4.7±3.4	5.8±4.18	3.8±2.74	6.2±4.3	6.3±4.47
Waiting for Results	10.4±7.4	11.5±8.21	9.0±6.51	13.1±9.2	11.5±8.14
Second Examination	5.8±1.1	7.4±0.97	4.7±1.76	7.6±0.84	8.6±1.26
Waiting for Drug Obtaining	2.0±2.6	2.4±3.13	1.7±2.2	2.8±3.65	3.3±4.32
Drug obtaining	2.9±0.99	4.0±1.05	2.4±0.52	3.7±0.67	3.5±1.08
Drug Taking	3.4±1.1	4.4±0.84	2.9±0.74	4.8±1.14	5.1±1.2
Total time Per Visit	**73.6±15.18**	**87.3±20.19**	**62.1±20.87**	**96.1±21.2**	**90.2±17.2**

[A] Fifty TB patients visit per chest dispensary

Table 2. Time flow analysis (minutes) of non-tuberculosis cases within the studied chest dispensaries [B]

Chest unit / Activity	Aga (X±SD)	El-Sinbellawin (X±SD)	Mit-Ghamr (X±SD)	Belquas (X±SD)	Nabrooh (X±SD)
Waiting for Ticket	5.45±7.03	6.08±7.74	5.28±6.87	7.0±8.4	6.0±7.7
Ticket Obtaining	2.78±0.83	3.5±0.99	2.63±0.63	3.68±0.9	3.7±0.92
Waiting for examination	8.98±6.82	10.23±7.08	7.85±5.81	10.5±7.6	10.1±7.4
First examination	10.13±3.16	11.53±2.69	8.73±2.4	12.2±2.6	11.4±2.8
Laboratory investigation	2.78±3.56	3.45±4.38	2.38±3.02	3.65±4.59	3.7±4.6
Waiting for Results	6.78±8.44	7.4±9.21	5.83±7.27	7.78±9.68	7.6±9.4
X-Ray Investigation	2.58±3.54	3.13±4.18	2.18±2.94	3.45±4.63	3.4±4.5
Waiting for Results	5.28±7.25	6.13±8.28	4.7±6.39	6.45±8.72	6.1±8.2
Second Examination	4.4±2.9	4.43±4.08	3.28±2.5	4.75±3.61	4.9±3.7
Waiting for Drug Obtaining	3.13±3.43	3.73±3.93	2.63±2.8	3.68±3.93	3.8±4.0
Drug obtaining	3.23±0.77	3.9±1.01	2.75±0.71	3.9±0.93	3.9±0.97
Total time Per Visit	**55.55±15.4**	**63.48±27.82**	**48.68±15.76**	**67.0±20.4**	**64.4±18.8**

[B] Fifty Non-TB patients visit per chest dispensary

Table 3. Distribution of cost-allocation factors among the studied chest dispensaries

Chest unit / Variable	Aga (X±SD)	El-Sinbellawin (X±SD)	Mit-Ghamr (X±SD)	Belquas (X±SD)	Nabrooh (X±SD)
Average total time per TB visit	73.6±15.18	87.3±20.19	62.1±20.87	96.1±21.2	90.2±17.2
No. of TB patients (per year)	51	103	86	84	24
Average total time per Non- TB visit	55.55±15.4	63.48±27.82	48.68±15.76	67.0±20.4	64.4±18.8
No. of Non-TB cases (per year)	8510	8357	14882	7140	4355
TB cost allocation factor (%)	0.79	1.67	0.73	1.66	0.77
Non-TB cost- allocation Factor (%)	99.21	98.33	99.27	98.34	99.23

Table 4. Distribution of total cost allocated for tuberculosis cases among the studied chest dispensaries

Chest unit / Element	Aga		El-Sinbellawin		Mit-Ghamr		Belquas		Nabrooh	
	Value (L.E.)	(%)	Value (L.E.)	(%)	Value (L.E.)	(%)	Value (L.E.)	(%)	Value (L.E.)	(%)
A-Capital Cost										
Land	52.55	0.65	222.19	1.7	259.0	2.64	61.84	0.67	30.73	0.47
Building	30.1	0.37	73.27	0.5	41.86	0.43	28.75	0.31	8.89	0.14
Medical Equip	474.09	5.9	265.96	1.99	116.29	1.19	99.63	1.08	0.52	0.01
Furniture	1.95	0.02	18.43	0.14	6.34	0.06	2.51	0.03	0.94	0.01
Subtotal	558.69		579.85		423.49		192.73		41.08	
B-Recurrent Cost										
Personnel Salaries	267.1	3.32	2354.85	17.58	703.13	7.17	597.37	6.48	174.96	2.67
Personnel Incentives	48.73	0.61	434.87	3.25	127.3	1.3	111.7	1.2	30.30	0.46
X. Ray	102.7	1.28	282.23	2.1	109.14	1.1	258.96	2.8	80.08	1.2
Drugs & Chemicals	7053.09	87.7	9728.02	72.6	8434.6	86.0	8048.5	87.3	6220.9	94.9
Consumable Commodities	1.9	0.02	5.41	0.04	2.05	0.02	3.17	0.03	1.23	0.02
Utilities	13.27	0.16	12.02	0.09	6.13	0.06	10.96	0.12	5.54	0.08
Subtotal	7486.79		12817.4		9382.31		9030.63		6512.98	
Total	**8045.48**		**13397.25**		**9805.8**		**9223.36**		**6554.06**	

Table 5 showed the outcome indicators of the studied chest dispensaries. It is clear that the highest output number of TB case treatment can be observed in EL-Sinbellawin unit and the lowest one (24) was found Nabrooh unit. While, the best TB cure rate has been achieved by Aga unit (85%) and least effective one was Nabrooh unit (76%). Such as important difference in cure rate (9%) between the two units may address the importance of the qualitative aspect of DOTS strategy to be considered by the service providers and call for more technical supervision from mid and high level administrators to detect and correct the defective aspects in service deliveries. The world health Organization (2001) clarified that rapid and effective implementation of DOTS can save literally millions of lives over the next 20 years but the challenge is to balance the urgent need for DOTS expansion with the equally important need to ensure the quality of services. A poorly implemented program is worse than no program at all (18).

The distribution of annual cost per TB case treated among the studied chest dispensaries was LE 157.75 (Aga), 130.07 (El-Sinbellawin), 114.02 (Mit-Ghamr), 109.80 (Belquas), and 273.09 (Nabrooh); while the overall average was 157±150. Meanwhile, the distribution of the annual cost per TB case cured was LE 187.10 (Aga), 163.38 (El-Sinbellawin), 136.19 (Mit-Ghamr), 139.75 (Belquas), and 364.11 (Nabrooh); the overall average was 198±190 (Table 6).

One may argue that there is an observed variation of the studied units' cost among the different chest units. These differences reflected important differences in the costs and outcome aspects of the studied ratios. This finding may indicate the great potential for cost savings by maximizing the outcome and/ or minimizing the wasting in inputs.

Table 5. Outcome of TB control activities at the studied chest dispensaries

Outcome / Chest unit	Aga	El-Sinbellawin	Mit-Ghamr	Belquas	Nabrooh
Treated TB cases (No.)	51	103	86	84	24
Cure TB cases (No.)	43	82	72	66	18
Cure Rate %	85	80	84	79	76

Table 6. Cost per outcome ratios of TB control activities at studies chest dispensaries

Cost (LE) per outcome ratio / Chest unit	Aga	El-Sinbellawin	Mit-Ghamr	Belquas	Nabrooh	Total (X±SD)
Cost per annually treated TB case	157.75	130.07	114.02	109.80	273.09	157±150
Cost-per annually cured TB case	187.10	163.38	136.19	139.75	364.11	198±190

CONCLUSIONS AND RECOMMENDATIONS

The study concluded that the implementation of DOTS strategy required more resources than the routinely managed chest cases at the studied units. Recurrent cost was the most important element in the calculation of the final cost per outcome ratios especially those of drugs and chemicals followed by the annualized capital and personnel costs.

Also, important variations have been observed among the studied chest units regarding the cure rates and units' costs, which may be contributed to the offered DOTS quality, inadequate technical supervision and improper utilization of the available resources.

We recommended the decision makers to conduct more studies at the different geographical areas and service delivery modes to get the full picture of DOTS strategy implementation in Egypt for future development and improvement.

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