Assessment of tuberculosis situation in Cairo governorate from 2006 to 2012 after application of directly observed therapy short-course strategy

Sherif A. Eissa, Ali A. Okab, Tarek S. Essawy, Eman A. El Ghany

Background Directly observed therapy short course (DOTS) is a strategy in which a trained healthcare worker or a designated individual provides the prescribed antituberculous drugs and watches the patient to ensure the patient is taking each dose.

Aim The objective of this work was to study tuberculosis situation in Cairo governorate from 2006 to 2012 after application of DOTS.

Methodology This was a retrospective clinical cohort study carried out at the Cairo governorate.

Results Percentages of cure and complete treatment were 61.6 and 20.4%, respectively. The incidence of failure, death, default, and transfer out decreased after DOTS (2.2, 4.5, 8.6, and 2.7, respectively).

Conclusion The introduction of DOTS in the Cairo governorate has led to a treatment success rate of 82% (nearly similar to the WHO target of '85%'). *Egypt J Broncho* 2016 10:52–57

Egyptian Journal of Bronchology 2016 10:52–57

Keywords: Cairo, DOTS, tuberculosis

Department of Chest Diseases

Correspondence to Tarek S. Essawy, MD, Benha University Hospital, Benha, Egypt
E-mail: tarek.essawy@yahoo.com

Received 24 June 2015 **Accepted** 28 July 2015

Introduction

Tuberculosis (TB) remains to be a major global health problem. It causes ill-health among millions of people each year and ranks as the second leading cause of death from an infectious disease worldwide, after the HIV. The latest estimates included in this report are that there were 8.6 million new TB cases in 2012 and 1.3 million TB deaths (1.0 million deaths among HIV-negative individuals and 0.3 million HIV-associated TB deaths). Most of these TB cases and deaths occur among men, but the burden of disease among women is also high [1].

The new post-2015 global TB strategy aims to end the targets to reduce TB deaths by 95% and to cut new cases by 90% between 2015 and 2035, and to ensure that no family is burdened with the catastrophic expenses due to TB.

The resolution calls on governments to adapt and implement the strategy with high-level commitment and financing. It reinforces a focus within the strategy on serving populations highly vulnerable to infection and poor healthcare access, such as migrants [2].

Directly observed therapy short course (DOTS) is a strategy in which a trained healthcare worker or a designated individual provides the prescribed antituberculous drugs and watches the patient to ensure the patients is taking each dose [3]. The main goals of TB treatment are to cure individuals with the disease and minimize the transmission of *Mycobacterium tuberculosis* to others in the community [4]. Major progress in global TB control followed the widespread implementation of the DOTS strategy.

The Stop TB Strategy, launched in 2006, builds upon and enhances the achievements of DOTS. The five components of DOTS are as follows: sustained government commitment to TB control; case detection through sputum-smear microscopy in the general health services; standardized short-course chemotherapy to all TB cases under proper case management conditions; regular, uninterrupted supply of all essential anti-TB drugs; and monitoring system for program supervision and evaluation [5].

The DOTS strategy has been implemented successfully in many countries and contexts. Through 2003, DOTS has been implemented in 182 of 211 countries, covering 77% of the world's population. In 132 countries, including most of the industrialized world, DOTS is available to more than 90% of their population.

Average treatment success among all national DOTS programs is 82%, close to the 85% global target. By 2005, more than 20 million patients had been treated under DOTS, with an expected case detection rate of close to 50%. Although the case detection rate has

 DOI: 10.4103/1687-8426.176787

been increasing over the past decade, it is still below the 70% target [6].

Aim of the work

The aim of this work was to assess the efficacy of DOTS applied to diagnosed cases of TB during the period from 2006 to 2012 in Cairo governorate as a tool for treatment and control of TB in the community.

Methodology

This was a retrospective clinical cohort study carried out at the Cairo governorate. The registered data on all TB cases (2006–2012) were collected from the TB registration units in the Cairo governorate.

The collected data included the following:

(1) TB registration code and the year.
(2) Sociodemographic data, which included name, age, sex, and residence.
(3) Forms of TB: pulmonary (either smear-positive or smear-negative) and extrapulmonary (and its site as lymph node, intestine, meninges, bone, renal).
(4) History of previous treatment if present (category of patients or the type of patient): new, relapse, treatment after failure, treatment after default, transfer in, or others.
(5) Schedule of treatment (recommended standardized treatment regimen) according to NTP [7].
(6) The recorded follow-up for smear-positive pulmonary TB included sputum smear microscopic examination for acid fast bacilli, at the end of the second month, at the end of the fifth month, and at the end of treatment [7].
(7) Outcome: cure, treatment completed, treatment failure, died, default, and transfer out.
(8) Culture result: the total number of cases examined yearly with culture and its result.

Table 1 Description of the studied samples as regards locality

Provinces	*N* = 6355 [*n* (%)]
Al Abbasia	387 (6.1)
Shobra	408 (6.4)
Bab Sheria	99 (1.6)
Zawia	548 (8.6)
Mataria	1627 (25.6)
Helwan	732 (11.5)
Khalifa	757 (11.9)
Saida Zainab	534 (8.4)
Bolak	333 (5.2)
M. Naser	419 (6.6)
El Salam	511 (8.0)

Statistical analysis

The collected data were tabulated and analyzed using SPSS version 16 software (SPSS Inc., Chicago, USA). Categorical data were presented as number and percentages, whereas continuous variables were presented as mean and SD. The χ^2-test, Fisher's exact test, and Student's *t*-test were used. Microstat software was used to calculate the 'Z'-test for two proportions of two independent groups. A *P* value less than 0.05 was considered significant.

Results

The highest number of cases was observed at Mataria (25.6%) and the lowest number of cases at Bab Sheria (1.6%) (Table 1).

The highest incidence of TB occurred in the age groups 15–35 and 35–55 years, and the lowest incidence occurred in those under 15 years of age those over 60 years of age, with a statistically highly significant difference as regards age groups throughout the study period (Table 2).

Table 3 shows that the highest number of pulmonary and extrapulmonary cases was seen during 2010 and 2009, respectively, and the lowest number of pulmonary and extrapulmonary cases was seen during 2007 and 2006, respectively. Statistical analysis was highly significant between pulmonary and extrapulmonary groups all over the years of the study period.

The most common type of patients were new cases, followed by relapse cases, default cases, and failure cases (Table 4). Statistical analysis as regards these

Table 2 Distribution of tuberculosis cases over different age groups in the years of the study

Year	Age groups					*P* value	Significance
	0–15 (*N* = 832) [*n* (%)]	15–35 (*N* = 2319) [*n* (%)]	35–55 (*N* = 2116) [*n* (%)]	>55 (*N* = 1088) [*n* (%)]	Total (*N* = 6355) [*n* (%)]		
2006	116 (13.6)	318 (37.7)	284 (33.6)	127 (15.1)	845 (13.3)	<0.001	HS
2007	94 (12.0)	278 (35.6)	276 (35.3)	133 (17.1)	781 (12.3)	<0.001	HS
2008	114 (13.0)	323 (36.9)	280 (32)	159 (18.1)	876 (13.8)	<0.001	HS
2009	137 (13.9)	375 (38.1)	290 (29.5)	182 (18.5)	984 (15.5)	<0.001	HS
2010	132 (12.5)	365 (34.7)	366 (34.8)	190 (18.0)	1053 (16.6)	<0.001	HS
2011	124 (13.7)	306 (33.7)	336 (37.0)	142 (15.6)	908 (14.3)	<0.001	HS
2012	115 (12.7)	354 (39.0)	284 (31.3)	155 (17.1)	908 (14.3)	<0.001	HS

groups throughout the years of the study period was highly significant.

The highest conversion percentage at second month was in 2008 and the lowest was in 2009 (Table 5). The highest percentage at fifth month was seen in 2010 and the lowest was seen in 2011. The highest percentage at the end of treatment was seen in 2010 and the lowest was seen in 2009. Statistical analysis between second month, fifth month, and at the end of treatment showed highly significant difference.

There was very good treatment outcome with increase in success rates (cure and complete rates) (Table 6). The highest cure and complete rates were observed in 2010 and the lowest rates were observed in 2007, with significant decrease in failure, death, default, and transfer out rates and statistically highly significant differences between treatment outcome in different groups during the study period.

Table 7 presents the indicators of DOTS successfulness throughout the study period.

Discussion

This study investigated the situation of TB in the Cairo governorate from January 2006 until December

Table 3 Pulmonary and extrapulmonary tuberculosis cases over the years of the study

Year	Type of TB			*P* value	Significance
	Pulmonary (*N* = 4627) [*n* (%)]	Extrapulmonary (*N* = 1728) [*n* (%)]	Total (*N* = 6355) [*n* (%)]		
2006	626 (74.1)	219 (25.9)	845 (13.3)	<0.001	HS
2007	557 (71.3)	224 (28.7)	781 (12.3)	<0.001	HS
2008	655 (74.8)	221 (25.2)	876 (13.8)	<0.001	HS
2009	683 (69.4)	301 (30.6)	984 (15.5)	<0.001	HS
2010	763 (72.5)	290 (27.5)	1053 (16.6)	<0.001	HS
2011	676 (74.4)	232 (25.6)	908 (14.3)	<0.001	HS
2012	667 (73.5)	241 (26.5)	908 (14.3)	<0.001	

HS TB, tuberculosis.

Table 4 Notification data of pulmonary tuberculosis cases over the years of the study

Year	Notification data of pulmonary TB						*P* value	Significance
	New cases [*n* (%)]	Relapse [*n* (%)]	Treatment failure [*n* (%)]	TAI [*n* (%)]	Others [*n* (%)]	Total [*n* (%)]		
2006	506 (80.8)	63 (10.1)	29 (4.6)	24 (3.8)	4 (0.6)	626 (13.5)	<0.001	HS
2007	456 (81.9)	58 (10.4)	22 (3.9)	19 (3.4)	2 (0.4)	557 (12.0)	<0.001	HS
2008	522 (79.6)	82 (12.5)	24 (3.7)	25 (3.8)	2 (0.3)	655 (14.2)	<0.001	HS
2009	545 (79.8)	70 (10.1)	25 (3.7)	34 (5.2)	9 (1.2)	683 (14.8)	<0.001	HS
2010	591 (77.5)	63 (8.3)	21 (2.7)	62 (8.1)	26 (1.9)	763 (16.5)	<0.001	HS
2011	549 (81.2)	62 (9.2)	19 (2.9)	44 (6.5)	2 (0.16)	676 (14.6)	<0.001	HS
2012	547 (82.0)	68 (10.2)	21 (3.1)	26 (3.9)	5 (0.80)	667 (14.4)	<0.001	HS
Total	3716 (80.3)	466 (10.1)	161 (3.5)	234 (5.1)	50 (1.1)	4627 (100)	<0.001	

HS TB, tuberculosis; TAI, treatment after interruption.

Table 5 Comparison between years of study period as regards the follow-up of conversion of positive sputum smear pulmonary cases at regular intervals (second month, fifth month, and at the end of treatment)

Sputum-negative cases at fifth month	Initial sputum-positive cases [*n* (%)]	Sputum-positive TB cases *N* = 3539		
		Sputum-negative cases at second month [*n* (%)]	Sputum-negative cases at fifth month [*n* (%)]	Sputum-negative cases at the end of treatment [*n* (%)]
2006	451 (12.7)	338 (74.9)	380 (84.3)	321 (71.2)
2007	427 (12.1)	333 (78.0)	353 (82.7)	317 (74.2)
2008	510 (14.4)	408 (80.0)	417 (81.8)	379 (74.3)
2009	557 (15.7)	401 (72.0)	467 (83.8)	380 (68.2)
2010	608 (17.2)	486 (79.9)	517 (85.0)	487 (80.1)
2011	521 (14.7)	401 (77.0)	423 (81.2)	406 (77.9)
2012	465 (13.1)	348 (74.8)	381 (81.8)	357 (76.8)
Total	3539 (100)	2715 (76.7)	2938 (83.0)	2647 (74.8)
P value	<0.001	<0.001	<0.001	<0.001
Significance	HS	HS	HS	HS

TB, tuberculosis.

Table 6 Outcome of tuberculosis cases over different years of the study

Year	Outcome of TB cases							*P* value	Significance
	Cure [*n* (%)]	Complete [*n* (%)]	Failure [*n* (%)]	Default [*n* (%)]	T/out [*n* (%)]	Death [*n* (%)]	Total [*n* (%)]		
2006	488 (57.8)	183 (21.6)	26 (3.1)	75 (8.9)	32 (3.8)	41 (4.8)	845 (13.3)	<0.001	HS
2007	467 (59.8)	157 (20.1)	20 (2.8)	59 (7.6)	38 (4.9)	40 (5.1)	781 (12.3)	<0.001	HS
2008	533 (60.8)	214 (24.4)	20 (2.3)	47 (5.4)	25 (2.9)	37 (4.2)	876 (13.8)	<0.001	HS
2009	603 (61.3)	170 (17.3)	27 (2.7)	122 (12.4)	22 (2.2)	40 (4.1)	984 (15.5)	<0.001	HS
2010	654 (62.1)	249 (23.6)	14 (1.3)	53 (5.0)	30 (2.8)	53 (5.0)	1053 (16.6)	<0.001	HS
2011	579 (63.8)	157 (17.3)	18 (2)	100 (11)	15 (1.7)	39 (4.3)	908 (14.3)	<0.001	HS
2012	591 (65.1)	169 (18.6)	13 (1.4)	92 (10.1)	7 (0.8)	36 (4.0)	908 (14.3)	<0.001	HS
Total	3915 (61.6)	1299 (20.4)	138 (2.2)	548 (8.6)	169 (2.7)	286 (4.5)	6355 (100)	<0.001	HS

TB, tuberculosis.

Table 7 Indicators of directly observed therapy short-course successfulness (years 2006–2012)

Year	Cure [*n* (%)]	Complete [*n* (%)]	Success rate [*n* (%)]
2006	488 (57.8)	183 (21.6)	671 (79.4)
2007	467 (59.8)	157 (20.1)	624 (79.9)
2008	533 (60.8)	214 (24.4)	747 (85.2)
2009	603 (61.3)	170 (17.3)	773 (78.6)
2010	654 (62.1)	249 (23.6)	903 (85.7)
2011	579 (63.8)	157 (17.3)	736 (81.1)
2012	591 (65.1)	169 (18.6)	760 (83.7)
Total	3915 (61.6)	1299 (20.4)	5214 (82.0)

2012, after the application of DOTS. The total number of recorded tuberculous cases was 6355. This work revealed that the highest number of cases was discovered at Mataria (25.6%) and the lowest at Bab Sheria (1.6%). Increase in the number of cases in many localities may be due to the increase in the number of slums and presence of factories.

As regards age, the highest prevalence of TB was among individuals between 15 and 35 years of age (33.2%) and the lowest prevalence was among those younger than 15 years and those older than 60 years.

This could be attributed to the increased prevalence of smoking behavior in this active age group in our society. Moreover, poverty, malnutrition, physical, mental, and occupational stress, and greater exposure to infection are other contributing factors. El-Zeheiry [8] conducted a retrospective study in the Dakahlia governorate, Egypt, to review the TB situation. He found that TB was common in the middle-aged group (15 ≤ 30 years).

In Kafr El Sheikh governorate, the highest incidence of TB occurred in both age groups (15–29 years, 37.6%; 30–44 years, 25.7%) and the lowest incidence occurred in the extremes of age, an incidence of 4.3% in those younger than 15 years and 10.9% in those older than 60 years. There was a statistically significant difference as regards the number of cases in all age groups during the study period [9].

In another study conducted at El-Minia governorate (1997–2010), the highest incidence occurred in the age group 15–29 years (30.9%), and the lowest incidence occurred in the extremes of age [10].

Table 3 shows the classification of total tuberculous cases on the basis of the site of lesion from year 2006 to 2012. The total number of tuberculous cases was 6355, of which 4627 (72.8%) were pulmonary TB and 1728 (27.2%) were extrapulmonary TB. Statistical analysis between pulmonary and extrapulmonary cases showed highly significant difference throughout the study period.

The high proportion of pulmonary cases compared with the extrapulmonary ones could be attributed to the fact that TB occurs almost exclusively from inhalation of droplet nuclei containing *M. tuberculosis*, and extrapulmonary TB occurs after pulmonary disease.

The current study is in agreement with the results obtained in Benha chest hospital (2002–2006); the number of pulmonary cases (73.9%) was significantly higher compared with the number of extrapulmonary cases (26.1%) during the study period [11].

Similar results were obtained in Menoufia governorate (1992–2008): 70% of patients had pulmonary TB and 30% of patients had extrapulmonary TB [12]. In Dakahlia governorate (2006–2011), 73.9% of patients had pulmonary TB and 26.1% of patients had extrapulmonary TB [8]. In El-Minia governorate, the percentage of pulmonary TB ranged between 57.6 and 76.2%, and the percentage of extrapulmonary TB ranged between 23.7 and 55.4% [10]. In Kafr El Sheikh, 78.9% of patients had pulmonary TB and 27.2% of patients had extrapulmonary TB [9].

In the present study, as shown in Table 4, the distribution of tuberculous cases according to the type of patient based on previous history of treatment

revealed that the most common type of patients were new cases (80.3%), followed by relapse cases (10.1%), default (5.1%), failure cases (3.5%), and other cases (1.1%). Statistical analysis as regards these groups of patient types throughout the study period showed significant difference.

This study coincided with another study, in which new cases (92.2%) represented the highest percentage of cases attending for treatment [11]. Moreover, in Fayoum, the proportion of newly diagnosed cases was higher compared with the retreated cases; the proportion of newly diagnosed cases was 92.3%, whereas the proportion of retreated cases was 7.7% [13]. Moreover, a study conducted in Menoufia found that the most common type of patients were new cases (93.3%) [12]. In Dakahlia governorate (2006–2011), the most common type of patients were new cases (88.8%) [8].

Throughout the study period, out of 3539 cases of positive sputum smear at 0 month, the highest conversion rate was 79.9% at second month (486 cases), with the highest percentage in 2008 of 80% (408 cases of 510), and lowest in 2009 of 72% (401 of 557 cases) (Table 5). The conversion rate at the end of second month was statistically highly significant; at the end of the treatment, conversion rate and percentage were statistically significant as the highest conversion rate was 80.1% at end of treatment (487 cases) in 2010, and lowest in 2009 (380 of 557 cases;68.2%). The conversion rate at fifth month (83%) showed the highest percentage of converted cases (85%) in the year 2010 and lowest rate (81.2%) in 2011.

The percentage of cases that became sputum-negative at 2 months of treatment was 80% (the highest percentage of converted cases was seen in the year 2008) (Table 5). The percentage of cases that became sputum-negative at 5 months of treatment was 85% (the highest percentage of converted cases was seen in the year 2010). The percentage of cases that became sputum-negative at the end of treatment was 80.1% (the highest percentage of converted cases was seen in the year 2010).

In Benha chest hospital (2002–2006), the proportion of cases that became sputum-negative were 87.5, 89.5, and 92.8% at second month, fifth month, and at the end of treatment, respectively. The high conversion rate can be attributed to competency of the healthcare workers with regular supervision, mobilization of healthcare services, stable supply of antituberculous drugs, and better patient adherence to treatment [11].

In Menoufia governorate (1992–2008), the percentage of cases that became sputum-negative was 65.11, 70.9, and 59.7% at second month, fifth month, and at the end of treatment, respectively [12].

In Kafr El Sheikh (2006–2012), the proportion of cases that became sputum-negative was 75.3, 83, and 74.5% at second month, fifth month, and at the end of treatment [9].

As per total cases studied, there was a very good treatment outcome with increase in success rates: cure rate was 61.6% and complete rate was 20.4%, with the highest cure rate (654 cases) and the highest complete rate (249 cases; 23.6%) seen in 2010 and the lowest cure rate (467 cases; 59.8%) seen in 2007 and the lowest complete rate (157; 17.3%) seen in 2007 (Table 6). In 2011, default rate was 8.6%, death rate was 4.5%, transfer out rate was 2.7%, and failure rate was 2.2%, with statistically significant differences between treatment outcome in different groups during the study period.

In Menoufia governorate, the cure rate was 37.1%, complete rate was 45.9%, fail rate was 2.4%, default rate was 7.3%, transfer out rate was 1.9%, and death rate was 5.4% after applying DOTS [12].

In this study, (Table 7) as regards the indicators of DOTS reporting successfulness throughout the study period, the cure rate was 61.6%, treatment completion rate was 20.4%, and success rate was 82%.

In El-Minia governorate within DOTS, the cure rate was 75.8%, the treatment completion rate was 8.5%, and the treatment success rate was 93.8% [10].

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1 WHO. Global Tuberculosis Report (2013).
2 WHO. Global strategy and targets for tuberculosis prevention, care and control after 2015 (2015).
3 American Thoracic Society (ATS). American Thoracic Society/Centers for Disease Control and Prevention/Infectious Diseases Society of America: controlling tuberculosis in the United States. *Am J Respir Crit Care Med* 2005; **172**:1169–1227.
4 Enarson DA, Rieder HL, Ar Nadottive T, Trebuqu A. *Management of tuberculosis. A guide for low income countries*. 5th ed. Paris: International Union against Tuberculosis and Lung Diseases, 2000.
5 NTP. *National tuberculosis control program*. Egypt: Programmatic Management of TB, Egypt, 2012.
6 WHO. *Global tuberculosis control: surveillance, planning, financing*. Geneva, Switzerland: World Health Organization, 2005.
7 NTP. *National Tuberculosis Control Program, manual of tuberculosis control in Egypt*. Egypt: Ministry of Health and Population, 2006.

8 FSH El Zeheiry. Assessment of directly observed therapy short course (DOTS) of tuberculosis in Dakahlia governorate Chest hospitals from 2006 to 2011, Master degree. *Benha Faculty of Medicine* 2012; (Thesis for master degree in chest disease and tuberculosis).

9 Saad El Din. Assessment of directly observed therapy short course (DOTS) of tuberculosis in Kafr-El Sheikh Governorate from 2006 to 2012 [thesis for Master degree in Chest Diseases and Tuberculosis]. Egypt: Benha Faculty of Medicine; 2014.

10 George MM. Tuberculosis situation in El-Minia governorate (1997–2010) before and after direct observed therapy short course strategy (DOTS) [thesis for Master degree in Chest Diseases and Tuberculosis]. Egypt: Benha Faculty of medicine; 2013.

11 Hindi MR. Assessment of direct observed therapy short course strategy (DOTS) in Kaluobia governorate [thesis for Master degree in Chest Diseases and Tuberculosis]. Egypt: Benha Faculty of medicine; 2009.

12 Abd El Ghany AE. Tuberculosis situation in Menoufia governorate (1992–2008) before and after direct observed therapy short course strategy (DOTS) [thesis for Master degree in Chest Diseases and Tuberculosis]. Egypt: Benha Faculty of medicine; 2010.

13 Abd El-Rahman M. Study of the pattern of variable forms of tuberculosis in Fayoum chest hospital in the period from June 2006 –June 2009 [MSc thesis on chest diseases. Egypt: Ain Shams University; 2010.