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

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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.

**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 $\chi^2$-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
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

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

P value <0.001 | Significance HS

| Year | Pulmonary TB cases over the years of the study | Notification data of pulmonary TB cases over the years of the study | 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) |
|------|-----------------------------------------------|---------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 2006 | 506 (80.8)                                    | 522 (79.6)                                                   | 3539 (100)                                                          |
| 2007 | 456 (81.9)                                    | 522 (79.6)                                                   | 3539 (100)                                                          |
| 2008 | 545 (79.8)                                    | 545 (79.8)                                                   | 3539 (100)                                                          |
| 2009 | 591 (77.5)                                    | 549 (81.2)                                                   | 3539 (100)                                                          |
| 2010 | 547 (82.0)                                    | 547 (82.0)                                                   | 3539 (100)                                                          |
| 2011 | 549 (81.2)                                    | 549 (81.2)                                                   | 3539 (100)                                                          |
| 2012 | 547 (82.0)                                    | 547 (82.0)                                                   | 3539 (100)                                                          |
| Total| 3716 (80.3)                                   | 466 (10.1)                                                   | 3539 (100)                                                          |

P value <0.001 | Significance HS

| Year | Initial sputum-positive cases [n (%)] | 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 (82.8)                                           |
| 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 | Significance HS

TB, tuberculosis.
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].

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Conflicts of interest
There are no conflicts of interest.

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