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Mohamed O Nour[1,2] and Sameh O Nour[3]

[1]Department of Public Health and Community Medicine, Damietta Faculty of Medicine, Al-Azhar University, Egypt (Correspondence to MO Nour: mohamednour.2022@azhar.edu.eg). [2]Faculty of Public Health & Health Informatics, Umm Al-Qura University, Makkah, Saudi Arabia.
[3]
Department of Chest Diseases, Faculty of Medicine, Al-Azhar University, Egypt.

Abstract

Background: Tuberculosis (TB) is a major cause of morbidity and mortality globally. Understanding its epidemiology and burden is critical for targeted interventions.

Aim: To highlight the prevalence, incidence and treatment outcomes of TB in Egypt during the last 2 decades.

Methods: For this systematic review and meta-analysis, we searched Medline/PubMed, ResearchGate, Google Scholar, and Scopus databases. We searched the local databases for unpublished studies, and the reports of international agencies, applying clear inclusion and exclusion criteria. The search covered prevalence; incidence; treatment outcomes; age, gender and residence of patients; and type of TB. Data were analyzed using STATA version 16.0. Pooled estimates with 95% confidence interval (CI) were calculated using a random effects model. Odds ratio (OR) with 95% CI was used as effect measures for related variables. Heterogeneity across studies was assessed using the I^2 statistic with sub-group analysis.

Results: A total of 23 studies from 22 governorates, out of 27 governorates, involving a 139 597 study population met the eligibility requirements with no publication bias. The pooled prevalence was 8.70 (95% CI: 5.80–12.41, I^2 = 92.7%) and the pooled incidence was 9.10 (95% CI: 6.65–14.86, I^2 = 95.5%) per 100 000 population. About 82.6% of cases showed cured/completed treatment, 4.4% failure of treatment, and 3.9% died. In the subgroup analyses, the odds of TB prevalence were higher among males than females (2.05; 95% CI: 1.44–3.28),

among those living in rural than in urban areas (1.29; 95% CI: 0.61–1.97), in Upper Egypt and Greater Cairo than in Lower Egypt and Delta Region (1.85; 95% CI: 0.97–4.15). The odds of pulmonary TB prevalence were higher than the extrapulmonary TB (2.43; 95% CI: 1.63–5.71). The odds of the treatment cases who were cured/completed (1.04; 95% CI: 0.96–1.51), failed (1.71; 95% CI: 1.35–2.73), and died (1.12; 95% CI: 0.87–1.60) were higher in Lower Egypt than in Upper Egypt.

Conclusion: TB incidence decreased in Egypt over the last two decades, but treatment outcomes were unsatisfactory, with variations across the different regions. To achieve TB eradication in Egypt, efforts should be made to sustain the TB control strategy by improving treatment outcomes and intensifying case finding and surveillance reporting.

Keywords: tuberculosis, surveillance, case finding, morbidity, mortality, prevalence, incidence, treatment outcome, Egypt

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Introduction

Tuberculosis (TB) has plagued human civilization for centuries and is a major cause of morbidity and mortality worldwide. TB mainly affects the lungs and spreads to other organs through the haematogenous route. About 1.8 billion people globally have latent TB. About 90% of cases of TB are in adults, with more cases among men. TB is still one of the 10 major causes of mortality in low- and low-to-middle-income countries. Until the COVID-19 pandemic, TB was the leading

cause of death from a single infectious pathogen, ranking above HIV/AIDS (1–4). COVID-19 has disrupted years of improvement in essential TB services, with reduced access to diagnosis and treatment.

Globally, an estimated 10 million people developed TB in 2020. Between 2019 and 2020, there was a large drop in TB incidence from 7.1 to 5.8 million, and a reduction in the number of people receiving treatment for drug-resistant TB (15%) and TB prophylaxis (21%). There was also an increase in TB deaths among HIV-negative patients from 1.2 to 1.3 million, and among HIV-positive patients from 209 000 to 214 000. If not taken seriously, these impacts may worsen in the next few years (4).

Approximately 2 billion people with latent TB serve as a reservoir for the global epidemic. Poor socioeconomic status, behavioural factors, malnutrition, young age, and HIV are considered strong risk factors for latent TB. Other emerging variables play a crucial role at both individual and population levels, including diabetes, indoor air pollution, alcohol intake, use of immunosuppressive drugs, and tobacco smoking. Specific groups such as healthcare workers and indigenous populations also have an increased risk of TB. Substantial changes in epidemiological factors and availability of treatment will affect the future disease burden (5).

TB is curable and preventable and about 85% of people who develop TB can be successfully treated with a 6-month drug regimen. Universal Health Coverage is important to ensure access to treatment for all people with TB (6). Multidrug-resistant and extensively drug-resistant TB is a major challenge to achieving complete disease control. However, the landscape for new TB diagnostics and therapies is promising (7).

Egypt does not have one of the highest global burdens of TB. However, we may expect a static or increasing level of TB because of the small decline in the annual risk of infection, high population growth, population ageing, and associated conditions such as poverty, unemployment, and overcrowding. According to the 2021 WHO TB country profile, the total TB incidence in Egypt was 10 (9–12) per 100 000 population. There were 6907 bacteriologically confirmed cases notified; of which, 54% were HIV positive, and 52% were pulmonary TB. About one-third were female (aged ≥ 15 years), 60% were male (aged ≥ 15 years), and 6% were aged 0–14 years. TB treatment coverage was 60% (52–69%), TB case fatality ratio was 4% (4–5%), and treatment success rate for new and relapsed cases was 89% (8). However, these data should be viewed with caution, and efforts should be continued to revitalize TB control programmes because the quality of reporting notified cases is not consistent.

This study investigated the prevalence, incidence, and treatment outcomes of TB in the last 2 decades, to understand the status, challenges, and ways to tackle TB in Egypt.

Methods

Study design

This study was a retrospective database analysis, systematic review, and meta-analysis. It was part of a wider project targeting different clinical, epidemiological, and public health aspects relevant to TB in Egypt since 2000.

Research questions

Primary research questions: (1) What was the trend in prevalence and incidence of TB in Egypt during the last 2 decades? (2) What were the treatment outcomes of TB in Egypt during the last 2 decades? Secondary research questions: (1) What was the trend in prevalence and incidence of TB in Egypt among different subgroups regarding age, gender, residence, geographical region, and type of TB? (2) What were the treatment outcomes of TB in Egypt, including cured/completed, failure, and death among different subgroups? (3) What were the potential common risk factors that may have accelerated the overall risk of TB exposure in Egypt?

Types of studies included

Different observational study designs were included (cross-sectional, prospective, and retrospective cohorts, epidemiological surveys, and surveillance studies) that reported the prevalence, incidence, and treatment outcomes of TB in Egypt among the general population. We also included epidemiological data presented in the WHO country profile as well as international and national reports.

Search strategy

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The study protocol was prospectively registered with PROSPERO (CRD42022295784) and approved by the Research Ethics Committee at Damietta Faculty of Medicine, Al-Azhar University, Egypt (# IRB 00012367- 21-12-005).

The search strategy was initiated after consultation with an expert librarian and a health informatics specialist for studies published from 1 January 2000 to 31 December 2021. The WHO directly observed therapy short-course strategy (DOTS) was implemented in Egypt from 1996 and became available to all patients in Ministry of Health chest clinics by 2000. We searched Medline/PubMed, ResearchGate, Google Scholar, and Scopus. Other sources

included Egyptian Knowledge Bank, Egyptian Universities Libraries Consortium website (for unpublished studies and dissertations), and online journals (e.g. International Journal of Tuberculosis and Lung Disease and the Egyptian Journal of Chest Diseases and Tuberculosis). We included reports from international agencies such as WHO and World Bank. The reference lists of selected papers and reports were hand-searched to identify additional relevant eligible studies. Efforts were made to uncover any epidemiological surveys carried out in Egypt during the study period. We tried to contact experts in TB care and research working at the Egyptian Ministry of Health, National Tuberculosis Control Program (NTCP), local universities, research institutes, and WHO Regional Office for the Eastern Mediterranean Region to identify unpublished studies. We also attempted to contact local authors of dissertations for clarification when outcome data were missing, or methodology was unclear. Unfortunately, we were unable to collect missing data from most theses within university libraries and we did not receive a response to our inquiries from the Ministry of Health or NTCP.

The search strategy included the following keywords and terms in different combinations and constructions (using “OR” then “AND”) depending on the database: “TB” or “Tuberculosis”, “Epidemiology”, “Trend”, “Burden of disease”, “Survey”, “Surveillance”, “Prevalence”, “Incidence”, “Treatment outcome”. This string was further attached to Egypt and 2000–2021 and all search terms were searched in title, abstract, and keywords fields. All systematic reviews concerning TB in Egypt and Africa were reviewed for eligible studies.

Main outcomes

The main outcomes were prevalence, incidence, and treatment outcomes related to TB in Egypt. We used the WHO standard definitions for TB cases and treatment outcomes that were designed to determine NTCP quality and effectiveness (9). Prevalence was calculated as the number of prevalent cases expressed as a proportion of the at-risk population. Incidence was the number of new and relapsed cases per 100 000 population per year. The treatment outcome indicators were: cured, treatment completed, treatment failed, died, lost to follow-up, not evaluated (transferred to other hospitals), and treatment success (sum of cured and treatment completed). Only the treatment outcome indicators cured/completed, failure, and death were used because of deficient data in many records.

Inclusion criteria

Full-text published online; unpublished studies and dissertations from the Egyptian Universities Libraries Consortium website and Egyptian Knowledge Bank; articles published in English language; studies on the general population (TB cases regardless of age, gender, residence, geographical region, type of TB) and non-TB-risk groups, targeting prevalence, incidence, and treatment outcomes of TB in Egypt; studies included only confirmed cases according to WHO case definition, with a sample size ≥ 75 to avoid selection bias; and studies published from 1 January 2000 to 31 December 2021.

Exclusion criteria

We excluded citations without full text, case reports, case series, commentaries, preprints, letters to editor, conference proceedings or abstracts, protocols, systematic reviews and meta-analyses; studies conducted outside Egypt; nonhuman studies; studies targeting risk groups such as HIV-positive patients, immunocompromised, and those with comorbid chronic conditions; studies without primary or adequate data, or with unrelated or duplicate data; studies without sampling methods; studies with follow-up 30% loss to follow-up.

Data extraction (selection and coding)

We used EndNote X9 to remove duplicates. Two independent reviewers, blinded to each other's decisions, manually screened the titles and abstracts of the articles for inclusion. The final selected articles were divided into halves, where each half was screened and read for the full text by an independent reviewer and a member of the research team. A standardized eligibility form containing the inclusion and exclusion criteria was tested (as a pilot) on 10 studies and modified accordingly. This form was used by each team to record their decisions and comments for each article and reasons for exclusion. Article coding was classified as included, excluded, or not sure. Articles excluded by both teams were eliminated from the review. Discrepancies were resolved by consensus or a third reviewer.

If a paper described detailed outcomes in multiple governorates, the data from each governorate were reported separately. If a paper and dissertation described outcomes from the same population in the same governorate, we included the study with the most complete data. If online supplementary files of included articles were available, they were reviewed for relevant information. Data from selected articles were manually recorded using Excel. The data extracted from each study included: name of first author; year of publication; year of data collection; study location (governorate); study design; sample size (number of TB cases); population characteristics such as age, gender, and residence; prevalence and incidence (per 100 000 population); and treatment outcomes (cured/completed, failure, or death) related to TB in Egypt.

A PRISMA flow chart was created to document the number of studies included and excluded at each stage of the study selection process (Figure 1).

Risk of bias (quality) assessment

We used a modified version of the Newcastle–Ottawa scale to evaluate the risk of bias and quality of the included articles. This depended on adequate participant selection (0–4 points),

comparability of studies based on design and analysis (0–1 point), and adequate ascertainment of outcomes (0–3 points). The total score ranged from 0 to 8. Studies with a score of 6–8 were considered good quality, 3–5 moderate quality, and 0–2 low quality. After excluding low-quality studies (high risk of bias), we identified 6 studies with high quality (low risk of bias) and 17 with moderate quality (moderate risk of bias).

Strategy for data synthesis

Data were analysed using STATA release 16.0. Tables and figures were used to illustrate summary results, including key study and participant characteristics, with descriptive statistics of frequencies and percentages. Heterogeneity and variability in results were expected because the studies differed in design, methodology, sampling, and individual characteristics. Therefore, we assessed the studies using the $\chi 2$ test or Cochran's (Q) statistic to estimate the I^2 value, which referred to the percentage variation across studies that resulted from heterogeneity, rather than chance. T2 was the between-study variance, reflecting the variance of the true effect sizes. Heterogeneity was considered significant with $P < 0.1$ and was categorized as low, moderate, and high when I^2 was 75%, respectively. A random effects meta-analysis model was used to determine the pooled measures (combined data from all included studies to estimate the pooled prevalence and incidence of TB) with 95% confidence intervals (CIs). A forest plot was generated to show estimates for individual studies. Publication bias, the tendency to publish studies with beneficial outcome or studies that show statistically significant findings, was assessed visually with the funnel plot symmetry and Egger's test ($P < 0.05$), and was also indicative of publication bias for small study effects. We considered subgroup analysis by population characteristics and type of TB.

Results

Study selection and study characteristics

We identified 322 studies (289 from database searches, 2 from references, and 31 from other sources and unpublished dissertations from local universities). After removing duplicates, those published before 2000, and ineligible records (n = 164), we screened the titles and abstracts of 158 studies (142 published articles and 16 unpublished dissertations) and excluded 130. We retrieved the full texts of the remaining 28 studies and excluded 5 because they did not report TB epidemiology, had missing essential data, or were not conducted in Egypt. Finally, we included 23 studies (Table 1 , S1–S23), including 6 theses (S2, S7, S12, and S15–S17) and 17 journal articles. They were of moderate (n = 17) or high quality (n = 6). The study search and selection process are shown in the PRISMA flow chart (Figure 1).

Prevalence was reported by all studies, incidence by 15, and treatment outcomes by 17. The characteristics of the included studies are summarized in Table 1.

The funnel plots were approximately symmetric, and Eggers' tests were not significant, indicating absence of publication bias for the 23 studies reporting TB prevalence (t = –0.51, P = 0.614), 15 studies reporting TB incidence (t = 0.34, P = 0.751), and 17 studies reporting treatment outcomes (t = 0.24, P = 0.832) (Figure 2).

All studies were retrospective except for 3 prospective follow-up studies (S18, S20, and S23) and 1 nationwide population-based study (S21). They were published between 2009 and 2021. The collected data were from 1997 to 2018 (we considered data collected after the application of DOTS in S6 and S14) from 22 of 27 governorates in Egypt, with a total study population of 139 597.

All studies provided data on gender of patients [93 781 male (67.2%) and 45 816 female (32.8%)]; 18 studies (78.3%) on age (all ages were included); 17 studies (73.9%) on residence [total number reported 129 671; 56 686 (43.7%) urban; 72 985 (56.3%) rural]; and 18 studies (78.3%) on type of TB [total number reported 136 638; 96 750 (70.8%) pulmonary; 39 888 (29.2%) extrapulmonary].

All studies were reported from chest hospitals and TB registration units. Ten studies (43.5%) were from Lower Egypt, 6 (26.1%) from Upper Egypt, and 4 (17.4%) from Greater Cairo. S6 was conducted across 19 different governorates from Upper and Lower Egypt; S21 included all TB units within the country; and S23 included 4 governorates from Upper Egypt, Lower Egypt, Greater Cairo, and Oasis. Five governorates were not covered, including Sinai.

Prevalence and incidence of TB

The total population included in the 23 studies representing the prevalence of TB was 139 597. The pooled prevalence using the random effects model was 8.70 (95% CI: 5.80–12.41) cases per 100 000 population (Figure 3). The prevalence ranged from 0.95 (95% CI: 0.66–1.78) (S9) to 15.43 (95% CI: 12.84–19.02) (S14), with high heterogeneity (I2 = 92.7%), and the variance between the studies was slightly elevated (T2 = 0.34).

There were 111 166 new and relapsed cases in the 15 studies reporting the incidence of TB. The pooled incidence was 9.10 (95% CI: 6.65–14.86) cases per 100 000 population (Figure 4). The highest incidence was 13.44 (95% CI: 10.65–16.31) (S15) and the lowest was 0.12 (95% CI: 0.08–0.85) (S3). The incidence showed high heterogeneity (I2 = 95.5%), and the variance

between the studies was slightly elevated (T2 = 0.25).

Treatment outcomes of TB

There were 136 166 TB cases in 17 studies that reported treatment outcomes. Cured/completed treatment was reported in 112 528 (82.6%) cases, treatment failure in 5989 (4.4%), and death in 5271 (3.9%).

Subgroup analysis of studied variables

There were insufficient data to pool the prevalence of TB among different age groups. The prevalence of TB was higher among males than females (pooled OR 2.05; 95% CI: 1.44–3.28); in rural than urban areas (pooled OR 1.29; 95% CI: 0.61–1.97); and in Upper Egypt and Greater Cairo than in Lower Egypt and Delta Region (pooled OR 1.85; 95% CI: 0.97–4.15). The prevalence of pulmonary TB was higher than that of extrapulmonary TB (pooled OR 2.43; 95% CI: 1.63–5.71). With the scarcity of data, we could not pool the incidence of TB among different subgroups.

There were insufficient data to pool the treatment outcomes of TB according to age group, gender, residence, or type of TB. The odds of cured/completed treatment (pooled OR 1.04; 95% CI: 0.96–1.51), failed treatment (pooled OR 1.71; 95% CI: 1.35–2.73), and death (pooled OR 1.12; 95% CI: 0.87–1.60) were higher in Lower Egypt than in Upper Egypt.

Discussion

This systematic review was carried out to estimate the prevalence, incidence, and treatment outcomes of TB in Egypt over the past 2 decades. Twenty-three studies of moderate to high quality fulfilled the inclusion criteria, suggesting scarcity of data, therefore making it difficult to establish the true epidemiological pattern of TB in Egypt.

It is important to note that the focus of countries on TB prevalence had stopped by 2015 when the ambitious new WHO End TB Strategy came into force. It served as a blueprint for countries to reduce TB incidence by 95%, TB deaths by 95%, and to eliminate catastrophic costs for TB-affected households between 2015 and 2035 (10). Our findings revealed a pooled TB prevalence of 8.70 (95% CI: 5.80–12.41) per 100 000 population. Based on the global burden of disease study in 2015, the prevalence of TB in Egypt among HIV-negative individuals was 10 354 (95% CI: 8582–12 661), with a reduction in annual prevalence from 2005 to 2015 of 1.3% (95% CI: 0.5–2.1%) (11). The prevalence of latent TB in high-risk groups was 59.1% (95% CI: 50.2–67.6%) among healthcare workers in Zagazig City, Sharkia Governorate (12), 13.5%

among healthcare workers at Fayoum University Hospital (13), and 29.9% (95% CI: 21.0–40.0%) among patients with erectile dysfunction (14). However, data on the prevalence of latent TB in the community are generally lacking.

Egypt is ranked as a medium-burden TB incidence country. A WHO descriptive analysis of TB burden in Egypt showed that the estimated incidence rate per 100 000 population decreased from 26 in 2000 to 10 in 2021 (15). The pooled TB incidence in this study (9.10; 95% CI: 6.65–14.86) was lower than that reported by WHO in 2020 (11.0; 95% CI: 9.80–13.0) and the Egyptian Ministry of Health in 2021 (10.0; 95% CI: 9.0–12.0). We found greater regional differences between governorates and wider CIs. The incidence matched the WHO End TB Strategy that proposed TB incidence to be < 10 cases per 100 000 population by 2035 (10). According to the World Bank and the WHO Global Tuberculosis Report in 2021, the neighbouring countries showed variable incidence rates: 59 per 100 000 population in Libya, 58 in Sudan, 8 in Saudi Arabia, 4 in Jordan, and 3 in Israel (15, 16).

In our analysis, treatment success rate was 87.0% in 2000, a minimum of 70.0% in 2004, a maximum of 91.0% in 2008 and 2009, and the most recent rate was 89.0% in 2020. We found that 82.6% of TB cases were reported as cured/completed treatment. This was less than the current World Bank and WHO estimates in 2020 of 89.0% and the latest Ministry of Health estimate in 2020 of 87.0%. The neighbouring countries showed variable treatment success rates: 90.0% in Saudi Arabia, 86.0% in Jordan and Sudan 86.0%, 81.0% in Israel, and 69.0% in Libya (15, 16).

Egypt has several risk factors with the potential to increase the overall risk of TB exposure. Increased life expectancy has resulted in a greater number of older people who are more prone to developing active TB (17). Economic hardship has increased susceptible populations, such as homeless people (18). Younger people have been forced to leave Egypt for work, and this may have brought them into contact with countries with a high TB prevalence. The Egyptian authorities have been unable to sustain high-quality care for TB, resulting in possible unreached or unreported cases. And there has been increased prevalence of medical risk factors that can favour the progression of latent to active TB, or to treatment failure, such as HIV (19), diabetes mellitus (20), smoking (21), and increasing drug resistance (22).

Our analysis showed variability among the regions within Egypt. Upper Egypt and Greater Cairo had the highest TB prevalence (up to 17.35 per 100 000 population), and the Delta Region had middle range estimates of 3–6. Giza and Fayoum Governorates in Upper Egypt showed the highest TB incidence (around 13 per 100 000 population) and El Behaira and Sharkia in Lower Egypt showed the lowest incidence (< 1). In their study in Assiut Governorate in Upper Egypt,

Hashem et al. found a decrease in TB incidence from 12.18 per 100 000 population in 2017 to 10.75 in 2020 (23). According to the Egyptian Ministry of Health Statistical Yearbook, Aswan Governorate in Upper Egypt and Cairo Governorate in Lower Egypt recorded the highest TB incidence (14.50 and 12.70 per 100 000 population in 2019 and 11 and 10.50 in 2020, respectively). The New Valley Border and El Menoufia Governorates in Lower Egypt recorded the lowest incidence in 2019 (3.20 and 3.30 per 100 000 population, respectively), and El Menoufia and Kafr El Sheikh Governorates in Lower Egypt recorded the lowest incidence in 2020 (2.10 and 3.10 per 100 000 population, respectively) (16).

Despite sustained efforts to decrease the national TB burden, Upper Egypt in particular was a high-burden region, where the prevalence and incidence were discouragingly higher than in other regions. This may be attributed to a combination of reasons, such as demographic, socioeconomic, and ecological circumstances, in addition to limited financial and logistic resources. This region should be prioritized for TB control efforts, with emphasis on targeting high-risk groups in intervention programmes and improving public awareness.

We found that El Menoufia, Alexandria, and El Gharbia Governorates in Lower Egypt had the highest percentage of cured/completed treatment cases (92.7%, 92.1%, and 90.1% respectively) with similar percentages to those in other governorates (mostly ranging from 80.0% to 90.0%), while the percentage of cases with treatment failure varied in different governorates (1.0%–8.2%). Death rates were highest in El Behaira and Sharkia Governorates in Lower Egypt and Qena in Upper Egypt (~7.0%) and the lowest were reported in Alexandria (1.5%) in Lower Egypt and Sohag (1.8%) in Upper Egypt. These results suggest wide variation in death rates in different regions in Egypt. Monitoring TB treatment outcomes and related factors is important for evaluating the effectiveness of TB interventions. Variations in treatment outcomes in Egypt are reported in the literature. In a study of treatment failure in 17 Egyptian governorates, Morsy et al. found that it was higher in Assiut in Upper Egypt (5.1%) and El Gharbia in Lower Egypt (4.5%), while the lowest rates were in Fayoum in Upper Egypt (0.9%) and Ismailia in Lower Egypt (1%). Noncompliance with treatment, poor patient knowledge, lack of health education, and comorbidity with diabetes mellitus were significant predictors for treatment failure (24). Gaballah et al. found 82.3% success rate, 10.3% mortality, and 3.0% treatment failure in 400 patients in Alexandria in 2005–2015 (25). Attention has been raised about the fluctuation in treatment success rates in Egypt in 2006–2011, with a plateau around 85.0% (26). In the first Egyptian cohort of patients with multidrug-resistant TB, treatment success rate was 69.3% from July 2006 to December 2010, treatment failure rate was 7.1%, and mortality was 11.8% (27).

We found that the prevalence of TB was higher among males than females, which is consistent with studies in other countries (28–30). This is probably because males are more exposed to TB risk factors such as smoking and infected animals. In their systematic review, Noykhovich et al.

found that the odds of developing TB were almost 5 times greater in urban slums (31). In contrast, we found that the prevalence of TB was higher among those living in rural than urban areas. This may be attributed to occupation and daily activities in agriculture and farming, which involved close proximity to infected animals. Similarly, an association between TB prevalence and rural residence was reported in China (32).

The main strengths of our study were that the results were reported in accordance with the PRISMA statement; most of the included studies had large sample sizes; there was no significant publication bias; we included unpublished papers and dissertations from local universities; and articles were reviewed and data were extracted by independent investigators. However, there were several limitations to our analysis. First, important data may have been missed from unpublished dissertations for which we did not receive responses from the authors; conference papers discussing TB in Egypt for which we could not search; non-English database sources; and other TB-specific databases. Second, the included studies showed significant heterogeneous estimates ($I2 > 90\%$) with insufficient data to define the sources of such heterogeneity. However, the variability in outcome estimates may have resulted from differences in population characteristics, geographic locations, regions, settings (urban or rural), associated comorbidities, HIV status, and statistical methods. Third, the low number of included studies may have affected the accurate estimation of TB burden in Egypt. Also, some governorates were not studied, including Sinai; hence, understanding of the burden of TB in some regions within the country was limited. Fourth, we were unable to include all treatment outcome indicators as defined by WHO because of the substantial study-level differences. Only cured/completed, failure, and death indicators were used. Treatment outcomes are a complex issue and are more appropriately measured with other types of study design, mainly interventions and prospective cohort studies. However, these studies may be challenged by loss of some participants during follow-up. Fifth, prevalence of drug-resistant TB was not measured because of lack of data. Sixth, the contribution of high-risk populations to the national TB burden may not have been sufficiently represented. Such populations include household contacts of confirmed TB cases, healthcare workers, drug users, prisoners, patients with latent TB, and people living with HIV. Seventh, prevalence as a measure of disease burden may not be entirely accurate, because it measures the disease at a single time and cannot distinguish between recent infection and reactivation. Finally, meta-analysis is not free of potential bias with models, estimations, and study selection, and Egger's test may not detect publication bias in small numbers of studies. Despite these limitations, our findings give insight to some important epidemiological trends related to TB in Egypt in the last 2 decades that may help in decision-making about whom to prioritize for surveillance, and for intervention strategies.

Conclusion

Egypt has shown progress in decreasing the incidence of TB over the last 2 decades; however, good treatment outcomes have remained unsatisfactory. The plateau in treatment success indicates that TB is a neglected disease in the era of influenza and other virus epidemics and pandemics. Programmes for TB control in Egypt should continue efforts to achieve good

treatment outcomes, extend case finding and surveillance reporting systems, and enhance the resources and quality of services, coupled with more studies to generate in-depth evidence for targeted interventions.

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Analyse systématique et méta-analyse de la prévalence et de l’incidence de la tuberculose et issue thérapeutique en Égypte : aperçu actualisé

Résumé

Contexte : La tuberculose est une cause majeure de morbidité et de mortalité dans le monde. Il est essentiel d'en comprendre l'épidémiologie et d'appréhender le fardeau qu'elle représente pour mener des interventions ciblées.

Objectif : Mettre en évidence la prévalence et l'incidence de la tuberculose ainsi que les issues du traitement en Égypte au cours des deux dernières décennies.

Méthodes : Pour réaliser la présente analyse systématique et méta-analyse, nous avons effectué des recherches dans les bases de données Medline/PubMed, ResearchGate, Google Scholar et Scopus. Nous avons également consulté les bases de données locales afin de trouver des études non publiées, ainsi que les rapports des agences internationales, en appliquant des critères d'inclusion et d'exclusion précis. La recherche a porté sur la prévalence, l'incidence, les résultats du traitement, l'âge, le genre et le lieu de résidence des patients, ainsi

que sur le type de tuberculose. Les données ont été analysées à l'aide du logiciel STATA version 16.0. Les estimations globales avec intervalle de confiance (IC) à 95 % ont été calculées à l'aide d'un modèle à effets aléatoires. L'odds ratio (OR) avec IC à 95 % a été utilisé comme mesure de l'effet pour les variables associées. La statistique I^2, combinée à une analyse de sous-groupes, a été utilisée pour mesurer l'hétérogénéité entre les études.

Résultats : Au total, 23 études provenant de 22 gouvernorats sur 27 et réalisées auprès de 139 597 participants répondaient aux critères d'admissibilité sans biais de publication. La prévalence globale était de 8,70 (IC à 95 % : 5,80-12,41, I^2 = 92,7 %) et l'incidence globale était de 9,10 (IC à 95 % : 6,65-14,86, I^2 = 95,5 %) pour 100 000 personnes. Près de 82,6 % des cas ont été guéris ou ont terminé leur traitement, 4,4 % ont connu un échec thérapeutique et 3,9 % sont décédés. Dans les analyses de sous-groupes, les probabilités de prévalence de la tuberculose étaient plus élevées chez les hommes que chez les femmes (2,05 ; IC à 95 % : 1,44-3,28), chez les personnes vivant en zone rurale qu'en zone urbaine (1,29 ; IC à 95 % : 0,61-1,97), en Haute Égypte et dans le Grand Caire qu'en Basse Égypte et dans la région du Delta (1,85 ; IC à 95 % : 0,97-4,15). Les probabilités de prévalence de la tuberculose pulmonaire étaient plus élevées que celles de la tuberculose extrapulmonaire (2,43 ; IC à 95 % : 1,63-5,71). Les probabilités de guérison ou d'achèvement du traitement (1,04 ; IC à 95 % : 0,96-1,51), d'échec thérapeutique (1,71 ; IC à 95 % : 1,35-2,73) et de décès (1,12 ; IC à 95 % : 0,87-1,60) étaient plus élevées en Basse Égypte qu'en Haute Égypte.

Conclusion : L'incidence de la tuberculose a diminué en Égypte ces vingt dernières années, mais les résultats du traitement n'étaient pas satisfaisants, avec des variations d'une région à l'autre. Dans l'objectif de parvenir à l'éradication de la tuberculose en Égypte, il est nécessaire de déployer des efforts pour soutenir la stratégie de lutte antituberculeuse en améliorant les résultats du traitement et en renforçant la recherche de cas et les rapports issus de la surveillance.

WHO EMRO | Systematic review and meta-analysis of the prevalence, incidence and treatment outcomes

ويتسم فَهْم خصائصه الوبائية وعبئه بأهمية بالغة في التدخلات المستهدفة .

: هدفت هذه الدراسة الى تسليط الضوء على معدل انتشار السل ومعدل الإصابة بهالأهداف
ونتائج علاجه في مصر خلال العقدين الماضيين .

: لإجراء هذا الاستعراض المنهجي والتحليل التلوي، بحثنا في قواعد البياناتطرق البحث
البيانات قواعد في وبحثنا Medline/Pub Med ▯ ResearchGate ▯ Google Scholar ▯ Scopus.
المحلية عن الدراسات غير المنشورة، وتقارير الوكالات الدولية، مع تطبيق معايير واضحة
للإدراج والاستبعاد . وشمل البحث معدل الانتشار، ومعدل الإصابة، ونتائج العلاج، وعمر
المرضى وجنسهم ومكان إقامتهم، ونوع السل . وحُلِّلت البيانات باستخدام الإصدار 16,0 من
برنامج STATA. وحُسبت التقديرات المُجمَّعة بفاصل الثقة 95% باستخدام نموذج
التأثيرات العشوائية . واستُخدمت نسبة الأرجحية بفاصل ثقة 95% بمثابة مقياس تأثير
للمتغيرات ذات الصلة بالموضوع . وقُيِّمت التغايُرِيَّة على مستوى الدراسات باستخدام
الاختبار الإحصائي I^2 مع تحليل المجموعات الفرعية .

: استوفى ما مجموعه 23 دراسة من 22 من أصل 27 محافظة، شملت 139,597 نسمة ، شروطالنتائ ج
الأهلية دون أي تحيز في النشر . وبلغ معدل الانتشار المُجمَّع 8,70 (فاصل الثقة 95%:
6,65-14,86، 95%: الثقة فاصل (9,10 عَّجمُالم الإصابة معدل وبلغ ، $I^2 = 92,7\%$) ، 5,80-12,41
،علاجها اكتمال أو شفاءها الحالات من 82,6% نحو وأظهرت . نسمة 100,000 لكل ($I^2 = 95,5\%$
وأظهرت 4,4% من الحالات فشلًا في العلاج، وتُوفي 3,9% من الحالات . وفي تحليلات
المجموعات الفرعية، كانت أرجحية انتشار السل أعلى بين الذكور منها بين الإناث (2,05 ؛
فاصل الثقة 95%: 1,44–3,28) ، وانتشاره بين أولئك الذين يعيشون في مناطق ريفية أكثر ممن
يعيشون في مناطق حضرية (1,29 ؛ فاصل الثقة 95%: 0,61–1,97) ، وانتشاره في صعيد مصر
والقاهرة الكبرى أكثر من شمال مصر ومنطقة الدلتا (1,85 ؛ فاصل الثقة 95%: 0,97–4,15).
وكانت أرجحية انتشار السل الرئوي أعلى من احتمالات انتشار السل خارج الرئة (2,43 ؛ فاصل
الثقة 95%: 1,63–5,71). وكانت أرجحية شفاء الحالات أو اكتمال علاجها (1,04 ؛ فاصل الثقة
95%: 0,96–1,51) ، وفشل العلاج (1,71 ؛ فاصل الثقة 95%: 1,35–2,73) ، والوفاة (1,12 ؛ فاصل
الثقة 95%: 0,87-1,60) أعلى في شمال مصر منها في صعيد مصر .

: انخفض معدل الإصابة بالسل في مصر على مدار العقدين الماضيين، ولكن نتائجالاستنتاجات
العلاج لم تكن مُرضية، مع وجود اختلافات بين المناطق المختلفة . ولاستئصال السل في مصر،
ينبغي بذل الجهود لمواصلة استراتيجية مكافحة السل، من خلال تحسين نتائج العلاج وتكثيف
تقصِّي الحالات والإبلاغ عن الترصُّد .

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