

# Epidemiological Profile of Tuberculosis and investigation of some risk factors in the province of Larache, Morocco (2000-2012)

## ABSTRACT

**Aim:** Tuberculosis (TB) remains a topical health issue all over the world.

**Methodology:** the present study took place in the province of Larache located at the north of Morocco, during the period between 2000 and 2012, and aimed to bring out the epidemiological profile of TB and to investigate some risk factors associated with this pathology.

**Results:** The results showed that pulmonary tuberculosis represents two thirds of all cases (58%). Moreover, 45% of patients completed their treatment and 34% are cured with negative bacilloscopy. We reported 89 cases of death during the period of study. The evolution of the annual rate of success knew a remarkable increase from 95.6% in 2000 to 98.4% in 2012.

On the other hand, we demonstrated that death occurs preferentially in the oldest patients and that ganglionic and cerebral TB occur preferentially in the youngest patients whereas urogenital and pericardial TB occur in the oldest patients especially.

As for localization, we found that patients suffering from pulmonary TB display a significantly higher risk of death compared to other patients (RR = 1.58; IC95%= 1.01 – 2.467). In contrast, the risk of death is significantly lower in patients with ganglionic TB (RR= 0.08; IC95%= 0.01- 0.56).

Furthermore, females present a significantly higher risk to contract ganglionic, Peritoneo-intestinal and pericardial TB compared to males. In contrast, the risk of contracting pulmonary TB is almost two times higher in males compared to females.

**Conclusion:** In conclusion, much effort should be made to fight against tuberculosis in Morocco.

Key words: Tuberculosis, epidemiology, age, gender, localization, Morocco.

## INTRODUCTION

The WHO estimates at 9.6 million the number of people affected by TB in 2014 and 1.5 million the number of people who died from it [1].

All the countries are affected but almost cases occur in Asia (55%) and Africa (30%), especially India and China that contain 35% of all TB cases. TB control could be achieved if Tuberculosis (TB) remains a topical health issue all over the world despite the implementation of preventive means such as BCG vaccination (1921) and efficient therapies since 1950. each patient was quickly diagnosed and treated [2].

In Morocco, in 2015, there were 30 636 cases of TB all types (28 955 new cases and 1681 relapses), that makes an incidence of 89 per 100 000 inhabitants. The number of deaths in the same year was 656 [3].

Moreover, putting an end to TB by 2030 is among health objectives the United Nations have put as priorities for the sustainable development.

In this context, the present study took place in the province of Larache located at the north of Morocco, during the period between 2000 and 2012, and had two objectives; the first is to bring out the epidemiological profile of TB, the second is to investigate some risk factors associated with this pathology. The results of the present work could contribute to the improvement of the application of the WHO Anti-Tuberculosis Program and to a better control of this contagious disease in this province.

## MATERIAL AND METHODS

The present work covers the province of Larache located in the north of Morocco and whose population came close to inhabitants in 2012. It consists in a retrospective study based on 7671 cases of tuberculosis, all forms combined, reported to the Centre for Diagnosis and Treatment of Respiratory

Diseases (CDTRD) of Larache during a period of 13 years from January 2000 to December 2012. These cases come from the provincial hospital of Larache, Ksar El Kbir hospital, various health centers, public and private pulmonologists and general practitioners in this province.

All criteria of reported cases (age, gender, affected organ, radiological and biological examination and treatment, case progress ...) are stored in individual records of patient treatment and in a register in the CDTRD.

The variables we were interested in in the present study are gender, age, localization (affected organ), evolution, admission year and season.

The population data used for the calculation of incidence rates originated from the estimations of the High Commissioner for Planning on a provincial level. The rate of incidence was obtained by multiplying the number of cases by 100 000 and dividing by the population of the province.

The specific lethality for each age group was obtained by dividing the number of deaths among this age group by the number of cases in the same age group.

In order to compare numbers between different groups, were used chi-square test with an error risk consented to 5%. Furthermore, we used the Relative Risk in order to investigate the association between death and localization, and between gender and localization. We also used One Factor Analysis of Variance (Anova) to analyze the relation between age and localization, and between age and TB evolution.

## RESULTS

Among the 7671 studied cases of TB, 4757 are males (62%) and 2914 are females (38%). The difference is statistically significant ( $\chi^2=442.8$ ;  $p<0.001$ ), the sex-ratio is 1.63.

The annual incidence of tuberculosis decreased slightly between 2000 and 2004, from 130 to 102 cases per 100 000 inhabitants, then it increased gradually to reach its maximum, which is 139 per 100 000 inhabitants, in 2012.

Similarly, the study of annual changes in incidence by gender showed that TB incidence remains much higher in males than in females throughout the study period. In fact, it went from 131 cases per 100 000 in 2004 to 172 in 2012 among males and from 74 cases per 100 000 in 2004 to 107 in 2011 among females (Fig. 1).

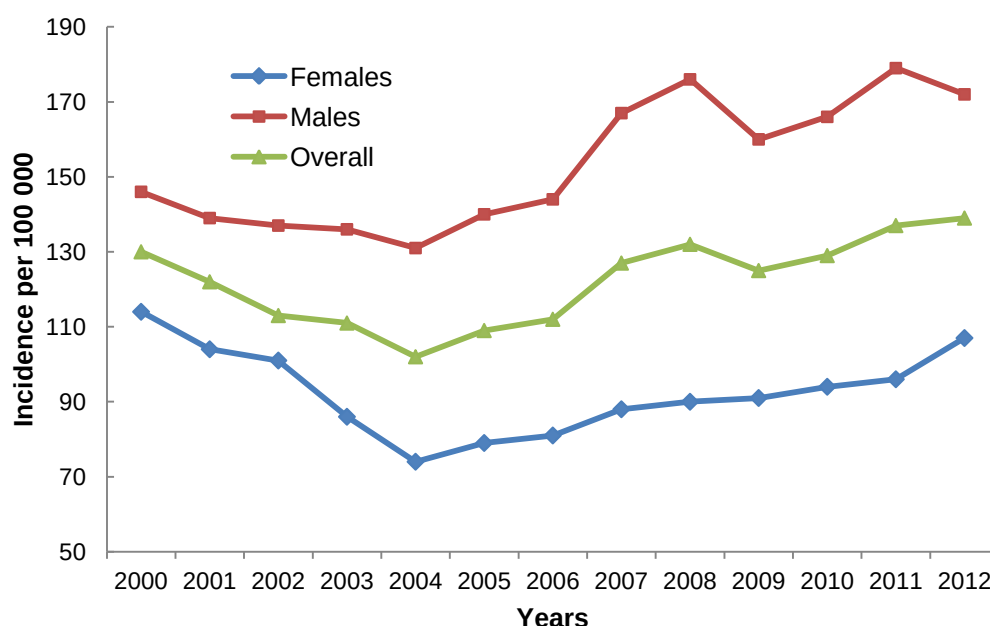


**Fig. 1. Evolution of the annual incidence of TB from 2000 to 2012.**

Moreover, the average age of TB patients is  $33.93 \pm 17.97$  years, while the median age is 28 years. The average age is  $33.6 \pm 17.1$  years in males and  $34.4 \pm 19.2$  in females, the gender difference is statistically not significant ( $F= 3.6$  ;  $p>0.05$ ).

The repartition by age groups shows a predominance of cases who are between 15 and 24 years (30.4%) followed by those who are between 25 and 34 years and those who are between 35 and 44

years respectively (Fig. 2). That means that the disease affects preferentially the most active population.

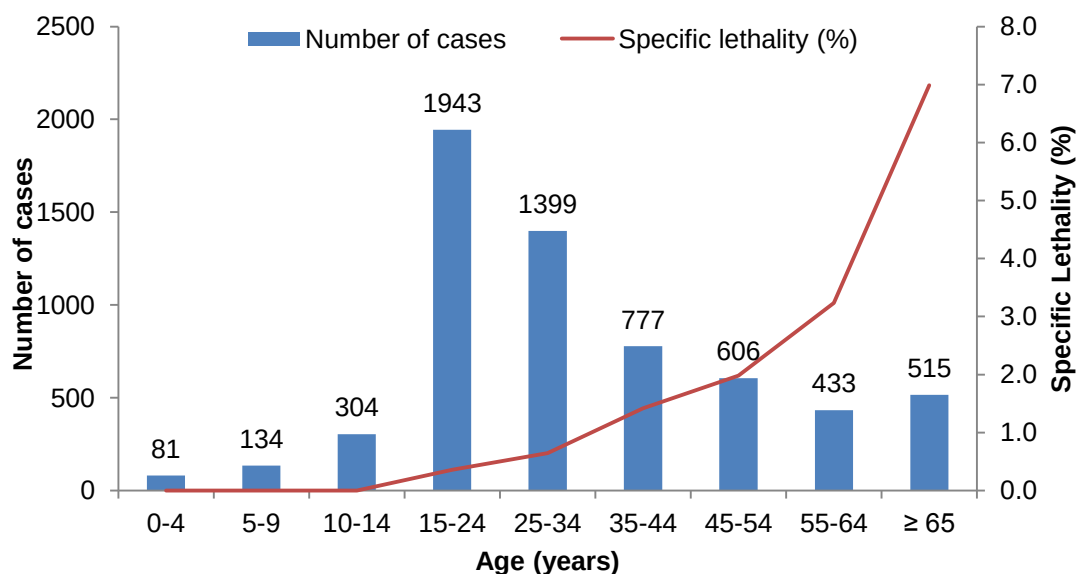


**Fig. 2. Repartition of TB cases number and specific lethality by age group.**

On the other hand, the specific lethality becomes important after the age of 45 years. It reaches a maximum value of 7% in more than 65 years age group (fig. 2).

The repartition of patients according to the type of tuberculosis shows that pulmonary tuberculosis represents two thirds of all cases (58%). Pleural TB comes second and Ganglionic TB comes third with 18% and 12% respectively (Fig. 3). It should be noted that cases of pulmonary TB confirmed by microscopy (TPM+) represent 88% of pulmonary TB cases.

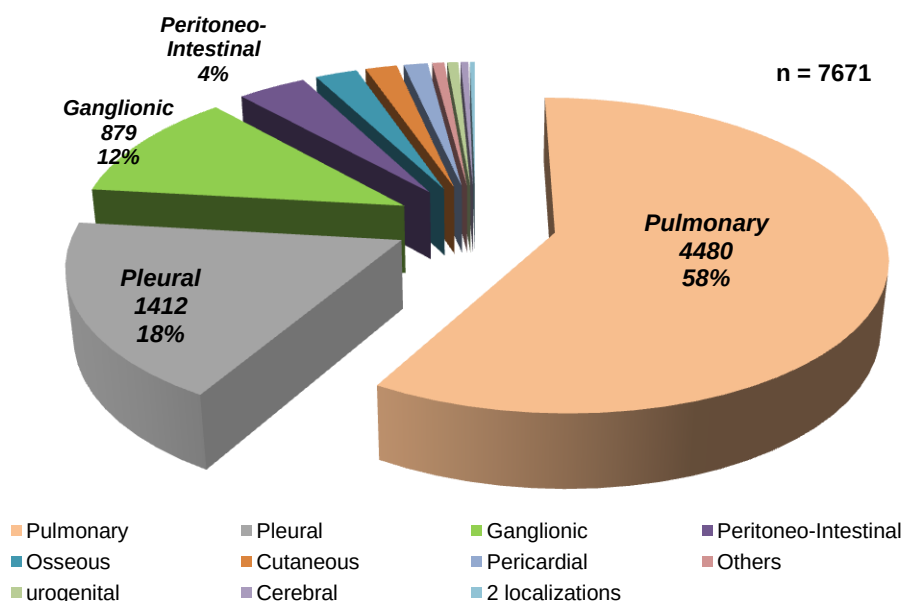


**Fig. 3. Repartition of tuberculosis cases according to the affected organ**

As far as season is concerned, we found that the number of cases is higher during spring and summer with 2196 and 1940 cases respectively, compared to autumn and winter with 1851 and 1684 cases respectively. The difference between seasons was statistically significant ( $\chi^2=71.4$ ;  $p<0.001$ ). The evolution of patients was also investigated and the figure 4 shows that 45% of patients completed their treatment, with disappearance of all signs of the disease and improvement of the health (but without bacilloscopy), and that 34% of patients are cured with negative bacilloscopy. In addition, 89 deaths were reported during the period of study. It should be noted that 14% of patients are lost to follow-up, so their evolution is unknown (Fig. 4).

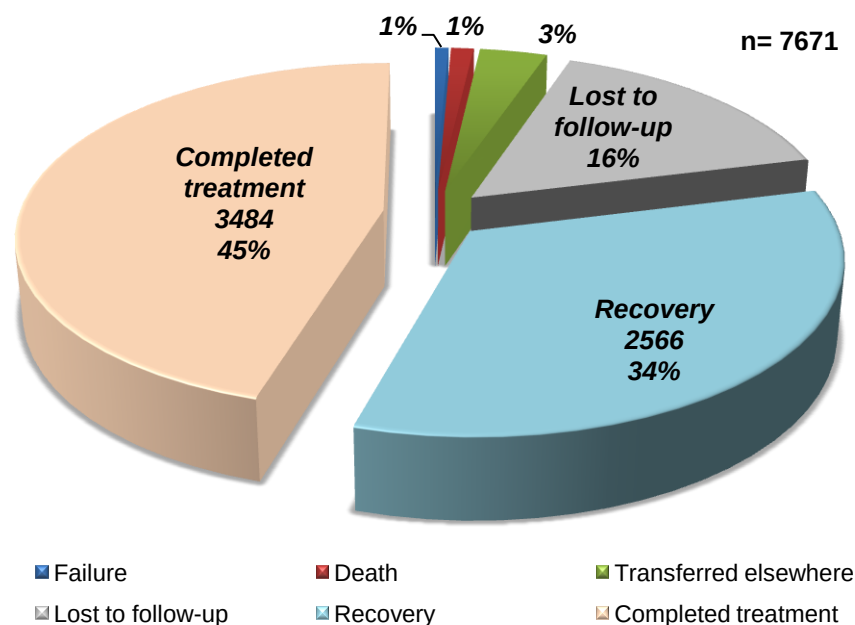


**Fig. 4. Repartition of tuberculosis cases according to the evolution**

Furthermore, the annual change according to the evolution of patients displays a remarkable and steady increase of the annual rate of success (completed treatment and recovery) from 95.6% in 2000 to 98.4% in 2012.

In order to investigate the impact of age on the evolution of patients, we used one factor Anova which revealed a significant association ( $F=54.2$ ;  $p<0.001$ ). This means that the evolution depends on age of patients. The means comparison method led to three groups of evolution according to the age (Fig. 5).

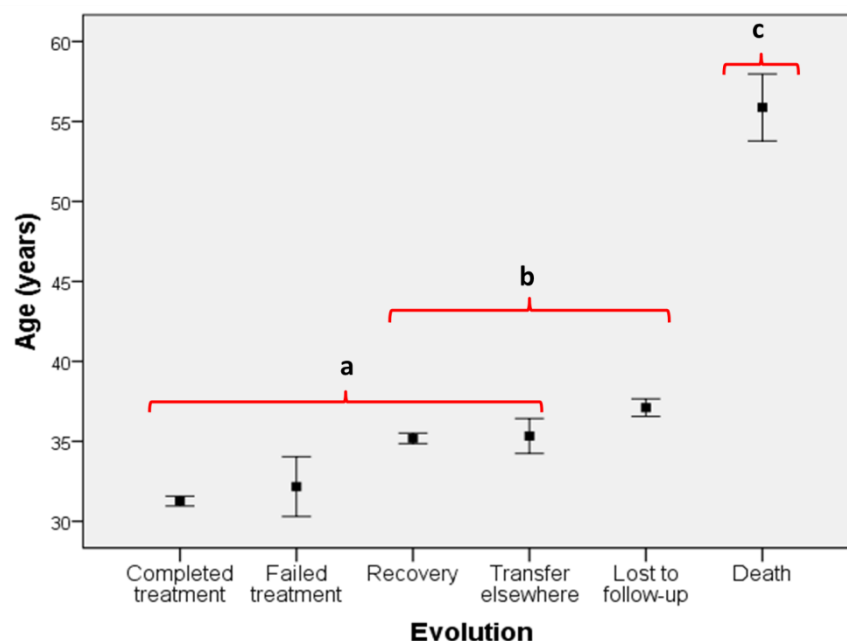


**Fig. 5.**Repartition of means of age according to the evolution.

Indeed, the figure 5 shows that death occurs preferentially in the oldest patients (c), the average age of dead patients was  $55.9 \pm 19.7$  years.

On the other hand, we investigated the implication of age in the repartition of TB localizations using one factor Anova. The results displayed a statistically significant relation between TB localization and patient age ( $F=46.6$ ;  $p<0.001$ ). The means comparison method led to seven groups of localizations according to the age (Fig. 6).

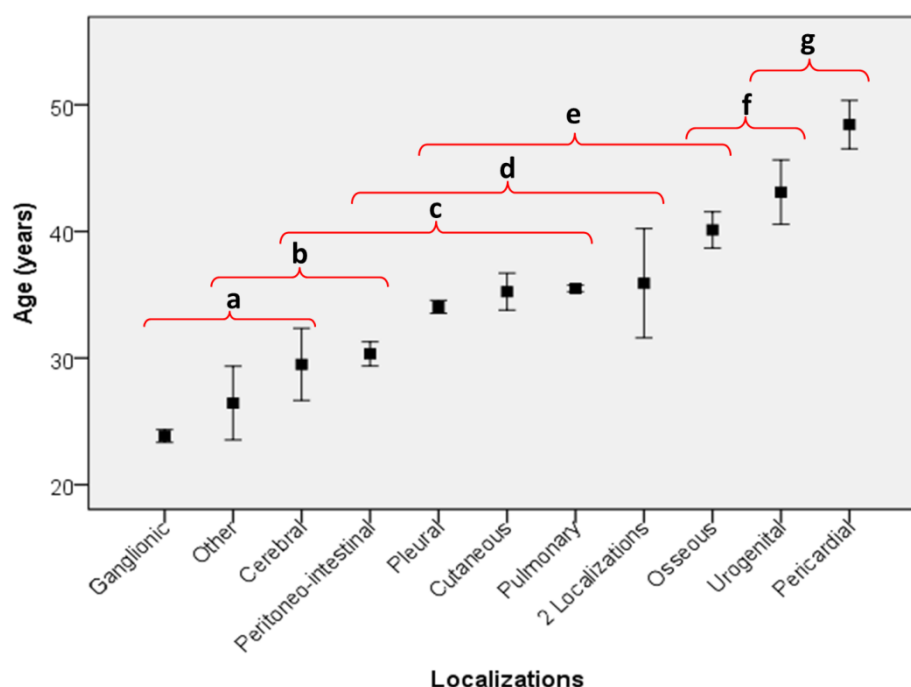


**Fig. 6.**Repartition of means of age according to the localization.

The results of figure 6 imply that ganglionic and cerebral TB occur preferentially in the youngest patients (a), with an average age of  $26.6 \pm 17.7$  years, whereas urogenital and pericardial TB occur in the oldest patients especially, with an average age of  $45.7 \pm 18.8$  years.

So as to study the association between TB localization and death, we calculated the relative risk of death for each localization (table 1). The results show that patients suffering from pulmonary TB display a significantly higher risk of death compared to other patients ( $RR= 1.58$ ;  $IC_{95\%}= 1.01 - 2.467$ ). In contrast, the risk of death is significantly lower in patients with ganglionic TB ( $RR= 0.08$ ;  $IC_{95\%}= 0.01- 0.56$ ).

**Table 1: Repartition of relative risks (RR) of death according to the localization.**

| Localizations        | RR<br>(Dead<br>exposed) | 95% Confidence<br>Interval |        |
|----------------------|-------------------------|----------------------------|--------|
| Pulmonary            | 1.579                   | 1.011                      | 2.467  |
| Ganglionic           | 0.078                   | 0.011                      | 0.562  |
| Cerebral             | 22.490                  | 0.401                      | 3.004  |
| Cutaneous            | 1.019                   | 1.015                      | 1.022  |
| Osseous              | 1.279                   | 0.400                      | 4.088  |
| Peritoneo-intestinal | 1.399                   | 0.563                      | 3.480  |
| Urogenital           | 1.008                   | 1.005                      | 1.010  |
| Pericardial          | 3.143                   | 0.969                      | 10.187 |
| Pleural              | 0.880                   | 0.503                      | 1.538  |
| 2 Localizations      | 1.003                   | 1.002                      | 1.005  |
| Others               | 1.464                   | 0.200                      | 10.731 |

Furthermore, we calculated the relative risk of gender (females being exposed) for each TB localization in order to analyze the association between the gender of patients and the TB localization (table 2). The results show that females present a significantly higher risk to contract ganglionic, Peritoneo-intestinal and pericardial TB compared to males with respective risks of 2.49, 2.29 and 1.55. In contrast, the risk of contracting pulmonary TB is almost two times higher in males compared to females (table 2).

**Table 2: Repartition of relative risks (RR) of gender according to the localization.**

| Localizations        | RR<br>(Females<br>exposed) | 95% Confidence<br>Interval |        |
|----------------------|----------------------------|----------------------------|--------|
| Pulmonary            | 0.534                      | 0.487                      | 0.587  |
| Peritoneo-intestinal | 2.489                      | 1.972                      | 3.142  |
| Ganglionic           | 2.294                      | 1.990                      | 2.644  |
| Pericardial          | 1.553                      | 1.060                      | 2.276  |
| Cerebral             | 1.842                      | 0.938                      | 3.617  |
| Cutaneous            | 1.110                      | 0.790                      | 1.559  |
| Osseous              | 1.173                      | 0.874                      | 1.574  |
| Urogenital           | 1.333                      | 0.758                      | 2.344  |
| Pleural              | 1.010                      | 0.897                      | 1.137  |
| 2 Localizations      | 5.577                      | 2.055                      | 15.133 |
| Others               | 2.213                      | 1.288                      | 3.803  |

## DISCUSSION

This work showed that males are by far the most affected by TB throughout the period of the study with a sex-ratio of 1.63 which remains lower than that found in south of Morocco (1.73) [4] and in Belgium (1.82) [5]. This result is comparable to that found by studies in France (1.63) [6]. Other studies reported a lower sex-ratio in favor of men, particularly in Madagascar (1.52) [7], in Switzerland (1.43) [8] in Congo (1.42) [9], in Tunisia (1.4) [10] and in Algeria (1.1) [11].

The fact that TB affects males more than females could be due to tobacco consumption which constitutes a risk factor for this disease and which is predominant in males [12,11].

Moreover, we found that median age of patients is 28 years, which is lower than that reported in south of Morocco [4], in Tunisia [10], in Cameroun [14], in Madagascar (40 years) [7], in France (44 years) [15] and in Belgium (37 years) [5]. The average age which is 34 years is similar to that found by other studies in south of Morocco [4] and in Congo [9].

The present study also showed that the most affected age group is 15-44 years with 66.4%, this result is in perfect accordance with those obtained in south of Morocco [4] and elsewhere [9, 16, 17].

As for TB localization, we showed that pulmonary TB is the most frequent with 58%. This percentage is higher than that found in south of Morocco, Tunisia and Congo [4,9,10] but considerably lower than that reported in France (73%), Madagascar (65.9%) and Netherland (62%) [6, 7, 18]. Moreover, the present study showed that 88% of pulmonary TB patients were TPM+ whereas another study carried out in Belgium reported 44% only, which indicates a greatly higher risk of contagiousness in Morocco [5].

Regarding the evolution of tuberculosis cases, this work showed a significant improvement in the success rate, which would be due to the effort of the nursing staff and/or the introduction of combined forms of medication. This success rate is prominent compared to that found in other countries [19-21]. In addition, we found that death occurs preferentially in oldest patients which is likely due to their frail health. This result is reported by several studies [8, 15].

On the other hand, we reported by the present study that patients with pulmonary TB display higher risk to die compared to other patients, which agrees with the results of other studies [9]. We also reported that males have higher risk to contract pulmonary TB compared to females. Indeed, gender aspects of TB have been a neglected research area, and little attention has been given to these aspects of TB control. However, certain studies demonstrated that males are biologically more vulnerable to pulmonary TB [22]. In addition, other studies, including in Bangladesh, Malawi and South Africa, argue that TB is more difficult to diagnose in women [23-25]. Some studies have found that women with pulmonary TB have a different immune response to TB than men [26] resulting in different symptoms, signs and outcomes, and that women with TB may not test positive on microscopic examination of the sputum [27]. One study found that TB lung lesions might not be as severe in women as in men, which can reduce the severity of symptoms in women and make diagnosis more difficult [28].

## CONCLUSION

In conclusion, even if the TB management success rate has known an important increase in the province of Larache, the incidence of TB there remains high. Then, Moroccan health authorities should make more effort to the successful implementation of the national anti-tuberculosis strategy in this province, and particular attention should be paid to old patients, male patients and pulmonary TB patients.

**The authors declare that there is no conflict of interest regarding the publication of this paper.**

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