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Original Research Article

Pediatric tuberculosis under six years old: an 18-year experience of a level II hospital

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ABSTRACT

Background: Tuberculosis disease under six years is an indicator of recent transmission within the community. We aim to characterize tuberculosis disease in children under six years in a pediatric department of a level II hospital in the Lisbon metropolitan area, which serves a high percentage of immigrants from Portuguese-speaking African countries.
Methods: Retrospective and descriptive study of tuberculosis disease cases treated in our Department between January 2004 and December 2021 (18 years). Descriptive analysis of the collected data was performed using SPSS Statistics® 25.
Results: 25 patients were included, 60% diagnosed between 2016 and 2021. Five patients were born in countries with high TB incidence and 11 other patients had immigrant families from such countries. Ten out of 13 patients not immunized with BCG had the recommendation to do so. A close contact with tuberculosis was known in 15 patients, and in seven of those the system for TB prevention failed. At diagnosis: 4/25 patients had disseminated tuberculosis (three miliary and one congenital).
Conclusions: The increase in tuberculosis disease cases under six years in the last three years points to some pitfalls in tuberculosis surveillance and transmission prevention. New studies and institutional protocols are needed to improve the effectiveness of the network involved in TB prevention and treatment.

Keywords: Pediatric tuberculosis, Tuberculosis, Prevention, Screening, Portugal, Child

INTRODUCTION

Tuberculosis (TB) disease in children under six years old is an indicator of recent transmission in the community.[1] In this age group, there is a higher risk of infection after contact with active tuberculosis, a higher rate of progression of TB infection to TB disease and more frequent manifestations of both severe disease and extrathoracic forms (miliary TB and meningitis). For all these reasons, screening is essential after contact with a baciliferous patient.[1] A positive screening (corresponding to either TB disease or TB infection) requires treatment with antimycobacterial therapy. If the screening is negative, chemoprophylaxis should be started.[1]

Tuberculosis shows a heterogeneous distribution worldwide: most TB cases occurred in the regions of South-East Asia (44%), Africa (24%) and the Western Pacific (18%), with smaller shares in the Eastern Mediterranean (8%), the Americas (3%) and Europe (3%).[2] Data reported by 80 countries show that a total of 1.2 million children under 5 years who were household contacts of TB patients started TB preventive treatment in the 3-year period of 2018-2020. This represents 29% of the 4 million children targeted by the WHO to receive preventive treatment, from 2018 to 2022. For children who started treatment, the median completion rate was 86% (IQR: 71-96%).[3] Of note, in the pre-pandemic years, within the European Union, the highest rates of new cases

among those aged 0-4 years were reported in Portugal, Romania, Slovakia and Spain.[4]

In 2014, the number of newly notified cases of tuberculosis in Portugal hit the threshold for classification as a low-incidence country (incidence lower than or equal to 20 cases per 100000 inhabitants). In 2015, another milestone was achieved: the annual incidence of TB meningitis in children under five years old was less than 1:10000000 inhabitants for five consecutive years,[5] thereby meeting all the criteria required by the WHO and UNICEF to stop the universal vaccination with Bacille Calmette-Guérin (BCG) vaccine and adopt a risk-group immunization plan.[6] This vaccine prevents the severe manifestations of the disease, namely miliary TB and meningitis, with a proven 80% efficacy.[5] For children under 6 years old, the risk groups that warrant BCG vaccination include: being born in, living in or staying for more than three months in a high endemicity country; living with someone with TB disease history or at risk of TB infection (such as HIV infection, alcohol or drug addiction and being from a high endemicity country); and belonging to a TB high-risk community, as defined by the local health public units.[5]

In 2019, TB incidence was 18.0/100000 inhabitants, with higher rates in Lisbon and Porto (22.1 and 20.9 cases per 100000 inhabitants, respectively). Incidence in children under six years was 6.59/100000 children.[7] Notably, incidence is higher in the migrant population: in 2019 the incidence in this group was 4 times higher than the national average (83.7/100000 inhabitants), accounting for 24.6% of all cases.[7] This higher incidence in the immigrant population is also a tendency in other countries with low TB incidence.[8] In 2020, Sintra and Amadora were the 2nd and 4th municipalities with the highest number of immigrants in Portugal. In 2020, 41.155 immigrants resided in Sintra and 23.458 resided in Amadora (10.5% and 12.6% of the total residing population, respectively).[9] The main origin countries were Brazil, Cape Verde, India, Guinea Bissau, Angola and Pakistan, all of which are countries where TB is highly endemic.[9]

Our goal was to characterize TB cases in children under six years old in a Pediatric Department of a level II hospital in the Lisbon metropolitan area, which serves a high percentage of immigrants from Portuguese-speaking African countries.

METHODS

We performed a retrospective and descriptive study of TB disease in patients under six years old treated in the Child and Youth Department of Hospital Professor Doutor Fernando Fonseca, in Amadora, between January 2004 and December 2021 (18 years). We included patients under six years old at the time of diagnosis of TB, treated in the study period. TB was diagnosed using the WHO definition of case, adapted by Portugal's Department of Health. A confirmed case was assumed when the patient had a positive culture for *M. tuberculosis* or a positive molecular technique (Polymerase Chain Reaction, PCR) with isolation of acid-alcohol resistant bacilli. A probable case is defined by the isolation of acil-alcohol resistant bacilli or positive PCR or suggestive histopathology findings, such as granulomata. A possible case lacks any of these findings, and is based on epidemiological, clinical and imagiological criteria.[7] TB cases were classified as intrathoracic and/or extrathoracic disease according to the European Respiratory Society Monograph.[10] Patients without a clear diagnosis were excluded. Sample sizing was determined via convenience sampling, over the study period. Demographic, clinical, laboratory, imaging, therapeutic and follow-up data were analysed. Statistical analysis was performed using *SPSS Statistics*® 25, using descriptive statistics.

RESULTS

In the 18-year study period, 25 patients under six years old were treated for TB disease in our hospital, fifteen of which (60%) were diagnosed between 2016 and 2021 (Figure 1).

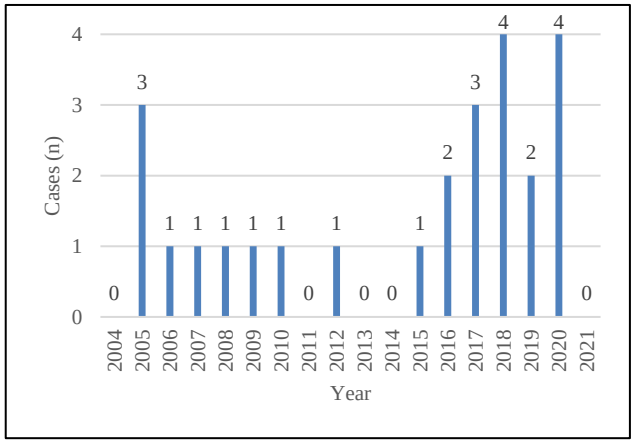

Figure 1: Cases of TB under six years old diagnosed in our hospital, during the period of study.

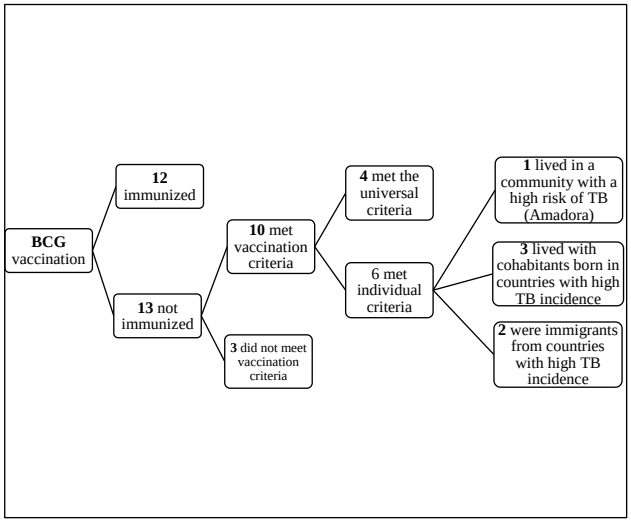

Figure 2. BCG vaccination status and vaccination criteria.

Table 1: Demographic data of the sample (n=25).

Demographic data		N
Age at diagnosis (years)	<1	4
	≥1 to <3	14
	≥3 to <6	7
Sex	Female	13
Country of origin	Portugal	20 (11 were born to immigrant parents from high-incidence coutries)
	Angola	3
	Guinea Conakry	1
	Romania	1
Municipality of residence	Amadora	13
	Sintra	11
	Oeiras	1
Cohabitants	≤3 cohabitants	11
	>3 and ≤5 cohabitants	7
	>5 cohabitants	3
	Unknown	4
Place to stay	Daycare	12
	At home with caregiver	8
	Unknown	5
Personal background	Relevant	7 (wheezing N=2, congenital CMV infection N=1, Fragile X syndrome N=1, Down syndrome N=1, malnutrition N=1 and sickle cell anemia N=1)
	Irrelevant	18

The median age at diagnosis was 25 months (minimum of nine days, maximum of 70 months). Notably, five patients (20%) were born in countries with high TB incidence and eleven other patients (44%) were born in Portugal but had immigrant families from said countries. Other relevant demographic data are shown in (Table 1). Twenty-four patients were admitted for investigation in our center. In one patient the investigation was performed on an ambulatory basis. The median length of stay was 9.5 days (minimum 3 days, maximum 105 days). Thirteen patients were not immunized with the BCG vaccine and, of those, ten met the vaccination criteria (Figure 2).

In 9 patients, contact with a TB patient was unknown (subgroup A). One patient with a known TB contact, despite timely screening and appropriate chemoprophylaxis, came to develop TB disease 5 months after screening (subgroup B). When analyzing the remaining 15 patients with a known TB contact, the system for TB prevention failed in seven: one patient was not screened and was diagnosed with TB disease at the emergency department two months after contact with a TB patient (subgroup C); in two patients, screening was delayed more than 15 days after contact, leading to the diagnosis of TB disease at the time of screening, which occurred one and three months after contact (subgroup D); and four patients were screened but failed to start chemoprophylaxis (subgroup E). In the remaining eight patients, TB was diagnosed within a week after contact (subgroup F), without failure in the prevention system. When comparing the group with and without failure in the prevention system: the median length of stay was not higher (8.0 versus 15.5 days, respectively (and the frequency of sequelae was similar (1/7 versus 1/8). More details related to diagnostic sequence and prognosis in these groups are shown in Table 2.

In symptomatic children (17/25), the time between the beginning of symptoms and TB diagnosis varied from 4 to 68 days (median of 22 days). This period was greater than 40 days[11] in three cases, one of which developed bronchiectasis as sequelae of pulmonary TB. Clinical picture details are shown in Table 3. HIV infection was excluded in 24/25 patients (in one patient, HIV status is unknown). At the time of diagnosis, 17 patients (68%) had intrathoracic TB, and 8 (32%) had and extrathoracic presentation (Figure 3). Four patients had disseminated TB (3 cases of milliary TB and 1 case of congenital TB). In this group, 2/4 were immunized with BCG.

Related to diagnostic tools (Table 3), most patients (22/25) had a positive tuberculin skin test or IGRA (by T-SPOT®.TB or Quantiferon®-TB Gold). Microbiological confirmation (positive culture for *M. tuberculosis*) was possible in 10/25 patients. One patient had multi-drug resistant TB (resistance to pyrazinamide, rifampicin, and streptomycin) In nine patients, a possible diagnosis was considered, since they had a very suggestive clinical presentation. They started treatment and showed clinical improvement, without sequelae.

Couse of treatment is further analysed in (Table 3). The median duration of therapy was 7 months (minimum 6 months, maximum 18 months in the multi-drug resistant TB). We found six cases of transient TB therapy-related toxicity that did not require changes in the therapeutic regimen.

Table 2: Diagnostic sequence and prognosis of patients, (n=25).

Subgroup	A, N=9	B, N=1	C, N=1	D, N=2	E, N=4	F, N=8
Close contact with TB patient	Unknown	Yes	Yes	Yes	Yes	Yes
Screening (yes/no and result)	NA	Yes, negative	No	Yes	Yes, negative	Yes, positive
Median time between contact and screening (days)	NA	Unknown	NA	90 days in both patients	Unknown (within a week after contact TB diagnosis)	Unknown (within a week after contact TB diagnosis)
Chemoprophylaxis (yes/no)	NA	Yes	NA	NA	No	NA
Median time between contact and diagnosis (days) (min, max)	NA	137	60	90 days in both patients	135 (90,330)	13 (7,30)
Median time between onset of symptoms and diagnosis (days) (min, max)	34 (6,52)	68	30	NA (both were asymptomatic)	14 (4,24) (only 2 were symptomatic)	16 (9,23) (only 5 were symptomatic)
Median length of stay (days) (min, max)	9 (3,105)	8	21	8 (one patient was followed on ambulatory basis)	7.5 (4,9)	16 (5,63)
Sequelae (N)	2/9 (scoliosis and atelectasis)	No	No	No	1/4 (bronchiectasis)	1/8 (atelectasis)
Severity (disseminated TB)	3 miliary/9	No	No	No	No	1 congenital/4

ED=emergency department, NA=not applicable, TB=tuberculosis.

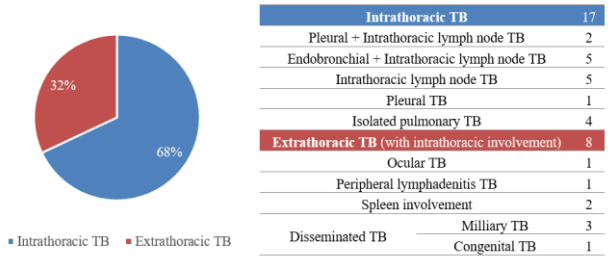

Figure 3: TB classification at the time of diagnosis.

Twenty-one patients achieved full recovery with no sequelae and four achieved recoveries with various degrees of sequelae, as described in (Table 2). When comparing the sequelae and the non-sequelae groups, the time between onset of symptoms and diagnosis was not higher in the former (median of 13 days versus 23 days, respectively), nor was the length of stay (median of 6 days versus 11 days, respectively). The patient with multi-drug resistant TB made a full recovery without sequelae. After diagnosis, all these children's close contacts completed TB screening.

DISCUSSION

In the year 2020, 9.9 million people fell ill with tuberculosis worldwide. Pediatric cases accounted for 11% of total new TB cases. In Portugal, there was an increase in reported cases per year under six years between 2015 (14 cases) and 2019 (45 cases), a tendency also seen in our study. National data also point to an increase in severe forms of TB (one case in 2015 and seven cases in 2019).[7] In 2020, 25 new cases/relapses were notified in children under 6 years, which translates into an incidence rate of 4.78 cases/100.000 inhabitants.[12] This is a steep decline from the 8.66 cases/100.000 reported in 2019, as the COVID-19 pandemic, changed the dynamics of all healthcare systems worldwide and hindered access to diagnosis and treatment of several diseases including TB.[12,13]

In the two municipalities served by our hospital, Amadora and Sintra, some asymmetries were seen. In the 5-year period of 2016-2020, Amadora had the highest notification rate of the district, with 39.2 cases/100.000 inhabitants, which even surpassed the municipality of Lisbon (30.4/100.000). Sintra was the 7th municipality with the highest notification rate (25.4/10.000). From a sociological point of view, the municipality of Amadora is also characterized by poor global health values, which is related to a high unemployment rate, a high number of social income beneficiaries and monoparental families.[14] The comparison between our study and national or international case series is difficult since the demographic characteristics of the population served by our hospital are

in various ways unique, due to the high proportion of immigrant population. In our sample, even though only five patients were born in countries with high TB incidence, and another 11 patients had immigrant families from such countries. In these migrant families, even if they have established residence in Portugal for a long time, it is very common for some members to travel back and forth for work or familial reasons.[15]

Table 3: Clinical picture, diagnostic tools, treatment and toxicity, (n=25).

Clinical picture	Frequency
Any symptom	22
Fever	14
Concomitant bacterial infection	8
Weight loss	3
Loss of appetite	2
Night sweats	1
Diagnostic tools	
Positive TST or IGRA	22
Positive TST and IGRA	6
Only positive TST	12
Only positive IGRA	4
Positive microbiological and/or molecular technique test	13
Positive culture and PCR	2
Only positive culture	8
Only positive PCR	3
Negative microbiological and/or molecular technique test	12
Suggestive histopathological exam (granulomata or isolation of alcohol-acid resistant bacilli)	3
Known close contact	9
Treatment (N=24)*	
HRZE	18
HRZ	7
Toxicity (N=6)	
Hyperuricemia	3
Hematologic	2
Hepatitis	1

H-isoniazide, R-rifampicin, Z-pirazinamide, E-ethambutol. *The patient with multi-drug resistant TB was referred to a Multiresistent TB Treatment Center.

It is important to note that the migration flux from high to low-incidence countries is increasing.[8] Considering the impact that migration has on local TB epidemiology, it is up to host countries to develop and investigate health programs directed to immigrant populations, namely for TB.[16] Some studies conducted on low-incidence countries have identified the country of origin as the main risk factor associated with a high incidence of TB notified in immigrant populations.[16,17] Despite this, there is still some controversy, with some authors attributing the higher incidence of TB in such populations to poor housing conditions, problems in access to healthcare, frequent changes in cohabitants, poor nutrition and a stressful environment in the host country.[18-20] It is relevant to note that these data do not include an important part of the immigrant population who is residing illegally, so the incidence of TB in migrants is likely underestimated.[21] Tuberculosis is linked to demographic and social factors. The gathering of people in large urban centers, its association with social difficulties and the association of TB with different comorbidities increase the difficulty in disease management. The immigrant population is extremely vulnerable and healthcare access is often challenging.[22] Cultural and linguistic barriers contribute to problems in compliance,[22] which is especially relevant in screening and treating TB. A combined social and medical action is necessary. It is known that factors like crowding and poor ventilation increase the risk of TB spread within communities.[23] Thus, TB incidence can be considered a "natural" biomarker of a country's state of development, as it declines with a higher human development index, higher access to improved sanitation and lower childhood mortality.[24]

In 2007, France stopped the universal vaccination with BCG and started a risk group immunization strategy. Data did not show an increase in TB cases among the pediatric population.[25] In Portugal, the shift in the immunization strategy made in 2016 was accompanied by the implementation of several strategies to reinforce the fight against TB, namely the identification of eligible children for BCG immunization, the restructuring of the laboratory network and the publication of recommendations for prevention, diagnosis and treatment in vulnerable groups, among others.[6] The efficacy of the shift in immunization policy and its accompanying strategies is yet to be determined and new studies are needed to ascertain this. For the reasons mentioned before, since the year 2016, the local health public units decided that living in Amadora is a sufficient criterion for BCG immunization since it is a TB high-risk community.[5] TB transmission control and eradication strategies are based on prompt diagnosis and treatment, treatment under observation, contact and risk-group screening, chemoprophylaxis and improved access to healthcare.[5] In the study period, we have identified several cases of TB in children under six years old, highlighting some frailties in the existing surveillance system. The National program for tuberculosis states that once a diagnosis of TB disease is made, contact screening should be complete in 15 days, which did not happen in two children.[7] Additionally, in four children the institution of chemoprophylaxis failed, resulting in TB disease, admission to the hospital and even long-term sequelae (bronchiectasis) in one case. We identified vaccine failure in two children who despite vaccination developed disseminated TB, since the BCG vaccine should protect against these forms of TB.

In 2016, the regional plan of the municipality of Amadora vouched to act on the most vulnerable groups (including migrants) to improve their health literacy and promote healthy habits, reduce the incidence of new cases of TB to 35/100000 inhabitants and shorten the time between

symptom onset and diagnosis to less than 40 days.[26] In our sample, this period was higher than 40 days in only 3 children. As mentioned earlier, geographic origin is one of the main determinant factors for TB incidence in a population. In some countries, there is even a clear epidemiologic profile that distinguishes two populations: migrant and local, with different incidences, mean age of the patients and forms of the disease. Much has already been achieved towards eliminating TB in Europe and, therefore, surveillance and prevention are key to maintaining such advances.[27] Children with TB are generally less infectious than adults, so they are easily overlooked in national TB control programs.[28]

Limitations

Current study has several limitations. First, the small sample size and the unique characteristics of the population studied may limit its generalizability. Second, it has all the limitations that are inherent to any retrospective study, including the existence of confounding factors not accounted for.

CONCLUSION

Current study points out some pitfalls in the screening pathway for TB prevention in children in Amadora and Sintra, and it also exposes the need for thorough TB surveillance in vulnerable populations, namely migrants. We believe that despite being a low-incidence country, the demographics of the population we serve require special considerations. To promptly identify new cases so that proper chemoprophylaxis can be started, connections between community services (community health centers, schools and pneumological diagnostic centers) should be improved. We also believe that there is a need for strategies that enhance the compliance focused on improving health literacy, with educational activities in schools and community centers. Our data suggest the need for collaborative social and medical protocols in preventing and treating TB. Developing a cost-effective strategy for the control of TB among any given population requires studying and surveilling the epidemiology in the local migrant population over time and might even involve targeting high-risk groups for screening. Furthermore, new studies are needed to evaluate the impact of the shift in BCG immunization strategy, the compliance with immunization guidelines and the effectiveness of the network involved in TB prevention and treatment, including timely and appropriate screening and chemoprophylaxis.

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REFERENCES

1. Carvalho A, Carvalho I, Marques L. Consenso sobre a abordagem da criança exposta a doente com tuberculose. Acta Pediatr Port. 2014;45:242-51.
2. Global tuberculosis report 2019. Available at: https://www.who.int/publications/i/item/9789241565714. Accessed on 20 November 2022.
3. Global tuberculosis report 2021. Available at: https://www.who.int/publications/i/item/9789240037021. Accessed on 20 November 2022.
4. Tuberculosis surveillance and monitoring in Europe 2020-2018 data. Available at: https://www.who.int/europe/publications/i/item/9789289054904. Accessed on 20 November 2022.
5. Estratégia de vacinação contra a tuberculose com a vacina BCG. Direção-Geral de Saúde. Available at:https://www.dgs.pt/directrizes-da-dgs/normas-e-circulares-normativas/norma-n-0062016-de-29062016-pdf.aspx. Accessed on 20 October 2022.
6. Tuberculose em Portugal Desafios e Estratégias 2018. Programa Nacional para a Tuberculose. Available at: https://www.dgs.pt/portal-da-estatistica-da-saude/diretorio-de-informacao/diretorio-de-informacao/por-serie-963780-pdf.aspx?v=%3d%3dDwAAAB%2bLCAAAAAAABAArySzItzVUy81MsTU1MDAFAHzFEfkPAAAA Accessed on 20 October 2022.
7. Manual de tuberculose e micobactérias não tuberculosas-Recomendações 2020. Available at: https://www.sip-spp.pt/media/rsrc5013/manual-tuberculose-e-micobacte-rias-na-o-tuberculosas.pdf . Accessed on 20 October 2022.
8. Jackson S, Kabir Z, Comiskey C. Effects of migration on tuberculosis epidemiological indicators in low and medium tuberculosis incidence countries: A systematic review. J Clin Tuberc Other Mycobact Dis. 2021;23:100225.
9. Indicadores de integração de imigrantes: relatório estatístico anual 2021. Available at: https://www.om.acm.gov.pt/documents/58428/383402/Sumário+REIII+2021.pdf/9c9f0272-9c31-4658-bf3c-6ea5c31255ac. Accessed on 20 October 2022.
10. European Respiratory Society Monograph, Tuberculosis. Available at: https://www.ers.com/content/tuberculosis-9781849841009.tab-info. Accessed on 20 October 2022.
11. Plano Nacional de Saúde e Estratégias Locais de Sáude. Novembro de 2015. Available at: https://www.dgs.pt/em-destaque/plano-nacional-de-saude-e-estrategias-locais-de-saude1.aspx. Accessed on 20 October 2022.
12. Relatório de vigilância e monitorização da Tuberculose em Portugal. Available at: https://www.dgs.pt/documentospublicacoe2020.aspx. Accessed on 20 October 2022.
13. Global tuberculosis report 2021. Available at: https://www.who.int/publications/i/item/9789240037021. Accessed on 20 October 2022.
14. Freitas A, Vaz A, Rodrigues T. Evaluating Portuguese population health in the last 20 years through a

Population Health Index, Eur J Public Health. 2015;25(3):175.
15. Henriques M. Argumentos para uma viagem sem regresso: a imigração PALOP por via da saúde: um estudo de caso. Available at: http://hdl.handle.net/10071/1809. Accessed on 20 October 2022.
16. Rieder HL, Zellweger JP, Raviglione MC, Keizer ST, Migliori GB. Tuberculosis control in Europe and international migration. Eur Respir J. 1994;7:1545-53.
17. Rapiti E, Fano V, Forastiere F. Determinants of Tuberculosis in an Immigrant Population in Rome: a case control study. Int J Tuberc Lung Dis. 1998:2(4):479-83.
18. Che D, Antoine D. Immigrants et Tuberculose: données épidémiologiques recentes. Med Mal Infect. 2009;39:187-90.
19. Buskin SE, Gale JL, Weiss NS, Nolan CM. Tuberculosis risk factors in adults in King County, Washington, 1988 through 1990. Am J Public Health. 1994;84(11):1750-6.
20. Lillebaek T, Andersen AB, Dirksen A, et al. Persistent high incidence of tuberculosis in immigrants in a low-incidence country. Emerg Infect Dis. 2002;8(7):679-84.
21. Gomes R, Dias S, Nunes C. Tuberculose e Imigração em Portugal: Características Sociodemográficas, Clínicas e Fatores de Risco. Revista Migrações. 2017;14:9-23.
22. Núcleo Executivo CLAS da Amadora. Plano de Desenvolvimento Social e de Saúde da Amadora. Available at: https://www.cm-amadora.pt/images/INTERVENCAO_SOCIAL/REDE_SOCIAL/PDF/plano_desenvlvmnt_social_saude_2018_2025.pdf. Accessed on 20 October 2022.
23. Narasimhan P, Wood J, Macintyre CR. Risk factors for tuberculosis. Pulm Med. 2013;2013:828939.
24. Dye C, Lönnroth K, Jaramillo E, Williams BG, Raviglione M. Trends in tuberculosis incidence and their determinants in 134 countries. Bull World Health Organ. 2009;87(9):683-91.
25. Guthmann JP, Belghiti FA, Lévy-Bruhl D. Épidémiologie de la tuberculose en France en 2015. Impact de la suspension de l'obligation vaccinale BCG sur la tuberculose de l'enfant, 2007-2015. J Mondiale Tuber. 2017;23:122-9.
26. Resenha dos Planos de Saúde: Nacional, Regionais, Locais. Plano Nacional de Estratégias Locais de Saúde. Available at: https://www.dgs.pt/documentos-e-publicacoes/resenha-dos-planos-de-saude-nacional-regionais-e-locais-2016.aspx. Accessed on 20 October 2022.
27. Boudville DA, Joshi R, Rijkers GT. Migration and tuberculosis in Europe. J Clin Tuberc Other Mycobact Dis. 2020;18:100143.
28. Perez-Velez CM, Marais BJ. Tuberculosis in children. N Engl J Med. 2012;367(4):348-61.

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