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Distribution of tuberculosis incidence rates in children under 15 years old according to poverty areas in Seville☆

Distribución de las tasas de incidencia de tuberculosis en menores de 15 años según zonas de pobreza de la ciudad de Sevilla

Dear Editor:

In May 2014, the World Health Assembly approved the action framework of the World Health Organization (WHO) *Towards tuberculosis elimiation*[1] with the objective of eliminating tuberculosis (TB) as a global health problem by 2035. This would require a 95% reduction in TB mortality and a 90% reduction in its incidence relative to 2015. The action framework includes policy and budget measures at the national and international levels ranging from guaranteeing universal access to health care to addressing the social and economic factors that have an impact on this disease.[2] Tuberculosis is associated with poverty, social exclusion and inequality, and there is evidence that factors such as low educational attainment, unemployment and low socioeconomic status (SES) are associated with an increased incidence and prevalence of TB.[3]

Low-resource countries have the highest incidence of TB and the highest associated mortality. Nevertheless, the action framework of the WHO also includes strategies for low-incidence countries (fewer than 10 cases/100 000 inhabitants/year) such as Spain.[2] According to the latest report of the *Red Nacional de Vigilancia Epidemiológica* (Spanish National Network of Epidemiological Surveillance), the overall incidence of TB in Spain in 2016 was 10.38 cases per 100 000 inhabitants (4.10 in children aged less than 15 years).[4] The incidence in the population aged less than 15 years in Spain in years 2013, 2014 and 2015 was of 5.33, 4.35 and 5.05 cases per 100 000 inhabitants, respectively. Although there is a decreasing trend in the incidence of TB nationwide, the incidence is decreasing by less than 11% per year (the target established by the WHO).

In order to analyse the distribution of cases of TB in children aged less than 15 years living in Seville based on the SES of the neighbourhoods where they resided, we calculated the annual incidence of cases of TB in children notified to the Department of Epidemiology of the Health District of Seville of the Department of Health of Andalusia in years 2013, 2014 and 2015. We obtained data on the geographical distribution by administrative subdistricts of the city of Seville and the total population aged less than 15 years residing in each subdistrict through the *Urban Audit Project* of the Instituto Nacional de Estadística (National Institute of Statistics).[5] Since data for the population distribution by subdistrict was not available for 2014, we calculated the incidence for 2014 using the population distribution of 2013. We defined low-SES subdistricts as those containing 1 or more of the areas established as *areas in need of social transformation* (ANSTs) in the city of Seville based on the classification of residential areas with structural poverty

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Table 1 Incidence of tuberculosis in children aged less than 15 years by subdistrict of the city of Seville in years 2013, 2014 and 2015.

Subdistricts	Year 2013				Year 2014				Year 2015			
	Population <15 y		Tuberculosis		Population <15 y		Tuberculosis		Population <15 y		Tuberculosis	
	n	%	*n*	Incidence[a]	*n*	%	*n*	Incidence[a]	*n*	%	*n*	Incidence[a]
1-A	2653	12.24	1	37.69	2653	12.24	0	0.00	2569	12.22	1	38.92
1-B	2897	13.01	0	0.00	2897	13.01	0	0.00	2966	13.67	0	0.00
1-C	1983	12.65	0	0.00	1983	12.65	0	0.00	1988	13.05	0	0.00
2-A	1425	11.07	0	0.00	1425	11.07	0	0.00	1494	11.82	1	66.95
2-B*	4163	13.46	0	0.00	4163	13.46	0	0.00	4070	13.54	2	49.14
2-C	1894	11.89	0	0.00	1894	11.89	0	0.00	1868	12.04	0	0.00
2-D	2041	12.15	0	0.00	2041	12.15	0	0.00	2043	12.46	0	0.00
3-A	4175	14.16	0	0.00	4175	14.16	0	0.00	4167	14.18	1	24.00
3-B	2778	12.91	0	0.00	2778	12.91	0	0.00	2839	13.34	0	0.00
4-A	3934	22.55	0	0.00	3934	22.55	0	0.00	4044	22.97	0	0.00
4-B*	3591	14.09	2	55.69	3591	14.09	0	0.00	3579	14.28	1	27.94
4-C	1650	12.95	0	0.00	1650	12.95	0	0.00	1672	13.21	0	0.00
4-D	2029	13.17	0	0.00	2029	13.17	0	0.00	1890	12.71	0	0.00
4-E*	2703	14.81	1	37.00	2703	14.81	6	221.98	2714	15.00	2	73.69
5-A*	3929	22.58	2	50.90	3929	22.58	1	25.45	3703	21.59	1	27.01
5-B	1481	11.37	0	0.00	1481	11.37	0	0.00	1459	11.72	0	0.00
5-C*	1397	15.30	0	0.00	1397	15.30	0	0.00	1319	14.85	0	0.00
5-D	1896	15.52	0	0.00	1896	15.52	0	0.00	1860	15.40	0	0.00
5-E	3119	15.02	0	0.00	3119	15.02	0	0.00	3089	14.90	0	0.00
6-A	2250	13,32	0	0,00	2250	13,32	2	88,89	2194	13,18	0	0,00
6-B	1296	11,56	0	0,00	1296	11,56	1	77,17	1358	12,28	0	0,00
6-C	2659	12,43	0	0,00	2659	12,43	0	0,00	2650	12,63	0	0,00
7-A	5217	16,61	0	0,00	5217	16,61	0	0,00	5184	16,23	0	0,00
7-B*	2452	15,62	0	0,00	2452	15,62	0	0,00	2348	15,35	0	0,00
7-C*	2058	15,88	0	0,00	2058	15,88	0	0,00	2099	16,22	0	0,00
7-D	1842	13,22	0	0,00	1842	13,22	1	54,30	1743	12,70	0	0,00
8-A	2299	11,92	1	43,49	2299	11,92	0	0,00	2230	11,86	0	0,00
8-B	1226	15,26	0	0,00	1226	15,26	0	0,00	1217	15,60	0	0,00
8-C	1768	12,99	0	0,00	1768	12,99	1	56,55	1740	12,92	0	0,00
8-D	2626	12,44	0	0,00	2626	12,44	0	0,00	2661	12,79	0	0,00
9-A*	3291	18,35	0	0,00	3291	18,35	0	0,00	3190	17,80	0	0,00
9-B	3153	16,06	0	0,00	3153	16,06	0	0,00	3235	16,68	0	0,00
9-C	3749	15,81	0	0,00	3749	15,81	0	0,00	3439	14,67	0	0,00
9-D	9527	24,30	0	0,00	9527	24,30	3	31,49	9471	22,90	0	0,00
10-A	1503	14,10	0	0,00	1503	14,10	0	0,00	1563	14,78	0	0,00
10-B	5927	20,05	0	0,00	5927	20,05	0	0,00	6194	20,60	0	0,00
11	3397	13,63	0	0,00	3397	13,63	0	0,00	3538	14,24	0	0,00
TOTAL	105976	14,71	7	6,61	105976	14,71	15	14,15	105400	15,19	9	8,54
[0,1-13]*ANST*												
YES	23585	22,26	5	21,20	23585	22,26	7	30,40	23023	21,84	5	21,72
NO	82391	77,74	2	2,43	82391	77,74	8	9,71	82377	78,16	4	4,86

ANST, subdistrict with areas in need of social transformation; <15 y: age less than 15 years.
[a] Incidence: cases per 100 000 inhabitants.
* Subdistricts containing areas in need of social transformation.

established by the Government of Andalusia (based on data on variables such as income, education, unemployment, social exclusion etc).[6] We calculated the incidence ratio (IR) of the incidence in subdistricts containing ANSTs relative to those that did not contain ANSTs for each of the 3 years under study.

The annual incidence of TB in the population aged less than 15 years in the city of Seville in the 3 years under study were higher than the nationwide average in Spain of this age group: 6.61 cases per 100 000 inhabitants aged less than 15 years in 2013, 14.71 in 2014 and 8.54 in 2015 (Table 1). The maximum differences in the calculated incidence between

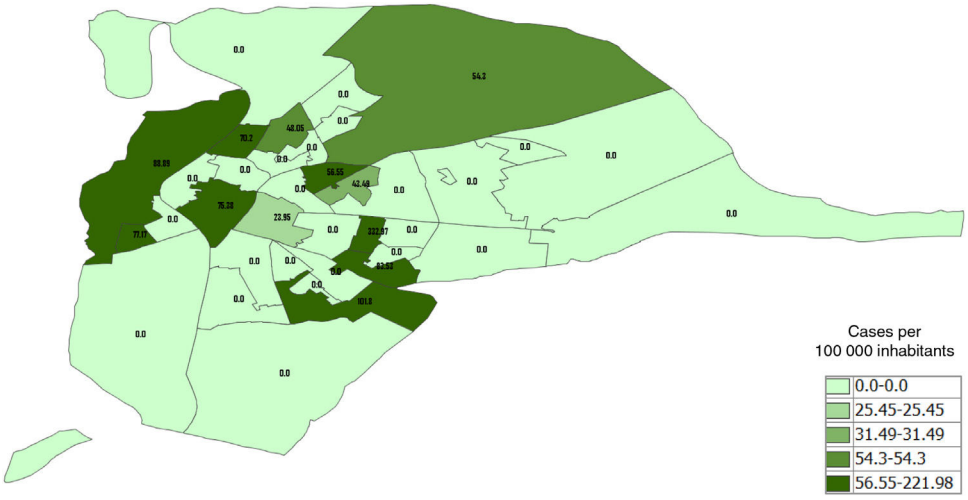

Figure 1 Quintile distribution of subdistricts of the city of Seville by incidence of tuberculosis in children aged less than 15 years from 2013 to 2015.
We generated this chart using the software application gvSIG, and data on the geographical distribution of the population aged <15 years of year 2013 for calculating the incidence of tuberculosis in this 3-year period.

districts in 2014 (using the distribution of the population by subdistrict of 2013) and in 2015 was of +/- 3 cases per 100 000 inhabitants, and we found no changes in incidence in the subdistricts with ANSTs or the subdistricts without ANSTs in 2014.

The IR comparing subdistricts of Seville with areas with structural poverty and the subdistricts without such areas revealed significant differences, with the incidence being up to nearly 9 times greater in the most disadvantaged areas (IR 2013 = 8.73; IR 2014 = 3.13; IR 2015 = 4.47) (Fig. 1).

Our findings join the already considerable body of evidence on the association between poverty and tuberculosis (including in the paediatric population) and reveal the considerable health inequalities that exist in relation to TB based on the SES of the area of residence of the inhabitants of Seville. To meet the WHO objectives *toward tuberculosis elimination*, we must prioritise efforts on the part of welfare and health care organizations for the active search of cases in the most disadvantaged areas of our cities and to raise the awareness of both the public and policy-makers on the need to implement a multidisciplinary strategy to address social determinants of health and the inequalities that they generate.

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Analysis of red blood cells in children diagnosed with obstructive sleep apnoea syndrome☆

Análisis de la serie roja en niños con síndrome de apnea-hipopnea del sueño

To the editor

Sleep apnoea-hypopnoea syndrome (SAHS) is a disease that affects 2%–4% of the paediatric population.[1,2] It consists in the recurrent collapse of the airway during sleep with cessation or reduction of airflow resulting in cycles of hypoxia followed by reoxygenation that in the long term can trigger an inflammatory cascade with systemic effects.[2,3]

One of the differences between SAHS in children and in adults is the type of repercussions it has on health. Thus, in the paediatric population the most frequent repercussions are growth delay and neurocognitive complications, while daytime somnolence and cardiovascular complications are more frequent in adults.

One of the haematologic changes described in adults with SAHS is an increased haemoglobin concentration,[4,5] in some cases in the range of polycythaemia,[5] and such changes are believed to be secondary to an increased secretion of erythropoietin resulting from the recurrent hypoxia during sleep. Recently, some authors have started to analyse other factors,[5] as not every patient with severe SAHS exhibits these changes.

In addition, there is evidence of a directly proportional correlation between the severity of SAHS and the increase in the red blood cell distribution width (RDW).[3] The RDW is currently being investigated as a proinflammatory marker (not only in the context of cardiovascular disease), and probably increases as a result of oxidative stress and chronic inflammation, which cause the release of cytokines that could act on the bone marrow and affect erythropoiesis.[3] It has also been hypothesised that this association may be influenced by increased neurohormonal activity.[3]

Other factors that have been studied in the paediatric population include signs of metabolic disturbances, such as elevation of glycated haemoglobin in patients with SAHS, which is considered a marker of severity (independently of age and weight),[6] but the data on RBC laboratory test values are still insufficient. For this reason, we designed a study to assess whether the haematologic changes typically found in adult patients with severe SAHS are also found in children, with the purpose of identifying new screening tools that could help expedite the performance of sleep studies.

We conducted a retrospective study by reviewing clinical health records and preoperatory laboratory test results in patients operated for severe SAHS in our hospital between 2012 and 2016 and in controls of similar age that underwent surgery for other reasons.

We defined severe SAHS as an apnoea-hypopnoea index (AHI) greater than 10 in the sleep study. The variables we analysed were age, AHI or obstructive AHI, oxygen desaturation index (ODI), oxygen saturation nadir, sleep time spent with an oxygen saturation of less than 90% (T90), arousals, total sleep duration, sleep efficiency, percentage of deep sleep and REM sleep and red blood cell (RBC) test values (haemoglobin, haematocrit, mean corpuscular volume and RDW).

We selected a sample of 87 children with severe SAHS (mean age, $4.30 \pm 2{,}27$), diagnosed by means of polysomnography in 78 and by means of respiratory polygraphy in 9, and a control group of 88 children (mean age, 6.01 ± 3.68). The mean AHI in the SAHS group was 21.34 ± 12.80. Table 1 summarises the rest of the polygraphy/polysomnography values.

When we compared mean haemoglobin values, we found no significant difference between the SAHS group (12.92 ± 0.92) and the control group (13.09 ± 0.99), nor did we find any differences between groups in any other haematologic variable (Table 2).

Given the significant age difference between groups and the variation in haematologic observed through the different stages of childhood, we decided to carry out an additional analysis by age group (Table 2), which also did not find significant differences in haemoglobin or haematocrit values. In our study, in children aged less than 6 years we found a higher RBC count in the SAHS group compared to the control group, but paradoxically in older children this trend not only did not persist but reversed, with higher RBC counts in the control group, so we were unable to draw conclusions on this aspect. When it came to the RDW, we found that in children aged more than 6 years, RDW values were slightly higher in the control group compared to the SAHS group.

Therefore, in contrast to the adult population, we did not find significant differences in RBC test values in children that underwent surgery for treatment of SAHS compared to children of similar age operated for other reasons.

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