

ORIGINAL ARTICLE

Influence of postcode on paediatric admissions in Seville[☆]



Sebastián Tornero Patricio^{a,*}, Liliana Charris-Castro^b, Mercedes Granero Asencio^c, Antonio Daponte Codina^d

^a Distrito Sevilla de Atención Primaria, Servicio Andaluz de Salud, Sevilla, Spain

^b Hospital Universitario Virgen del Rocío, Servicio Andaluz de Salud, Sevilla, Spain

^c Hospital Universitario Virgen Macarena, Servicio Andaluz de Salud, Sevilla, Spain

^d Ciber de Epidemiología y Salud Pública (CIBERESP), Observatorio de Salud y Medio Ambiente de Andalucía (OSMAN), Escuela Andaluza de Salud Pública, Campus Universitario de la Cartuja, Granada, Spain

Received 6 October 2016; accepted 1 December 2016

Available online 12 November 2017

KEYWORDS

Hospitalised child;
Socioeconomic factors;
Social determinants of health;
Poverty areas;
Healthcare disparities;
Health resources;
Length of stay;
Hospital mortality

Abstract

Introduction: The postcode (where the home is situated) is an indicator of socioeconomic status and is associated with morbidity, mortality, and the use of health services. The aim of this study was to analyze its effects on paediatric admissions and to determine the rates of the most common causes of paediatric admissions in Seville.

Materials and methods: Observational cross-sectional study with two analysis units: under 15 year-old "admissions" in public hospitals in Seville ($n=2660$) and "city districts" of Seville ($n=11$). The independent variable analyzed was whether the postcode of the admitted patients was within a Regional Government designated "area with social transformation needs". The analysis of the admissions was performed using X^2 -test, Fisher test and Student- t test, with the description of rates using the calculation of crude and specific rates, and by rate ratio.

Results: Children living in districts with a lower socioeconomic status were on average 7 months younger ($p<0.001$), and they were significantly more likely to be admitted via the emergency department ($p<0.001$). There was no statistical difference detected in either the length of hospital stay or mortality. The crude admission rate ratio was higher in districts with a lower socioeconomic status (1.8), with a higher specific rate ratio detected in admissions due to asthma, respiratory infections, inguinal hernia, and epilepsy/convulsions.

[☆] Please cite this article as: Tornero Patricio S, Charris-Castro L, Granero Asencio M, Daponte Codina A. Influencia del código postal en las hospitalizaciones pediátricas en Sevilla. An Pediatr (Barc). 2017;87:320–329.

* Corresponding author.

E-mail address: sebastornero@yahoo.es (S. Tornero Patricio).

PALABRAS CLAVE

Ingresos pediátricos;
Factores socioeconómicos;
Determinantes sociales de la salud;
Áreas de pobreza;
Desigualdades en salud;
Recursos sanitarios;
Estancia hospitalaria;
Mortalidad hospitalaria

Conclusions: Paediatric hospital admission rates of the main diagnoses were higher in districts with a lower socioeconomic status. Children living in these districts were more likely to be admitted younger and via the emergency department.

© 2016 Asociación Española de Pediatría. Published by Elsevier España, S.L.U. All rights reserved.

Influencia del código postal en las hospitalizaciones pediátricas en Sevilla**Resumen**

Introducción: El lugar de vivienda es un indicador del nivel socioeconómico que influye en la morbimortalidad y utilización de recursos sanitarios. Los objetivos de este estudio fueron analizar este efecto en las hospitalizaciones pediátricas y describir las tasas de hospitalización de los diagnósticos principales más frecuentes en la ciudad de Sevilla.

Material y métodos: Estudio observacional y transversal con 2 unidades de análisis: «ingresos hospitalarios» en los hospitales públicos de Sevilla de menores de 15 años (n = 2.660) y «distritos de Sevilla» (n = 11). La variable independiente de estudio fue la residencia en distritos con o sin «zonas de necesidad de transformación social», obtenida del código postal. El análisis de las características hospitalarias se realizó mediante los test de la χ^2 , Fisher y t de Student, y la descripción de tasas mediante el cálculo de tasas cruda y específica, y del índice de tasas.

Resultados: Los ingresos pediátricos procedentes de distritos con menor nivel socioeconómico se produjeron a una edad media 7 meses menor ($p < 0,001$) y con carácter urgente en mayor proporción ($p < 0,001$). No se detectaron diferencias en la estancia media ni en la mortalidad intrahospitalaria. El índice de la tasa bruta de hospitalización fue superior en los distritos con menor nivel socioeconómico (1,8), con una mayor diferencia en las tasas específicas de hospitalización por asma, infecciones respiratorias, hernia inguinal y epilepsia/convulsiones.

Conclusiones: Las tasas de hospitalización de los diagnósticos principales más frecuentes fueron mayores en distritos con menor nivel socioeconómico. Sus ingresos se produjeron a edades más tempranas y con mayor carácter urgente.

© 2016 Asociación Española de Pediatría. Publicado por Elsevier España, S.L.U. Todos los derechos reservados.

Introduction

Health is largely conditioned by social determinants.¹ The circumstances under which a person is born, grows, works and ages determines not only the 3 dimensions of health—physical, psychological and social²—but also life expectancy.³ Inequalities in health can be explained by the different living conditions of individuals, which depend on the political and socioeconomic context (structural determinants) and the opportunities in education and employment that will determine their work, housing, place of residence etc. (intermediary determinants).⁴ Inequalities in health are unfair and preventable, and their consequences have been amply proven. Exposure to unfavourable living conditions during childhood has a great impact on long-term health and development during adult life,⁵ and therefore interventions implemented in the early stages of life are the most cost-effective.⁶

Numerous studies use the place of residence as a socioeconomic determinant, using indicators such as educational attainment, unemployment, type of occupation or average income of the population of an area.⁷ There is evidence of an inverse correlation between mortality and socioeconomic level in the comparison between cities and between

districts or neighbourhoods within a city.^{8,9} There is evidence that the postcode can be useful in representing a geographical area and as an indicator of socioeconomic level¹⁰; on the other hand, the studies conducted by the MEDEA group in Spain have been using census divisions to demonstrate the aforementioned correlation for different causes of death.^{11,12} Other studies have found evidence of a higher frequency of hospital visits in members of socially-disadvantaged groups,^{13,14} as well as an unequal use of different health care resources.^{15,16} But there are not many studies that assess the impact of the place of residence—used as an indicator of socioeconomic level—on the health of children in Spain.

A systematic review of studies on the impact of social inequalities in child and adolescent health in Spain¹⁷ revealed a broad variability in the indicators used as social determinants and a scarcity of studies in preschool-aged children. The paediatric health issues studied most frequently were obesity,¹⁸ mental health¹⁹ and dental health,²⁰ and the data demonstrated the negative impact of a low socioeconomic status. Studies conducted in the United States^{21,22} have also demonstrated this correlation with the same health problems as well as others, such as preterm birth, faltering weight, behavioural and learning

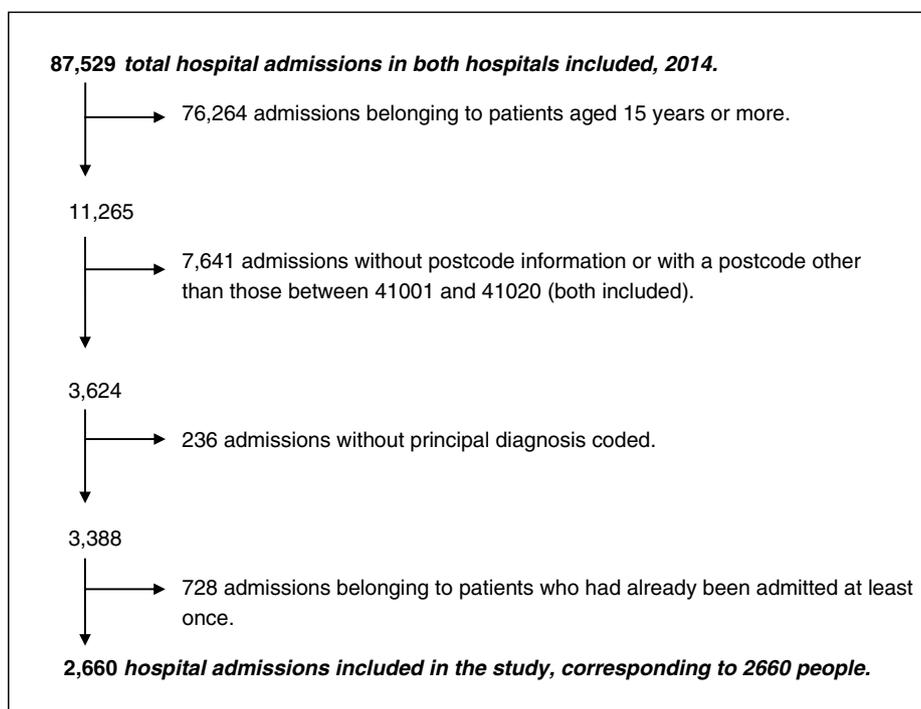


Figure 1 Flow chart of the selection of hospital admissions for the study.

disorders, traumatic injury, poisonings and asthma, with a higher number of hospital admissions in patients of lower socioeconomic status due to the latter.^{23,24} A prospective study in a cohort of newborns followed up over 10 years also found an increased frequency of respiratory and gastrointestinal diseases, traumatic injury and poisonings in patients with fewer resources.²⁵ Last of all, there are studies that have found increased use of inpatient services, longer mean lengths of stay, increased inpatient costs²⁶⁻²⁸ and even a higher in-hospital mortality^{25,29} in hospitalised paediatric patients from areas of a low socioeconomic level.

The growth of the outskirts of the city of Seville peaked around the second half of the 20th century, when most of the working-class neighbourhoods that exist today were developed and expanded.³⁰ Seville is divided into 11 districts,³¹ of which 6 are above the 75th percentile in the distribution of mean per capita annual income³²: Casco Antiguo, Nervión, San Pablo-Santa Justa, Bellavista-La Palmera, Triana and Los Remedios. Areas with social transformation needs (ASTNs) have been defined as urban areas whose inhabitants are in a structural situation of extreme poverty or social marginalization. This status is determined based on indicators such as housing, education, unemployment, hygiene-sanitation deficiencies, and manifestations of social disintegration.³³ The Public Health Service of Andalusia has implemented an action plan adapted to the needs of ASTNs. In Seville, there are 11 identified ASTNs, located in the 5 districts with the lowest annual per capita income.³⁴ These 5 districts border the city centre in the north, east and south-east.

The objectives of our study were: (1) to analyze the impact of place of residence in the hospitalization characteristics of paediatric admissions in Seville, and (2) to

describe the rate of hospital admission for the most frequent primary diagnosis by city district.

Materials and methods

We conducted a cross-sectional observational study on the most frequent reasons for paediatric hospital admissions in the city of Seville in relation to place of residence. We pursued objective 1 by an analysis in which the unit of analysis was "hospital admission", and objective 2 by a descriptive ecological study in which the unit of analysis was "districts of Seville". We obtained the data from the discharge summaries, or "Minimum Basic Discharge Data Set" (Conjunto Mínimo Básico de Datos al Alta [CMBD])³⁵ of the 2 public hospitals serving the residents of the city of Seville: the Hospital Universitario Virgen del Rocío and the Hospital Universitario Virgen Macarena. We included hospitalizations in which patients were discharged between January 1st, 2014 and December 31st, 2014. The exclusion criteria were: age 15 or more years, residential postcodes outside of the 41001–41020 range (postcodes outside the city of Seville), lack of data on the postcode or the primary diagnosis, and hospital readmission. For the sake of preserving the independence of observations, in cases of patients that were admitted to hospital more than once, we only included the first admission. A total of 2660 patients were included in the study after applying these criteria (Fig. 1).

The independent variables were age, sex, postcode, district and ASTN. The dependent variables were type of admission, hospital, length of stay, type of discharge and primary diagnosis coded according to the International Classification of Diseases (ICD-9-MC).³⁶ We built the district and

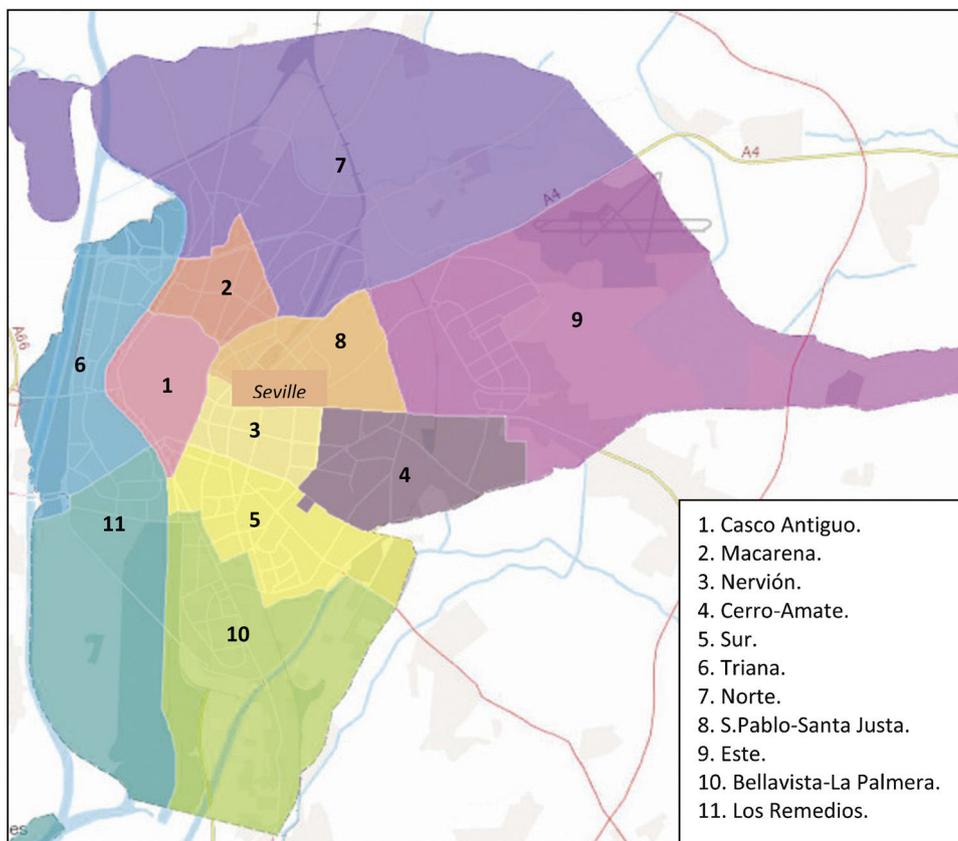


Figure 2 Districts of the city of Seville.

Source: Geographic Information System, Urbanism, Seville City Council.

ASTN variables from the postcode variable based on the distribution of postcodes by district established by the City Council of Seville (Fig. 2)³¹ and the postcodes that contain the neighbourhoods classified as ASTNs by the Government of Andalusia,³⁴ respectively (Table 1). The administrative division of the city of Seville (into districts) does not coincide exactly with the postal division (into postcodes). The criterion we used to assign postcodes to districts was that 75% or more of the streets were being contained in one district. This criterion was met for all postcodes except 41008 (55.1% of streets in Macarena), 41016 (70.8% of streets in Este) and 41019 (52.4% of streets in Norte). We assigned postcode 41019 to the Este district given its physical proximity, and the other 2 postcodes to the district that contained the larger percentage of streets.

To calculate the rates of different primary diagnoses at admission, we took into account those diagnoses that amounted to 1% or more of the total 2660 admissions included in the study (Table 2). Code 518.81 (acute respiratory failure, 5.49%) was included in the asthma, bronchitis or pneumonia categories if the latter featured as a secondary diagnosis. We grouped into single categories the codes corresponding to bronchitis, bronchiolitis and bronchospasm; the codes for pneumonia; the codes for epilepsy and unspecified convulsions; the codes for hypertrophy of tonsils and of adenoids; and the codes low birth weight, prematurity and intrauterine growth restriction (IUGR). We assigned codes 780–799 (“symptoms, signs, and ill-defined

conditions”) to other, better-defined categories if any of the latter were recorded as a secondary diagnosis. Although the total number of patients with asthma as the main reason for admission did not reach 1%, we decided to preserve this category on account of the existing literature on its association with place of residence.^{23,24} We excluded primary diagnoses coded as 780.6 (“fever and other physiologic disturbances of temperature regulation”) or 599 (“other disorders of urethra and urinary tract”) even though they did slightly exceed 1%, due to the nonspecificity of the former, and to incomplete coding in the latter.

We assessed the impact of the place of residence on the distribution and characteristics of hospital admissions by means of a bivariate analysis in which ASTN was the independent variable. We conducted a bivariate analysis of sex and primary diagnosis that led us to include a detailed analysis based on sex. The statistical tests used in the analyzes were the χ^2 , Fisher exact test and Student *t*, carried out with the software R i386 3.3.0; we defined statistical significance as a *p*-value of less than 0.05.

To calculate the rate of hospital admissions, we created a second unit of analysis from the 11 districts of the city, with the districts group based on whether or not they contained ASTNs. The source of the data used to calculate the denominators was the census of Seville inhabitants of January 01, 2015.³⁷ We used the total population aged less than 15 years, and for the 2 neonatal diagnoses included in the study, the number of children born in 2014. Using these populations,

Table 1 Distribution of postcodes, districts and areas with social transformation needs in the city of Seville.

Postcode	District	Neighbourhoods considered ASTNs
41001	Casco Antiguo	None
41002	Casco Antiguo	None
41003	Casco Antiguo	None
41004	Casco Antiguo	None
41005	Nervión	None
41006	Cerro-Amate	Los Pájaros-Amate, La Plata
41007	San Pablo-Santa Justa	None
41008	Macarena	None
41009	Macarena	Polígono Norte
41010	Triana	None
41011	Remedios	None
41012	Bellavista-La Palmera	None
41013	Sur	Las Letanías, Polígono Sur
41014	Bellavista-La Palmera	None
41015	Norte	La Bachillera, El Vacie, Los Carteros
41016	Este	Carretera Torreblanca, Torreblanca de los Caños, San Rafael
41017	Este	Carretera Torreblanca, Torreblanca de los Caños, San Rafael
41018	Nervión	None
41019	Este	None
41020	Este	None

Table 2 Primary diagnoses included in the calculation of the rate of admissions.

Primary diagnosis	ICD-9-CM code	Patients (n)	Percentage (%)
Asthma	518.81 ^a , 493	17	0.6
Bronchitis, bronchiolitis or bronchospasm	518.81 ^a , 519.11, 519.19, 466	263	9.89
Pneumonia	518.81 ^a , 480–486	52	1.95
Epilepsy and other convulsions	345, 780.39	120	4.51
Gastroesophageal reflux	530.81 ^b	64	2.41
Hypertrophy of tonsils and/or adenoid vegetations	474.1, 474.2	135	5.08
Appendicitis	540	95	3.57
Inguinal hernia without obstruction or gangrene	550.9	28	1.05
Preterm birth, prematurity or IUGR	764, 765 ^b	222	8.35
Maternal infection affecting newborn	760.2 ^b	42	1.58

^a Admissions with code 518.81 ($n = 142$) as the primary diagnosis were classified into the asthma, bronchitis or pneumonia categories if any of them appeared as a secondary diagnosis.

^b Admissions with codes 780–799 ('symptoms, signs, and ill-defined conditions') for the primary diagnosis were added to these categories if the latter featured as a secondary diagnosis.

we calculated specific rates for each district and for the groups of districts with and without ASTNs. We compared the rates of districts with and without ASTNs by calculating rate ratios.

Results

Table 3 shows univariate analysis of the demographic and hospital variables. The age group with the highest rate of hospital admissions corresponded to children aged less than 5 years (61.95%). The mean age at hospital admission in children from districts with ASTNs was 3.80 years, compared to 4.37 years in children from districts without ASTNs (Student t ; $p < 0.001$). There were more admissions of boys (56.69% boys vs 43.23% girls). We did not find a statistically significant association between sex and residence in an ASTN

(χ^2 test; $p = 0.475$), or sex and any of the primary diagnoses, save for pneumonia, which was more frequent in girls: 2.7% vs. 1.4% (χ^2 test; $p = 0.017$). The proportion of urgent admissions was higher in the admissions of patients from districts with ASTNs compared to districts without: 73.50% vs 66.10% (χ^2 test; $p < 0.001$). We did not find statistically significant differences in the type of discharge (Fisher exact test; $p = 0.909$). Of all in-hospital deaths, 50% ($n = 10$) were of patients from ASTNs. The mean length of stay was similar in both groups: 5.68 days for admitted patients from ASTNs vs 5.54 days for patients that did not reside in an ASTN (Student t ; $p = 0.744$).

We did not find statistically significant differences in the bivariate analysis of the 'hospital admissions' based on the presence of ASTNs for any of the primary diagnoses. For neonatal admissions, we only included admissions

Table 3 Univariate analysis of age, sex, hospital of admission, type of admission, department of admission, type of discharge and area with social transformation needs (ASTN).

Variable	Frequency (n)	Percentage (%)
Age		
0–4 years	1648	61.95
5–9 years	456	17.14
10–14 years	556	20.90
Sex		
Female	1150	43.23
Male	1508	56.69
Undetermined	2	0.08
Hospital		
Macarena	1164	43.76
Rocio	1496	56.24
Type of admission		
Urgent	1853	69.66
Scheduled	807	30.34
Department of admission		
Neonatology	319	11.99
Paediatrics	1495	56.20
Other	846	31.81
Type of discharge		
Home	2621	98.53
Transfer	27	1.02
Against medical advice	1	0.04
Death	10	0.37
Not documented	1	0.04
From a district with ASTN		
Yes	1272	47.82
No	1388	52.18

of newborns aged less than 28 days ($n=512$), and found p -values that neared statistical significance for low birth weight, preterm birth or IUGR (χ^2 test; $p=0.051$). When it came to newborns affected by maternal infection, the p -value rose to 0.627. However, the descriptive analysis of the overall rates of admission and the specific rates by districts of Seville did show differences in the distribution of hospital use based on district (Tables 4 and 5). The overall rate of admission for all the primary diagnoses included in the study was higher in districts that contained ASTNs (overall rate ratio = 1.8). With the exception of hypertrophy of the tonsils and/or adenoids, all the specific rates of admission were higher in districts with ASTNs, and these differences were larger for respiratory infections, asthma, epilepsy/convulsions and inguinal hernia, with ratios equal or greater than 1.8 (Table 6).

Discussion

Girls and boys residing in the lower socioeconomic level districts of Seville are admitted to the public referral hospitals more frequently, with a higher proportion of urgent admissions versus scheduled ones, and a lower mean age. Thus, place of residence does have an impact on some of the hospi-

talization characteristics of paediatric admissions, as well as in the rates of hospitalization for the most frequent reasons for admission.

These results are consistent with the literature, which has evidence of an increased frequency of paediatric admissions in patients of lower socioeconomic status.^{13,14,38} However, we did not find statistically significant differences in mean length of stay, conversely to other studies.^{26–28} Different studies have found contradictory evidence as regards the association between in-hospital mortality and socioeconomic status.^{25,26,29} In our study, in-hospital mortality was not associated with socioeconomic status.

Admissions were most frequent in patients aged less than 5 years (61.95%). The mean age at admission of children from districts with ASTNs was 7 months younger ($p < 0.001$) and nearly 3 out of 4 of hospital admissions in this group were urgent ($p < 0.001$). This could be explained by an increased morbidity or greater severity of disease, or by greater difficulties in the outpatient management of disease, especially for illnesses that depend more on this type of care, such as asthma.¹⁴ We did not find statistically significant differences in the analysis by sex of place or precedence or the primary diagnoses included in the study (with the exception of pneumonia, more frequent in girls), so we did not conduct a more detailed analysis based on sex.

Of the entire population of Seville aged less than 15 years, 62.1% lived in districts containing ASTNs, that is, those with lower socioeconomic level. To control for the effect of the unequal distribution of the paediatric population of the city on hospital admissions, we calculated the rate of hospitalization for the most frequent reasons for admission. The ratio for the overall hospitalization rate was higher in districts with lower socioeconomic level (1.8). The Macarena and Norte districts had the highest specific rates of hospitalization, with the Macarena district having the highest rate for 6 of the 10 primary diagnoses analyzed. All specific hospitalization rates in the analysis by district were greater in districts of lower socioeconomic level, except for the diagnosis of hypertrophy of the tonsils and/or adenoids. This difference was larger for diagnoses involving respiratory illness, inguinal hernia and epilepsy/convulsions, for which the specific hospitalization rates were equal to or exceeded the overall rate by ASTN. We ought to highlight the considerable difference we found in the rate of asthma-related admissions in patients from districts with a lower socioeconomic level (rate ratio = 4.6), which is consistent with other studies.^{14,23,24} In opposition, we found smaller differences in the hospitalization rate ratios for diseases associated with invasive diagnostic and therapeutic procedures (gastroesophageal reflux, appendicitis and hypertrophy of tonsils and/or adenoids), except for inguinal hernia, which could be explained by its association with preterm birth, which is more common in districts with a lower socioeconomic level.

The Cerro-Amate district had the highest rate of admissions for the 2 neonatal diagnoses included in the study. As has been described in other studies,^{21,22,25} districts with lower socioeconomic levels had the highest rates of hospitalization for low birth weight, prematurity or IUGR. The predominance of the pattern of informal care that revolves around women in disadvantaged areas (where the burden of care is higher due to being in charge of a greater number of components), the stress caused by circumstances associated

Table 4 Overall and specific rates of paediatric admission by Seville district (admissions/100,000 inhabitants aged less than 15 years).

Area District	Population (<15 years)	Asthma		Bronchitis/ bronchiolitis		Pneumonia		GER		Appendicitis		Inguinal hernia		Adenoid/tonsil HT		Epilepsy and convulsions		All admissions	
		<i>n</i>	Rate	<i>n</i>	Rate	<i>n</i>	Rate	<i>n</i>	Rate	<i>n</i>	Rate	<i>n</i>	Rate	<i>n</i>	Rate	<i>n</i>	Rate	<i>n</i>	Rate
Casco Antiguo	7643	2	26.17	25	327.10	5	65.42	4	52.34	6	78.50	3	39.25	8	104.67	13	170.09	204	2669.11
Macarena	9580	9	93.95	55	574.11	9	93.95	10	104.38	15	156.58	7	73.07	7	73.07	23	240.08	474	4947.81
Nervión	7080	0	0.00	15	211.86	0	0.00	4	56.50	2	28.25	1	14.12	8	112.99	4	56.50	115	1624.29
Cerro-Amate	14,042	0	0.00	36	256.37	7	49.85	6	42.73	15	106.82	3	21.36	37	263.50	16	113.94	375	2670.56
Sur	11,551	1	8.66	21	181.80	7	60.60	6	51.94	12	103.89	0	0.00	13	112.54	13	112.54	234	2025.80
Triana	6262	0	0.00	8	127.75	3	47.91	6	107.93	6	107.93	0	0.00	11	197.88	5	89.94	106	1906.82
Norte	11,455	3	26.19	38	331.73	9	78.57	8	69.84	6	52.38	7	61.11	7	61.11	13	113.49	349	3046.70
San Pablo-Santa Justa	7936	0	0.00	10	126.01	2	25.20	2	25.20	3	37.80	1	12.60	12	151.21	2	25.20	97	1222.28
Este	19,479	2	10.27	46	236.15	7	35.94	11	56.47	21	107.81	6	30.80	17	87.27	25	128.34	543	2787.62
Bellav-La Palmera	7824	0	0.00	5	63.91	1	12.78	5	63.91	5	63.91	0	0.00	13	166.16	5	63.91	126	1610.43
Remedios	3570	0	0.00	4	112.04	2	56.02	2	56.02	4	112.04	0	0.00	2	56.02	1	28.01	37	1036.41
With ASTN	66,107	15	22.69	196	296.49	39	59.00	41	62.02	69	104.38	23	34.79	81	122.53	90	136.14	1975	2987.58
Without ASTN	40,315	2	4.96	67	166.19	13	32.25	23	57.05	26	64.49	5	12.40	54	133.95	30	74.41	685	1699.12
Seville	106,422	17	15.97	263	247.13	52	48.86	64	60.14	95	89.27	28	26.31	135	126.85	120	112.76	2660	2499.48

ASTN, area with social transformation needs; Bellav, Bellavista; GER, gastroesophageal reflux; HT, hypertrophy.

Table 5 Overall and specific hospitalization rates for neonatal primary diagnoses in Seville (admissions/1000 births in 2014).

Area	Population (born in 2014)	LBW-prematurity-IUGR		NB-maternal infection	
		<i>n</i>	Rate	<i>n</i>	Rate
Casco Antiguo	501	16	31.94	6	11.98
Macarena	650	30	46.15	0	0.00
Nervión	446	10	22.42	2	4.48
Cerro-Amate	895	49	54.75	13	14.53
Sur	655	21	32.06	5	7.63
Triana	353	8	22.66	2	5.67
Norte	726	28	38.57	1	1.38
San Pablo-Santa Justa	462	11	23.81	1	2.16
Este	1071	31	28.94	9	8.40
Bellavista-La Palmera	550	15	27.27	3	5.45
Remedios	230	3	13.04	0	0.00
With ASTN	3997	159	39.78	28	7.01
Without ASTN	2542	63	24.78	14	5.51
Seville	6539	222	33.95	42	6.42

IUGR, intrauterine growth restriction; NB, newborn, LBW, low birth weight.

Table 6 Specific rate ratios by area with social transformation needs (rate in area with ASTNs/rate in areas without ASTNs).

Primary diagnosis	Rate
Asthma	4.6
Bronchitis/bronchiolitis	1.8
Pneumonia	1.8
GER	1.1
Appendicitis	1.6
Inguinal hernia	2.8
Hypertrophy tonsils/adenoids	0.9
Epilepsy and seizures	1.8
LBWNB-preterm birth-IUGR	1.6
NB-maternal infection	1.3
All admissions	1.8

with economic adversity, the higher frequency of unskilled jobs that require greater physical exertion and difficulties in adhering to prenatal care are some of the factors that could explain this finding. As for admissions due to maternal infection, the absence or low number of observations of such admissions in some districts, and the fact that the hospital stay of newborns in the maternity ward is not documented as an admission, may have led us to underestimate the size of the difference for this diagnosis.

One of the limitations of our study is the exclusive use of data from the public hospitals in Seville, which may underestimate the rate of hospitalization in districts of a higher socioeconomic level. This limitation may have missed up to 16.1% of paediatric admissions in the city.³⁹ The use of the postcode as the variable that defines place of residence has additional limitations, as the postal division of Seville does not completely match the administrative division. This may have contributed to selection bias, mainly in 3 out of the 20 postcodes of Seville. The use of large geographical units for the calculation of rates and the bivariate analysis may have underestimated the differences that

exist between smaller geographical areas, such as neighbourhood or census sections, and especially those declared ASTNs.⁴⁰ Last of all, the extrapolation of admission rates calculated with aggregate data may lead to the ecological fallacy.

This study is one of the few conducted in Spain that analyzes the impact of the place of residence as a socioeconomic factor in the main reasons for paediatric admission and, to our knowledge, the first that has taken place since the start of the current economic crisis. One of its strengths is the use of the CMDB as a data source, as it provides objectivity and comparability for future research. The records of the 2 referral hospitals of Seville provided a large number of admissions for the analysis, avoiding duplication and preserving the independence of observations by excluding readmissions. The availability of demographic data for the city³⁷ facilitated the direct calculation of rates without the need for standardization. On the other hand, the definition and identification of ASTNs by the Department of Equality and Wellbeing of Andalusia (Consejería para la Igualdad y Bienestar de Andalucía)³⁴ allowed us to use an official socioeconomic criterion.

The deleterious effects of poverty on the health of children are numerous, and they have long-lasting repercussions in their developing bodies.^{6,21,22} While we are aware that using paediatric hospitalisations as a method to evince this association excludes a considerable part of the health care spectrum, and especially primary care, this approach could provide a starting point to guide future lines of research on this subject. The role of paediatricians is essential in the identification, prevention and treatment of these consequences, but also in raising awareness in policy makers to prevent the impact of inequalities on health starting at such early ages.

Conflicts of interest

The authors have no conflicts of interest to declare.

Acknowledgments

We thank Dr José Sala Turrens for giving us access to the CMDB database of the Virgen del Rocío and Virgen Macarena hospitals (Seville), which was the main source of data for this study.

References

- Organización Mundial de la Salud. Subsancar las desigualdades en una generación; 2009. Available from: http://apps.who.int/iris/bitstream/10665/44084/1/9789243563701_spa.pdf [accessed 30.10.16].
- World Health Organization. Constitution of the World Health Organization; 2014. Available from: <http://apps.who.int/gb/bd/PDF/bd48/basic-documents-48th-edition-en.pdf?page=7> [accessed 30.10.16].
- Marmot M. Public Health Social determinants of health inequalities. *Lancet*. 2005;365:1099–104.
- Solar O, Irwin A. A conceptual framework for action on the social determinants of health; 2010. Available from: http://www.who.int/sdhconference/resources/ConceptualFrameworkforActiononSDH_eng.pdf [accessed 30.10.16].
- Pillas D, Marmot M, Naicker K, Goldblatt P, Morrison J, Pikhart H. Social inequalities in early childhood health and development: a European-wide systematic review. *Pediatr Res*. 2014;76:418–24.
- Irwin LG, Siddiki A, Hertzman C. Early child development: a powerful equalizer; 2007. Available from: <http://whqlibdoc.who.int/hq/2007/a91213.pdf> [accessed 30.10.16].
- Domínguez-Berjón MF, Borrell C, Cano-Serral G, Esnaola S, Nolasco A, Pasarín MI, et al. Construcción de un índice de privación a partir de datos censales en grandes ciudades españolas (Proyecto MEDEA). *Gac Sanit*. 2008;22:179–87.
- Ruiz-Ramos M, Sánchez J, Garrucho G, Viciana F. Desigualdades en mortalidad en la ciudad de Sevilla. *Gac Sanit*. 2004;18:16–23.
- Álvarez-del Arco D, Vicente Sánchez M, Alejos B, Pascual C, Regidor E. Construcción de un índice de privación para los barrios de Madrid y Barcelona. *Rev Esp Salud Pública*. 2013;4:317–29.
- Krieger N, Gordon D, Geronimus AT, Bound J. Use of census-based aggregate variables to proxy for socioeconomic group: Evidence from national samples' (multiple letters). *Am J Epidemiol*. 1999;150:892–6.
- Borrell C, Mari-Dell'Olmo M, Serral G, Martínez-Beneito M, Gotsens M. Inequalities in mortality in small areas of eleven Spanish cities (the multicenter MEDEA project). *Heal Place*. 2010;16:703–11.
- Nolasco A, Moncho J, Quesada JA, Melchor I, Pereyra-Zamora P, Tamayo-Fonseca N, et al. Trends in socioeconomic inequalities in preventable mortality in urban areas of 33 Spanish cities, 1996–2007 (MEDEA project). *Int J Equity Health*. 2015;14:33.
- Sloan C, Chandrasekhar R, Mitchel E, Schaffner W, Lindegren ML. Socioeconomic disparities and influenza hospitalizations, Tennessee, USA. *Emerg Infect Dis*. 2015;21:1602–10.
- Disano J, Goulet J, Muhajarine N, Neudorf C, Harvey J. Socioeconomic status and rates of hospital admission for chronic disease in urban Canada. *Can Nurs*. 2010;106:24–9.
- Lostao L, Blane D, Gimeno D, Netuveli G, Regidor E. Socioeconomic patterns in use of private and public health services in Spain and Britain: Implications for equity in health care. *Heal Place*. 2013;25:19–25.
- Garrido-Cumbrera M, Borrell C, Palencia L, Espelt A, Rodríguez-Sanz M, Pasarín M, et al. Social class inequalities in the utilization of health care and preventive services in Spain, a country with a national health system. *Int J Heal Serv*. 2010;40:525–42.
- Font-Ribera L, García-Continente X, Davó-Blanes MC, Ariza C, Díez E, García Calvente MM, et al. The study of social inequalities in child and adolescent health in Spain. *Gac Sanit*. 2014;28:316–25.
- Duarte-Salles T, Pasarín M, Borrell C, Rodríguez-Sanz M, Rajmil L, Ferrer M, et al. Social inequalities in health among adolescents in a large southern European city. *J Epidemiol Community Health*. 2011;65:166–73.
- Rajmil L, López-Aguilà S, Mompert Penina A. Desigualdades sociales en la salud mental infantil en Cataluña. *An Pediatría*. 2010;73:233–40.
- Fisher-Owens S, Soobader M, Gansky S, Isong I, Weintraub J, Platt L, et al. Geography matters: State-level variation in children's oral health care access and oral health status. *Public Health*. 2016;134:54–63.
- Council on Community Pediatrics. Poverty and child health in the United States. *Pediatrics*. 2016;137, peds.2016-0339. Available from: <http://pediatrics.aappublications.org/content/early/2016/03/07/peds.2016-0339> [accessed 30.10.16].
- Schickedanz A, Dreyer BP, Halfon N. Childhood poverty: understanding and preventing the adverse impacts of a most-prevalent risk to pediatric health and well-being. *Pediatr Clin North Am*. 2015;62:1111–35.
- Beck AF, Moncrief T, Huang B, Simmons JM, Sauers H, Chen C, et al. Inequalities in neighborhood child asthma admission rates and underlying community characteristics in one US county. *J Pediatr*. 2013;163:574–80.
- Largent J, Nickerson B, Cooper D, Delfino R. Paediatric asthma hospital utilization varies by demographic factors and area socio-economic status. *Public Health*. 2012;126:928–36.
- Petrou S, Kupek E, Hockley C, Goldacre M. Social class inequalities in childhood mortality and morbidity in an English population. *Paediatr Perinat Epidemiol*. 2006;20:14–23.
- Sarría Santamera A, Franco Vidal A, Redondo Martín S, García de Dueñas Geli L, Rodríguez González A. Hospitalizaciones en menores de un año en la ciudad de Madrid y su relación con el nivel social y la mortalidad infantil. *An Esp Pediatr*. 2002;57:220–6.
- Petrou S, Kupek E. Socioeconomic differences in childhood hospital inpatient service utilisation and costs: prospective cohort study. *J Epidemiol Community Health*. 2005;59:591–7.
- Fieldston ES, Zaniletti I, Hall M, Colvin JD, Gottlieb L, Macy ML, et al. Community household income and resource utilization for common inpatient pediatric conditions. *Pediatrics*. 2013;132:e1592–601. Available from: <http://pediatrics.aappublications.org/content/132/6/e1592.long> [accessed 30.10.16].
- Colvin J, Zaniletti I, Fieldston E, Gottlieb L, Raphael J, Hall M, et al. Socioeconomic status and in-hospital pediatric mortality. *Pediatrics*. 2012;131:e182–3190. Available from: <http://pediatrics.aappublications.org/cgi/doi/10.1542/peds.2012-1215> [accessed 30.10.16].
- Mora Ruiz V, Jiménez Martín JA, Gamboa Gallego MDC. Diagnóstico de territorios desfavorecidos en la ciudad de Sevilla. Ayuntamiento de Sevilla. 2011;364. Available from: http://www.empleo.gob.es/redretos/es/contenidos/actualidad/2011/06/Diagnostico_de_territorios_desfavorecidos_opt.pdf [accessed 30.10.16].
- Ayuntamiento de Sevilla Distritos de la ciudad de Sevilla. Available from: <https://www.sevilla.org> [accessed 12.07.16].
- Instituto Nacional de Estadísticas. Proyecto Urban Audit. Available from: http://www.ine.es/ss/Satellite?L=es_ES&C=INESeccion_C&p=1254735110672&pagename=ProductosYServicios%2FPYLayout¶m1=PYSDetalleFichaSeccionUA&

- [param3=1259944561392&.charset.=UTF-8&cid=1259948749713](#) [accessed 12.07.16].
33. Pérez Villar J, Gavilán Palomo R, Oliver Navarro B, García Galán R, Puertas Rodríguez F, Ortega Cruz C, et al. Atención a la salud en las zonas con necesidades de transformación social de Andalucía (ZNTS); 2004. Available from: <http://www.znts.es/> [accessed 30.10.16].
 34. Consejería de Salud y Bienestar Social de la Junta de Andalucía. Zonas de necesidad de transformación social; 2016. Available from: <http://www.znts.es/node/287> [accessed 12.07.16].
 35. Goicoechea Salazar JA, Jiménez Romero MR, Rodríguez Herrera J, Estrada Troncoso J, Larrosa Mata D, Canto Casasola VD, et al. Manual de instrucciones del Conjunto Mínimo Básico de Datos de Andalucía. Sevilla: Servicio Andaluz de Salud, Consejería de Igualdad, Salud y Políticas Sociales; 2015. Available from: http://www.juntadeandalucia.es/servicioandaluzdesalud/library/plantillas/externa.asp?pag=../publicaciones/datos/613/pdf/2015_Manual_CMBD.pdf [accessed 23.12.16].
 36. Organización Mundial de la Salud, Ministerio de Sanidad Servicios Sociales e Igualdad del Gobierno de España. Clasificación Internacional de Enfermedades, 9.a revisión Modificación clínica. Madrid: Ministerio de Sanidad Servicios Sociales e Igualdad; 2014. p. 1149–50. Available from: https://eciemaps.mspsi.es/ecieMaps/browser/index_9_mc.html [accessed 30.10.16].
 37. Suero Salamanca JA, Moreno Nisa MF, Vílchez Medina MA. Anuario estadístico de la ciudad de Sevilla. Sevilla: Ayuntamiento de Sevilla; 2015. Available from: <http://www.sevilla.org/ayuntamiento/competencias-areas/area-de-hacienda-y-administracion-publica/servicio-estadistica/atribuciones-del-servicio/anuario>
 38. Masseria C, Giannoni M. Equity in access to health care in Italy: a disease-based approach. *Eur J Public Health*. 2010;20:504–10.
 39. Dirección General de Salud Pública, Calidad e Innovación. Estadística de Centros Sanitarios de Atención Especializada, Hospitales y Centros sin Internamiento, año 2014. Madrid: Ministerio de Sanidad, Servicios Sociales e Igualdad; 2016. Available from: <https://www.msssi.gob.es/estadEstudios/estadisticas/docs/TablasSIAE2014/SIAE.2014.pdf> [accessed 08.11.16].
 40. Soobader M, LeClere F, Hadden W, Maury B. Using aggregate geographic data to proxy individual socioeconomic status: does size matter? *Am J Public Health*. 2001;91:632–6.