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ORIGINAL ARTICLE

Pediatric asthma hospitalization in Chile: 2001-2014

Hospitalizaciones por asma infantil en Chile: 2001-2014

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Abstract

Background: Bronchial asthma is the most prevalent chronic disease in children. Every year an important number of asthmatic children is hospitalized for asthma crisis. The magnitude of this problem in Chile is unknown. **Objective:** To evaluated the asthma hospitalization rate in 5-15 year-old children and evaluate their evolution. **Patients and Method:** We calculate the asthma hospitalization rate in children based on data from the National Hospitalization Discharge Registry from the Statistics and Health Information Department of the Ministry of Health (DEIS) and the National Institute of Statistics (INE). We evaluate the evolution of these rates from 2001 to 2014. **Results:** We observed a significant increase in the asthma hospitalization rates in children from 3,8 for 10.000 inhabitants in 2001 to 7,8 for 10.000 inhabitants in 2014. The average age was 8,5 years \pm 2,7. Male gender was predominant (57,58%) with a mean length of stay of 3 days (range 1-12). **Conclusions:** The actual asthma hospitalization rate in Chile is 7,8 for 10.000 inhabitants for children 5 to 15 years old, with a double increase in this rate during the 14 year period analyzed.

Keywords:
Asthma,
child,
hospitalization rate

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Introduction

Bronchial asthma is a highly prevalent disease. According to the World Health Organization, about 300 million people have asthma worldwide and it is also the most common chronic disease in the pediatric population¹. In the United States, the prevalence of asthma in children is 8.6%². In Latin America, more than half of the countries report a prevalence greater than 15%³. Using standardized questionnaires, the International Study of Asthma and Allergies in Childhood (ISAAC) determined that the prevalence of asthma in Chile was 17.9% in children aged 6 to 7, and 15.5% in children aged 13 to 144. In a cross-sectional study conducted in Santiago with 4,561 children from 6 to 7 and 13 to 14 years old, the prevalence of asthma was higher in men than in women (13.2% versus 10.8%)⁵. According to the international literature, it is estimated that 5% of all asthmatic patients have a severe evolution, which is associated with high morbidity and accounts for at least 50% of health costs related to the disease⁶. Despite receiving appropriate treatment, the vast majority of these patients have poor control of their symptoms, presenting frequent exacerbations, emergency room visits, hospitalizations, poor quality of life, and sometimes decreased lung function⁶. Asthma hospitalizations are a very important characteristic of patients with "severe asthma" and "difficult to control asthma". This represents a serious adverse outcome, which could be avoided with improved outpatient management. The objective of this study is to determine asthma hospitalization rates in Chilean children, due to the lack of information available in the literature.

Patients and Method

The evolution of asthma hospitalization rates was studied in 5 to 15-year-olds from 2001 to 2014. The evolution of these rates was analyzed globally and by simple age. The data was obtained from hospital discharge records provided by the Department of Statistics and Health Information of the Ministry of Health of Chile (DEIS). The data was selected according to ICD10 codes: J450, J451, J458, J459, and J46X. Age, gender, hospitalization length, hospitalization date, and discharge status were also registered. The sizes of the populations at risk of hospitalization were obtained from population projections provided by the Chilean National Institute of Statistics. The evolution of hospitalization rates was analyzed using a linear first-order autoregressive model (Prais-Winsten). The association between the hospitalization rate and variables such as gender and Explicit Health Guarantees (GES) was evaluated using the Poisson regression. Continuous variables were described using percentiles, averages and standard deviation, while qualitative variables were analyzed using frequencies and proportions. Confidence intervals (CI) were 95%, with a significance of 5%. Data was processed with the statistical software STATA 14.0.

Results

During the study period, there was a total of 58,548 patients hospitalized for asthma exacerbations, 23,382 (39.9%) of them were children between 5 and 15 years old. The median length of hospital stay was 3 days (range 1 to 12); this result was similar in men and women, and did not change during the observed period. The mean age was 8.5 ± 2.7 years. 13,467 (57.58%) were male, while 9,919 (42.42%) were female. The distribution of hospitalizations by age group was 26% in 5 to 10-year-olds, 13% in 11 to 15-year-olds, and less than 6% in children older than 15 years (Figure 1). From 2001 to 2014, there was a significant increase in the hospitalization rate for asthma in children 5 to 15 years old, from 3.8 per 10,000 inhabitants in 2001 to 7.8 per 10,000 inhabitants in 2014. This trend had a rate of increase of 0.25 per 10,000 inhabitants per year (p = 0.000) (Figure 2). Analyzing the hospitalization rates by single age, it is possible to observe a significant increase in every single age from 5 up to 11 years. In older ages the rates stabilize and remained constant (Table 1). The most significant increase in hospitalization rates occurs between the ages of 5 to 7 (Figure 3). The mean hospitalization rate in the 5 to 10 year-old group was 8.06 per 10,000 inhabitants and 2.86 per 10,000 inhabitants in the 11 to 15 year-old group. No

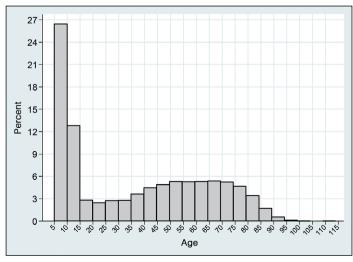


Figure 1. Age distribution of hospitalization. Chile 2001-2014.

significant differences in asthma hospitalization rates by sex were found (p = 0.902). After the GES insurance for asthma started in 2006, there was a 10.5% increase in hospital discharge for asthma, compared to the pre-GES period (p = 0.000). Nevertheless, this increase does not explain the upward trend in asthma hospitalization rates in children (p = 0.679). With regard to seasonality of hospitalization, there was an increase in March and October (Figure 4). During the 14 years analyzed, 5 asthmatic children died, which represents a lethality of 0.02%.

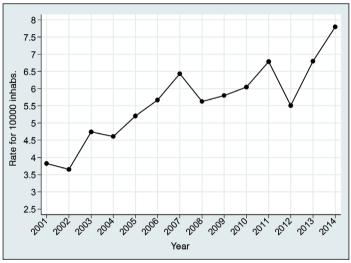


Figure 2. Evolution of the hospital discharge rate due to asthma. Chile 2001-2014.

Discussion

Asthma hospitalizations are an indicator of poor asthma control and disease severity. Sometimes asthma could be underdiagnosed, which delays the start of controller treatment⁷. When the diagnosis is established, the main cause of poor control is the lack of adherence to the maintenance treatment, which indirectly reflects poor outpatient control and lack of knowledge about the disease in patients and their caregivers^{7,8}. Morbidity and hospitalizations in patients with asthma are associated with poor quality of life and significant costs to the health system, plus indirect costs to the parents and their children^{6,10,11}. This study shows that asthma hospitalizations are significantly more frequent in children than in adults. The most vulnerable group is 5 to 10 year-olds. It is possible that the higher rate of hospitalizations in this age group could be due to underdiagnosis carried out at younger ages, and lack of appropriate treatment. Another explanation could be the increased exposure of this age group to viral infections, the main trigger for asthma exacerbations. Comparing hospitalization rates in Chilean children with those reported by other countries, there could be important differences. The hospitalization rate in the United States was 18.5 per 10,000 inhabitants in 2010 and in Spain it was 1.87 per 10,000 inhabitants in 2009^{11,12}; however, in Chile the rate was 7.8 per 10,000 inhabitants in 2014.

The difference between the Chilean rate and the American one could be the fact that the latter included

Year	Global	5 year old	6 year old	7 year old	8 year old	9 year old	10 year old	11 year old	12 year old	13 year old	14 year old	15 year old
2001	3,83	5,92	5,86	5,44	4,71	5,50	3,77	3,37	2,98	2,09	1,53	0,85
2002	3,65	5,33	5,12	5,08	4,84	3,59	4,44	3,44	2,80	2,72	1,93	1,01
2003	4,74	7,05	6,91	6,82	6,63	5,62	5,61	4,02	3,69	2,69	2,65	1,03
2004	4,61	6,45	7,11	7,03	7,16	5,53	5,62	3,78	3,17	2,57	2,18	1,02
2005	5,21	8,67	7,59	8,04	9,21	6,15	5,67	4,70	3,58	2,38	1,93	1,07
2006	5,67	9,81	8,92	8,80	8,59	6,89	5,80	4,89	3,85	2,90	2,59	1,11
2007	6,44	10,87	11,62	9,89	9,88	7,48	6,44	5,98	4,33	3,10	2,32	1,02
2008	5,63	9,89	9,42	9,76	8,05	5,70	6,19	4,75	3,77	2,89	2,22	1,06
2009	5,80	10,56	10,45	8,59	9,30	7,30	5,15	4,28	3,83	2,74	2,57	0,90
2010	6,05	10,22	9,22	8,88	9,28	8,73	6,46	5,60	3,98	3,06	2,04	0,87
2011	6,79	12,76	9,66	10,43	9,97	9,72	7,85	5,66	3,92	3,34	2,15	0,92
2012	5,51	9,74	9,66	7,99	7,68	6,56	6,39	5,17	3,00	2,56	2,01	0,87
2013	6,80	13,21	11,95	10,35	8,61	8,71	6,92	5,10	3,83	3,81	1,94	1,23
2014	7,80	16,41	14,82	13,61	10,34	8,22	6,81	4,96	4,13	3,20	2,72	1,07
Slope of trend	0,25	0,65	0,56	0,46	0,34	0,32	0,20	0,14	0,06	0,07	0,02	0,01
p-value	0,000	0,000	0,000	0,000	0,008	0,000	0,001	0,013	0,068	0,001	0,367	0,590

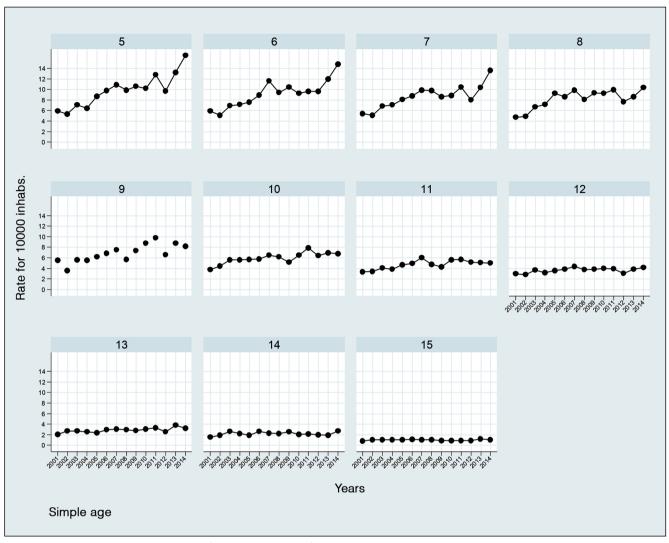


Figure 3. Rate hospital discharge evolution of hospital discharge of asthma by simple age. Chile 2001-2014.

children from 0 to 4 years of age, or an underdiagnosis of the disease in Chile. On the other hand, the lower hospitalization rate in Spain in comparison with our country could be due to a lower frequency or severity of asthma exacerbations in Spanish children, or a better outpatient management of these patients. After analyzing the trend of hospitalizations due to asthma exacerbations over time, an increase from 2001 to 2014 was found, especially in children aged 5 to 7. This increase contrasts with Spanish and American data, which presented a reduction^{11,12}. In Spain, the rate decreased from 2.05 to 1.87 per 10,000 inhabitants, from 2002 to 2010, and in the United States, it decreased from 21.1 to 18.4 per 10,000 inhabitants from 2000 to 2009. In the latter case, the decrease was mainly due to a drop in hospitalizations of the 0-4 age group because no changes in the 5-11 age group was observed. These differences could be reflecting regional variations,

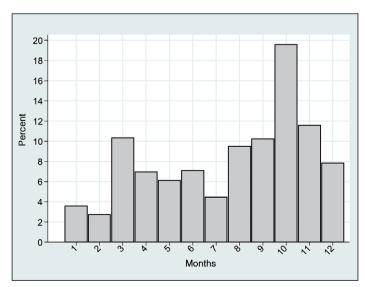


Figure 4. Cases per months distribution. Chile 2014.

which might be due to several factors, such as genetics, perinatal exposure, diet, obesity, exposure to tobacco and environmental pollutants³. As reported in the international literature, children hospitalized for asthma in Chile are mostly male^{11,12}. This was observed at all ages and in all of the analyzed years. In this study, the median days of hospitalization was 3 and did not change during the 14 analyzed years. This result contrasts with data from Spain, which shows a reduction in the length of stay from 3.71 to 3.16 days between 2002 and 2010, and also with data from the United States which also shows a reduction from 2 to 1.9 days between 2000 and 2009. This difference could be explained by the "safe discharge" policies in our country, where there is a 24-hour waiting period without the administration of supplemental oxygen to enable medical discharge.

In this study, two hospitalizations peaks were observed, one in March and the other one in October. The first one is probably related to the beginning of the school year and viral circulation. This increase has been thoroughly described in the international literature, occurring in the northern hemisphere in September^{13,14}. The increase observed in October may be related to the beginning of the pollen season in Chile. In this regard, there are studies that show an association between the pollen season and the severity of asthma symptoms and an increase in emergency room visits^{15,16}. Moreover, a recent study in Santiago showed an increase in the prevalence of Mycoplasma Pneumoniae infection during fall and spring months, which may also contribute to the increase in asthma exacerbations during these months¹⁷. In Chile, the lethality was the same as in the United States in 2009 (0.02%), and lower than in Spain (0.09%)^{11,12}.

The low asthma lethality in Chilean children could be due to lower severity of the disease, the non-inclusion of children younger than 5 years in this analysis, or to early medical consultations for respiratory diseases in children due to the 'Winter Campaigns' implemented annually by the Ministry of Health in our country.

In conclusion, the relevance of this study is that it has shown, for the first time in Chile, the impact of asthma hospitalizations in a large number of pediatric patients over an extended period of time. A significant increase in asthma hospitalization rates in children was observed, especially in the 5-7 age group. The main weakness is the lack of detailed hospitalization data of the available records, such as asthma severity, presence of comorbidities, adherence to the maintenance treatment or type of therapy. It is essential to determine the main causes of the increase in asthma hospitalization rates in children and to determine the potentially modifiable factors that could reduce this trend. In order to achieve this goal, it is fundamental to carry out multicentric, prospective studies allowing a better assessment of the clinical characteristics of these patients.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Financial Disclosure

Authors state that no economic support has been associated with the present study.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

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