

## Trends in Hospitalizations and Mortality From Asthma in Costa Rica Over a 12- to 15-year Period

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**What is already known about this topic?** Use of inhaled corticosteroids has been shown to reduce morbidity and mortality due to asthma in industrialized nations, for example, the United States.

**What does this article add to our knowledge?** We show that nationwide efforts to standardize management and to increase the use of inhaled corticosteroids in subjects with persistent asthma probably contributed to marked decrements in hospitalizations and mortality due to asthma in Costa Rica, an economically developing Latin American country with universal health coverage.

**How does this study impact current management guidelines?** This study emphasizes the importance of implementing current guidelines for asthma management, including educational programs and appropriate use of inhaled corticosteroids, in economically developing countries where this disease has become a significant public health problem.

**BACKGROUND:** Little is known about trends in morbidity and/or mortality due to asthma in Latin America.

**OBJECTIVE:** To examine trends in hospitalizations and mortality due to asthma from 1997-2000 to 2011 in Costa Rica.

**METHODS:** The rates of hospitalization due to asthma were calculated for each sex in 3 age groups from 1997 to 2011. The number of deaths due to asthma was first calculated for all groups and then for each sex in 3 age groups from 2000 to 2011. All analyses were conducted over the entire period and separately for the periods before and after a National Asthma Program (NAP) in 2003. Data also were available for prescriptions for beclomethasone since 2004. All analyses were conducted by using Epi Info.

**RESULTS:** Substantial reductions were found in hospitalizations and deaths due to asthma in Costa Ricans (eg, from 25 deaths in 2000 to 5 deaths in 2011). Although, the percentage decrement in the rates of hospitalization for asthma in subjects <20 years old was similar before and after the NAP, the reduction in both deaths due to asthma and rates of asthma hospitalizations in older subjects were more pronounced after the NAP, when prescriptions for beclomethasone were also increased by approximately 129%.

**CONCLUSION:** In Costa Rica, there was a marked decrement in hospitalizations and mortality due to asthma from 1997-2000 to 2011. In younger subjects, this is likely due to guidelines that, since 1988, recommend inhaled corticosteroids for persistent asthma. In older adults, the NAP probably enhanced reductions in hospitalizations and deaths due to asthma through inhaled corticosteroid use. © 2013 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2014;2:85-90)

**Key words:** Asthma; Hospitalizations; Mortality; Costa Rica

The prevalence of asthma in Costa Rica is among the highest in the world.<sup>1,2</sup> In a nationwide study of 2682 children ages 5-17 years, the estimated prevalence of physician-diagnosed asthma was 23% in 1989.<sup>2</sup> Among Costa Rican children ages 13-14 years who participated in phase I of the International Study of Asthma and Allergies in Childhood in 1995, current wheeze was reported by approximately 24%.<sup>3</sup> Eight years later, approximately 27% of children in the same age group reported current wheeze in phase III of the International Study of Asthma and Allergies in Childhood.<sup>3</sup> Similarly, current wheeze was very frequently reported by parents of children ages 6 to 7 years in phase I (approximately 32%) and phase III (approximately 38%) of the International Study of Asthma and Allergies in Childhood.<sup>3</sup> The causes of this high asthma burden are likely multifactorial and at least partly related to heredity and the "Westernized" lifestyle of contemporary Costa Ricans.<sup>1,4</sup>

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**Abbreviations used**

*COPD- Chronic obstructive pulmonary disease*  
*HNN- Hospital Nacional de Niños*  
*ICS- Inhaled corticosteroids*  
*NAP- National Asthma Program*

Costa Ricans have had universal health coverage since the late 1940s. In Costa Rica, only 1 hospital provides tertiary level of care for childhood asthma by pulmonologists or allergists (Hospital Nacional de Niños in San José [HNN]). Pediatric specialists at the HNN have played a leading role in developing guidelines for the treatment of childhood asthma (first published in 1985, and first recommending the use of inhaled corticosteroids [ICS] by pulmonologists or allergists in 1988<sup>5</sup>) and conducting 4 nationwide epidemiologic studies of childhood asthma in Costa Rica since 1989. In 2003, a National Asthma Program (NAP), which consisted of educational meetings at all major public health care centers, the HNN, and 4 tertiary-level hospitals for adults, was implemented in Costa Rica. This program emphasized early diagnosis by using ICS as first-line therapy for asthma control, early use of reliever medications (eg, albuterol) to treat exacerbations, appropriate referral to specialists for asthma care, and avoidance of common allergen sources (eg, cockroaches) or tobacco smoke. Concurrent with this program, general practitioners, pediatricians, and internists were first allowed to prescribe ICS for asthma (only pulmonologists or allergists could prescribe ICS before 2003).

To date, little is known about temporal trends for morbidity and mortality in Latin American countries. In this study, we examined trends in hospitalizations due to asthma in Costa Rica over a 15-year period (1997-2011), including nearly equal periods of surveillance before and after implementation of the NAP in 2003. In addition, we assessed the number of deaths due to asthma in Costa Rica from 2000 to 2011.

**METHODS**

As part of the Costa Rican nationwide health care system, the Caja Costarricense del Seguro Social collects complete information on all hospitalizations and deaths that occur at public hospitals or health care centers (which care for approximately 4.5 million people). Information on hospitalizations and deaths due to asthma (as coded by the treating physicians) as well as prescriptions for 3 medications (beclomethasone, montelukast, and formoterol) approved by the Caja Costarricense del Seguro Social was obtained for patients of all ages from 2 databases maintained by the Health Statistics Division and the Epidemiology Division of the Caja Costarricense del Seguro Social. Age and sex were available for all individuals who were hospitalized for or died of asthma.

We analyzed temporal trends in the rates of hospitalizations (from 1997 to 2011) and the number of deaths (from 2000 to 2011) due to asthma in Costa Rica. Rates of hospitalization due to asthma were calculated for each sex in 3 age groups: younger than 10 years old, 10 to 20 years old, and over 20 years old. Because of relatively small sample size and the observed age distribution, the number of deaths due to asthma was calculated for all age and sex groups, and then separately for each sex in 3 age groups: subjects younger than 5 years old, subjects ages 5-35 years old, and subjects older than 35 years. To further examine

mortality in older subjects, we also examined the number of deaths due to asthma in subjects older than 40 years. For the analysis of temporal trends in hospitalizations and mortality due to asthma, we first showed the results over the entire observation period (eg, from 1997 to 2011 for hospitalizations) and then separately for the periods before and after implementation of the NAP in 2003. We also examined the number of prescriptions issued for beclomethasone (from 2004 to 2011), montelukast (from 2005 to 2011), and formoterol (from 2006 to 2011) in Costa Rica. In secondary analyses of temporal trends for respiratory diseases other than asthma in Costa Rica, we examined the number of hospitalizations for bronchitis and bronchiolitis at the HNN from 2000 to 2011 as well as the number of hospitalizations for chronic obstructive pulmonary disease (COPD) in adults from 2002 to 2011. All analyses were conducted by using Epi Info 7 (US Centers for Disease Control, Atlanta, Ga).

**RESULTS**

Between 1997 and 2011, there were 56,002 hospitalizations for asthma in Costa Rica. Of these 56,002 hospitalizations, 35,714 (64%) were for subjects younger than 20 years. The total number of asthma hospitalizations in Costa Rica in both children and adults decreased by approximately 53% from 1997 ( $n = 5207$ ) to 2011 ( $n = 2459$ ). The sex-adjusted rates of hospitalizations for asthma in Costa Rica in the 3 age groups from 1997 to 2011 are shown in [Figure 1](#). Although the sex-adjusted rate of asthma hospitalizations was reduced in all 3 age groups from 1997 to 2011, the most substantial changes in absolute terms (given high baseline rates) occurred in children younger than 10 years old. In this age group, the rates of hospitalizations for asthma were reduced by approximately 57% in boys (from 46/10,000 to 20/10,000) and by approximately 54% in girls (from 35/10,000 to 16.2/10,000) between 1997 and 2011. Among subjects ages 10-20 years old, the rates of asthma hospitalizations were reduced by approximately 60% in male subjects (from 5.7/10,000 to 2.3/10,000) and by approximately 51% (from 5.7/10,000 to 2.8/10,000) in female subjects between 1997 and 2011. In adults older than 20 years, the rates of asthma hospitalizations were reduced by approximately 74% in male subjects (from 3.5/10,000 in 1997 to 0.9/10,000 in 2011) and by approximately 51% in female subjects (from 10.7/10,000 in 1997 to 5.2/10,000 in 2011).

An increment in hospitalization rates for asthma in all age groups was noted from 2002 to 2003. During this period, hospitalizations for bronchitis at the HNN were essentially unchanged but the number of hospitalizations for bronchiolitis increased by 38.6% (from 796 to 1103). From 2002 to 2003, there was a slight reduction in the number of hospitalizations due to COPD in Costa Rican adults older than 20 years (889 vs 842).

Among children (boys and girls) younger than 10 years and girls and women aged 10-20 years, there were similar decrements in the rates of asthma hospitalizations before (1997-2002) and after (2004-2011) implementation of the NAP. For example, although the rates of asthma hospitalizations in children younger than 10 years decreased by approximately 37% in boys (from 46.5/10,000 to 29.5/10,000) and by approximately 33% in girls (from 35/10,000 to 23.4/10,000) between 1997 and 2002, such rates decreased by approximately 34% in boys (from 30.4/10,000 to 20/10,000) and by approximately 30% in girls (from 23.1/10,000 to 16.2/10,000) between 2004 and 2011

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