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Asthma mortality among Brazilian children up to 19 years old between 1980 and 2007

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Abstract

Objective: To evaluate asthma mortality among Brazilian children up to 19 years old in 1980 to 2007.

Methods: This ecological time-series study used the database of the Brazilian Unified Health System, from which data were collected about the number of asthma deaths and the population under 19 years of age in Brazil. Mortality rates were calculated as the number of asthma deaths divided by population and multiplied by 100,000. Linear regression was used to assess the trend of mortality. For the analysis, participants were assigned to three separate age groups: 1-4 years, 5-9 years and 10-19 years.

Results: During the study period, there were 9,051 deaths due to asthma in children under 19 years of age. Of these, 69% (6,270 records) of the children were younger than 5 years. There was a significant decrease in asthma mortality during the study in all age groups. The mean annual reduction of asthma mortality rates among children was 0.022 ($p < 0.0001$). The reduction was 0.076, 0.005 and 0.004 for the 1- to 4-, 5- to 9- and 10- to 19-year-old age groups ($p < 0.0001$).

Conclusion: Asthma mortality among Brazilian children is low and has kept a downward trend during the study in all pediatric age groups.

J Pediatr (Rio J). 2012;88(5):384-8: Asthma, mortality, children, retrospective study.

Introduction

In the world, 250,000 deaths are assigned to asthma every year, and most could have been avoided if effective control treatments were used. There is a large difference in mortality rates between countries that provide control treatment to their population and those that do not.[1]

In developed countries, mortality rates raised gradually from 1975 on, stabilized in the 1980s and started to fall in the 1990s.[2-4] Data for Latin America are scare and often do not represent the whole universe of its inhabitants,[5] which is also the case in Brazil, where death records have not been kept reliably in certain areas, particularly the North and Northeastern regions.

For childhood mortality rates, there are no country-wide studies about the progression of mortality assigned specifically to asthma among children. Most studies use the 5- to 34-year-old age group for analysis because, since the publication by Sears et al.,[6] several studies have demonstrated some consistency in data obtained

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from death records for this age group.[2] Only one Brazilian study, conducted in the end of last century, included children younger than 5 years.[7]

Our study analyzed the asthma mortality trend among children in Brazil since January 1980, when the 9th revision of the International Classification of Diseases (ICD) was adopted, to the date when data were last reported by the Brazilian Ministry of Health.

Methods

This ecological time-series study used the database of the Brazilian Unified Health System, from which we obtained the number of asthma deaths and the number of people younger than 19 years in the whole country.[8] The study was conducted from January 1980 to December 2007. The system does not use codes for multiple causes to record deaths; therefore, we used the ICD 493 (asthma) rubric of the 9th ICD to classify data from 1980 to 1995. To calculate asthma mortality coefficients from 1996 to 2007, the ICD J45 (asthma) rubric of the 10th ICD was used. Population data to calculate coefficients were also retrieved from the database of the Brazilian Unified Health System, according to estimates calculated by the Center for Regional Development and Planning.

Data were extracted independently by two observers using a standardized form and checked by two other observers. The main variable under study was the asthma mortality rate (number of asthma deaths/population), multiplied by 100,000. We also calculated the relative reduction of the asthma mortality coefficients (1980 versus 2007; the 2007 mortality coefficient minus the 1980 mortality coefficient divided by the 1980 mortality coefficient and multiplied by 100). Simple linear regression was used to analyze the time trend toward coefficient reduction in the three age groups: 1 to 4, 5 to 9 and 10 to 19 years. The regression coefficient represented the annual mean change of asthma mortality coefficients. The models were built using the asthma mortality coefficients as dependent variables (y) and the calendar years as independent variables (X); to avoid autocorrelation between the equation terms, X-1993 was used; the estimated model was $Y = \beta 0 + \beta 1 (X-1993)$, where Y = asthma mortality coefficient, $\beta 0$ = mean coefficient in time interval, $\beta 1$ = mean annual coefficient variation, and X = calendar year. The Stata 9 program was used for statistical analyses.[9] This study was approved by the Ethics Committee of the University Hospital of Universidade Federal de Rio Grande.

Results

From January 1980 to December 2007, 9,051 asthma deaths of children younger than 19 years were recorded. Of these, 69% (6,270 records) were younger than 5 years (Table 1).

Table 2 shows the asthma mortality coefficients in each year and in each of the three age groups under study. Figure 1 is a graph that shows this trend and demonstrates that the decline of the mortality coefficient was more marked in the 1- to 4-year-old age group. In this group, mean annual fall of the asthma mortality coefficient was 0.076; in the 5 to 9, it was 0.005; and in the 10 to 19, 0.004. In all age groups under study, mean reduction of the asthma mortality coefficient was 0.022 (Table 3).

The analysis of relative reduction of asthma mortality coefficients, compared for all the study interval from 1980 to 2007, revealed an overall mortality coefficient reduction of 66.3%. This reduction was 71.2%, 48.3% and 34.6% for the 1-to 4-, 5- to 9-, and 10- to 19-year-old age groups.

Discussion

This study was the first to collect data about asthma mortality among children from all over Brazil. In contrast to studies conducted in other parts of the world, we found a constant fall of the asthma mortality coefficients during the study interval. A large review published in 2009 collected data from 20 countries and showed that, overall, there was a progressive increase of asthma mortality rates during the 1980s, which reached its peak in the end of that time interval and then fell systematically.[10] Of the 20 countries included, only Finland, Holland and Spain did not have an increase of mortality during the study period.

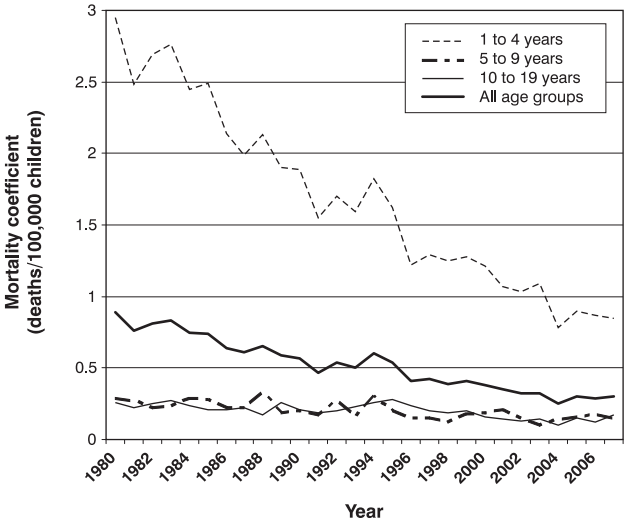

Figure 1 - Asthma mortality among children younger than 19 years. Brazil, 1980-2007

Table 1 - Number of asthma deaths among children younger than 19 years. Brazil, 1980-2007

Calendar year	1 to 4 years	5 to 9 years	10 to 19 years	All age groups
1980	379	44	72	495
1981	326	41	63	430
1982	354	33	72	459
1983	363	37	77	477
1984	322	46	71	439
1985	328	44	62	434
1986	281	36	63	380
1987	261	36	67	364
1988	286	55	53	394
1989	254	32	81	367
1990	254	35	68	357
1991	207	30	60	297
1992	230	45	66	341
1993	218	29	76	323
1994	253	55	87	395
1995	228	37	96	361
1996	153	25	82	260
1997	173	26	69	268
1998	163	21	63	247
1999	168	31	72	271
2000	160	31	55	246
2001	143	35	50	228
2002	140	26	47	213
2003	149	18	51	218
2004	108	25	38	171
2005	129	29	56	214
2006	126	33	48	207
2007	114	23	58	195
Total	6,270	958	1,823	9,051

When analyzed together, the mortality coefficients for individuals 1- to 19 years old showed a constant falling trend. This fall was particularly marked for individuals in their first 5 years of age, exactly the time when it is more difficult to make a diagnosis of asthma. Part of the extraordinary fall of the mortality coefficient in this age group may be associated with improvements in healthcare services, implemented in countries in the last decades, such as the Brazilian Program of Community Healthcare Agents and Family Health Program, developed by the Ministry of Health, which provide preventive and therapeutic services to the population. However, part of this reduction (four times greater among children younger than 5 years than the mean for all age groups) should be assigned to the greater accuracy in diagnosing wheezing children and the earlier inclusion of these children in asthma control programs. These changes have been used as an explanation for the reduction of mortality coefficients in several countries.[11,12] The most probable explanation for the overall reduction in all pediatric age groups may be the progressive increase in the use of inhaled corticosteroids, and evidence shows that the reduction of the risk of asthma death results from the adoption of this treatment modality.[13,14] This reduction has also been concurrent with the increase in the use of long-lasting beta-agonists, associated with greater mortality when used isolatedly.[10]

The discussion of data described here should take into consideration that there are important biases in the mortality recording system, based on data generated from the analysis of death certificates. The only actually reliable method would be the collection of data directly from the results of necropsias.[7] Moreover, important coefficient variations may occur between states in Brazil, which may be affected by the quality of information.[2] In addition, the ICD, issued by the World Health Organization, is a confounding factor in mortality studies. The introduction of the 9th revision of the ICD affected changes in mortality rates. According to

Table 2 - Asthma mortality coefficient among children younger than 19 years. Brazil, 1980-2007

Calendar year	1 to 4 years	5 to 9 years	10 to 19 years	All age groups
1980	2.95	0.29	0.26	0.89
1981	2.48	0.27	0.22	0.76
1982	2.69	0.22	0.25	0.81
1983	2.76	0.24	0.27	0.83
1984	2.45	0.29	0.24	0.75
1985	2.49	0.28	0.21	0.74
1986	2.14	0.22	0.21	0.64
1987	1.99	0.22	0.22	0.61
1988	2.13	0.33	0.17	0.65
1989	1.90	0.19	0.26	0.59
1990	1.89	0.20	0.11	0.57
1991	1.55	0.17	0.19	0.47
1992	1.70	0.27	0.20	0.54
1993	1.59	0.16	0.23	0.50
1994	1.82	0.30	0.26	0.60
1995	1.62	0.20	0.28	0.54
1996	1.22	0.15	0.24	0.41
1997	1.29	0.15	0.20	0.42
1998	1.25	0.12	0.19	0.39
1999	1.28	0.18	0.20	0.41
2000	1.21	0.19	0.16	0.38
2001	1.07	0.21	0.14	0.35
2002	1.03	0.15	0.13	0.32
2003	1.09	0.10	0.14	0.32
2004	0.78	0.14	0.10	0.25
2005	0.90	0.16	0.15	0.30
2006	0.87	0.18	0.12	0.29
2007	0.85	0.14	0.17	0.30

Table 3 - Mean annual reduction of asthma mortality coefficient among children younger than 19 years. Brazil, 1980-2007

Age group	Linear regression coefficient	95%CI (p)	r^2 (p) (model)
1 to 4 years	-0.076	-0.084 to -0.069 (p < 0.0001)	0.94 (p < 0.0001)
5 to 9 years	-0.005	-0.007 to -0.003 (p < 0.0001)	0.51 (p < 0.0001)
10 to 19 years	-0.004	-0.006 to -0.003 (p < 0.0001)	0.53 (p < 0.0001)
All age groups	-0.022	-0.024 to -0.019 (p < 0.0001)	0.93 (p < 0.0001)

95%CI = 95% confidence interval; r^2= determination coefficient that measures regression model quality and shows what proportion of total dependent variable variation is explained by independent variable variation.

the ICD-9 rules, the reports of asthma deaths, entered as bronchitis, changed to being reported as asthma, differently from the usual practice when using the ICD-8. In 1996, the new ICD-10 may also have introduced some variation in the identification of asthma deaths.[15] These changes do not seem to be significant in the 5- to 9-year-old age group,[16] but no studies have included children younger than 5 years.

This is the first study to describe the magnitude of asthma deaths among children all over Brazil. Despite its limitations due to the fact that it is a retrospective study based on secondary data and subject to inaccurately entered records, data showed that asthma mortality among children in Brazil is low and has kept a falling trend in all age groups treated by pediatricians.

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