Hospital admissions due to respiratory diseases in children and adolescents of São Paulo city, 2000-2004

Perfil de internações hospitalares por doenças respiratórias em crianças e adolescentes da cidade de São Paulo, 2000-2004

Perfil de internaciones hospitalares por enfermedades respiratorias en niños y adolescentes de la ciudad de São Paulo, 2000-2004

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ABSTRACT

Objective: To analyze the profile of children and adolescents' hospital admissions due to respiratory diseases in São Paulo (SP), Brazil.

Methods: This is an ecological time series study. Data was obtained on hospital admissions for respiratory diseases (International Classification of Diseases, 10th Revision: J00–J99) in hospitals under the Brazilian Unified Health System located in São Paulo between 2000 and 2004. Main characteristics of the temporal distribution of respiratory morbidity in childhood and adolescence by age and cause are described.

Results: Pneumonia and bronchopneumonia (51%), asthma (18%) and acute and chronical diseases from upper airways (10%) accounted for most of the admissions. Children up to five years are most frequently hospitalized, regardless of the specific cause. Among adolescents, the main causes of hospitalization were respiratory diseases that affects mainly the interstitial lung (0.1%) and the necrotic and suppurative diseases of lower airways (0.2%). From the age of six to ten years, admissions for acute and chronic diseases from upper airways (10%) were predominant. The peak of morbidity occurs in early autumn. There was a trend towards increasing hospital admissions for respiratory illnesses during the analyzed period.

Conclusions: The distribution of hospital admissions for respiratory diseases in children and adolescents is dependent on age and season. The younger the age the greater the number of hospital admissions.

Key-words: respiratory tract diseases; hospitalization; child; adolescent.

RESUMO

Objetivo: Analisar o perfil das internações hospitalares por doenças respiratórias em crianças e adolescentes na cidade de São Paulo (SP).

Métodos: Estudo ecológico de séries temporais. Foram obtidas informações sobre internações hospitalares por doenças respiratórias (Código Internacional de Doenças, 10ª Revisão: J00–J99) em hospitais conveniados ao Sistema Único de Saúde, localizados na cidade de São Paulo, entre 2000 e 2004. Foram descritas as principais características de distribuição temporal, por faixa etária e por causa de morbidade respiratória na infância e na adolescência.

Resultados: As pneumonias e broncopneumonias (51%), a asma (18%) e as doenças agudas e crônicas das vias aéreas superiores (10%) responderam pela maior parte das internações. As crianças até cinco anos são as mais internadas, independentemente da causa específica. Entre os adolescentes, observou-se que as

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principais causas de internações foram as doenças respiratórias que afetam o interstício pulmonar (0,1%) e as afecções necróticas e supurativas das vias aéreas inferiores (0,2%). Na faixa etária de seis a dez anos, predominam as internações por doenças agudas e crônicas das vias aéreas superiores (10%). Houve tendência de aumento das internações por doenças respiratórias ao longo do período analisado, além da constatação de que o pico de morbidade se dá no começo do outono.

Conclusões: As internações por doenças respiratórias de crianças e adolescentes apresentam padrão de distribuição dependente da faixa etária e da sazonalidade. Quanto menor a faixa etária maior o número de internações.

Palavras-chave: doenças respiratórias; hospitalização; criança; adolescente.

RESUMEN

Objetivo: Analizar el perfil de las internaciones hospitalarias por enfermedades respiratorias en niños y adolescentes en la ciudad de São Paulo, Brasil.

Métodos: Estudio ecológico en series temporales. Se obtuvieron informaciones sobre internaciones hospitalarias por enfermedades respiratorias (Código Internacional de Enfermedades 10ª Revisión J00-J99) en hospitales conveniados al Sistema Único de Salud, ubicados en la ciudad de São Paulo, entre 2000 y 2004. Se describieron las principales características de distribución temporal, por franja de edad y por causa de morbilidad respiratoria en la niñez y adolescencia.

Resultados: Las neumonías y bronconeumonías (51%), el asma (18%) y las enfermedades agudas y crónicas de las vías aéreas superiores (10%) contestan por la mayor parte de las internaciones. Los niños de hasta cinco años son los más internados, independiente de la causa específica. Entre los adolescentes, se observó que las principales causas de internaciones fueron las enfermedades respiratorias que afectan el intersticio pulmonar (0,1%) y las afecciones necróticas y supurativas de las vías aéreas inferiores (0,2%). En la franja de edad de los 6 a los 10 años, predominan las internaciones por enfermedades agudas y crónicas de las vías aéreas superiores (10%). Hubo una tendencia de aumento de las internaciones por enfermedades respiratorias a lo largo del periodo analizado, además de la constatación de que el pico de morbilidad se da en el comienzo del otoño.

Conclusiones: Las internaciones por enfermedades respiratorias de niños y adolescentes presentan estándar de distribución dependiente de la franja de edad y de la estacionalidad. Cuanto menor sea la franja de edad, mayor será el número de internaciones.

Palabras clave: enfermedades respiratorias; epidemiología; hospitalización; niño y adolescente.

Introduction

Diseases that affect the respiratory system are responsible for a large proportion of sickness and death among both adults and children[1], impacting on infant mortality coefficients and overloading healthcare services[2,3] Childhood respiratory diseases are a group of diseases of varying etiology and severity that affect one or more section of children's airways[4].

According to Graham, between 1980 and the first part of the 1990s, acute respiratory infections were the cause of 25 to 33% of all deaths of under-5s in developing countries[5]. After this period, and up to the year 2000, the World Health Organization (WHO) estimated that 8% of all deaths in developed countries and 5% of deaths in developing countries were caused by respiratory disease, confirming the importance of these conditions in the global population's morbidity and mortality[6].

In 2007, respiratory infections were expected to cause 30% of infant mortality in developing countries[7]. Around 90 to 95% of upper respiratory tract conditions and a proportion of lower airway diseases are caused by viruses and other non- bacterial agents[8-11].

The most significant risk factor for respiratory diseases is age group, with the young being affected more often. Incidence peaks between 6 and 24 months of age and declines thereafter[2,12].

According to data published by the World Health Organization (WHO), around 15 million children under the age of five die every year worldwide as a result of diseases of the respiratory system and 95% of these deaths occur in developing countries[13]. In Brazil, diseases of the respiratory system accounted for 40% of all hospitalizations of children from 0 to 4 years old between 1998 and 2007, underlining the significance of these conditions to the community and when planning government expenditure. In Brazil's North and Northeast administrative regions, the number of hospital admissions for respiratory diseases is lower than in the other three regions, and the South region has the highest rates[14]. In terms of mortality, respiratory diseases are responsible for approximately 10% of deaths of infants less than 12 months old and are the second greatest cause

of death in that population and the greatest cause of death among children under 4 years old[13].

While the metropolitan area of Greater São Paulo, which has approximately 19 million inhabitants, does not undergo the large magnitude temperature variations seen in temperate countries, it does have distinct seasonality which means that respiratory diseases are the most common conditions seen in children and adolescents during the coldest months of the year, irrespective of effect indicator analyzed[4,8,15,16].

Additionally, the importance of smoking as a risk factor for childhood respiratory diseases cannot be ignored and passive smoking of at least 10 cigarettes per day is a risk factor both for disease incidence and disease exacerbation[8,17,18].

It is against this background that the present study was conducted with the objective of describing the principal characteristics of the temporal, age group and specific cause distribution of hospital morbidity due to respiratory diseases in childhood and adolescence in the city of São Paulo, Brazil, using admission records from Brazilian National Health Service (SUS - *Sistema Único de Saúde*) hospitals from 2000 to 2004.

Method

This was a mixed ecological study that investigated the distribution of events of interest according to age group for the period between January 1, 2000 and December 31, 2004.

Irrespective of age group, all procedures undergone by patients while in hospital must be notified to the SUS using a hospital admission authorization form. The SUS's statistical department (DATASUS) analyzes the data and produces reports that include information such as hospital name and the city or town in which it is located, patient age, cause of admission, patient's town or city of residence, length of hospital stay, date of discharge and others. This study analyzes the date of admission, patient age in years, and the principal diagnosis that caused the admissions of children and adolescents from the city of São Paulo. These data were harvested from annual records held on electronic media and provided by Datasus and can also be obtained from their website.

Around 50% of the population of the city of São Paulo are treated by the Brazilian National Health Service[12]. This study analyzes all admissions due to respiratory diseases of children and adolescents aged 0 to 19 years to hospitals affiliated to the SUS in the city of São Paulo between January of 2000 and December of 2004. The SUS Hospital Information System (SIH-SUS) uses the ICD-10 to classify respiratory diseases, which are listed in chapter X (from J00 to J99)[19]. For the purposes of this study, respiratory diseases were subdivided as follows: J00-J06 (acute upper respiratory infections); J10 and J11 (influenza - flu); J12-J18 (pneumonia); J20-J22 (other acute lower respiratory infections, including acute bronchitis and acute bronchiolitis); J30-J39 (other diseases of upper respiratory tract); J40-J44 and J46-J47 (chronic lower respiratory diseases); J45 (asthma); J60- J70 (lung diseases due to external agents); J80-J84 (other respiratory diseases principally affecting the interstitium); J85 and J86 (suppurative and necrotic conditions of lower respiratory tract); J90-J94 (other diseases of pleura); and J95-J99 (other diseases of the respiratory system not classified elsewhere).

Results are presented as absolute values or percentage admissions per age group, defined as follows, 0 to 5; 6 to 10; 11 to 13 or 14 to 19 years of age, by year, and by disease group. Time series graphs were then plotted in order to analyze seasonality by age group and by disease group. The statistical software SPSS 10.0 for Windows was used for these analyses.

This study is based on analyses of secondary data from the records of hospitals affiliated to the SUS and there was no direct contact with patients and patient data was neither identified nor used individually. The study was approved by the Research Ethics Committee at the *Hospital Estadual do Grajaú*.

Results

There were a total of 130,653 pediatric admissions due to respiratory diseases between 2000 and 2004 in the city of São Paulo. The 0 to 5 age group accounted for 102,454 admissions and the remaining 28,199 admissions were of patients aged 6 to 19.

Graph 1 demonstrates that pneumonia (J12-J18) was responsible for slightly over half of all pediatric admissions due to respiratory diseases (51.4%). Asthma (J45) and other upper respiratory diseases (J30-J39) were ranked second and third in terms of admissions of patients in this age group.

It will be observed from Graph 2 that other acute lower respiratory infections (J20-J22), flu (J10 and J11) and pneumonia and bronchopneumonia (J12-J18) were the principal causes of hospital admission for children aged 0 to 5 years. Other upper respiratory diseases (J30-J39) were responsible for the greatest number of admissions of 6-to-10-year-olds. Respiratory diseases principally affecting the interstitium

(J80-J84) were equally prevalent in the oldest and youngest age groups.

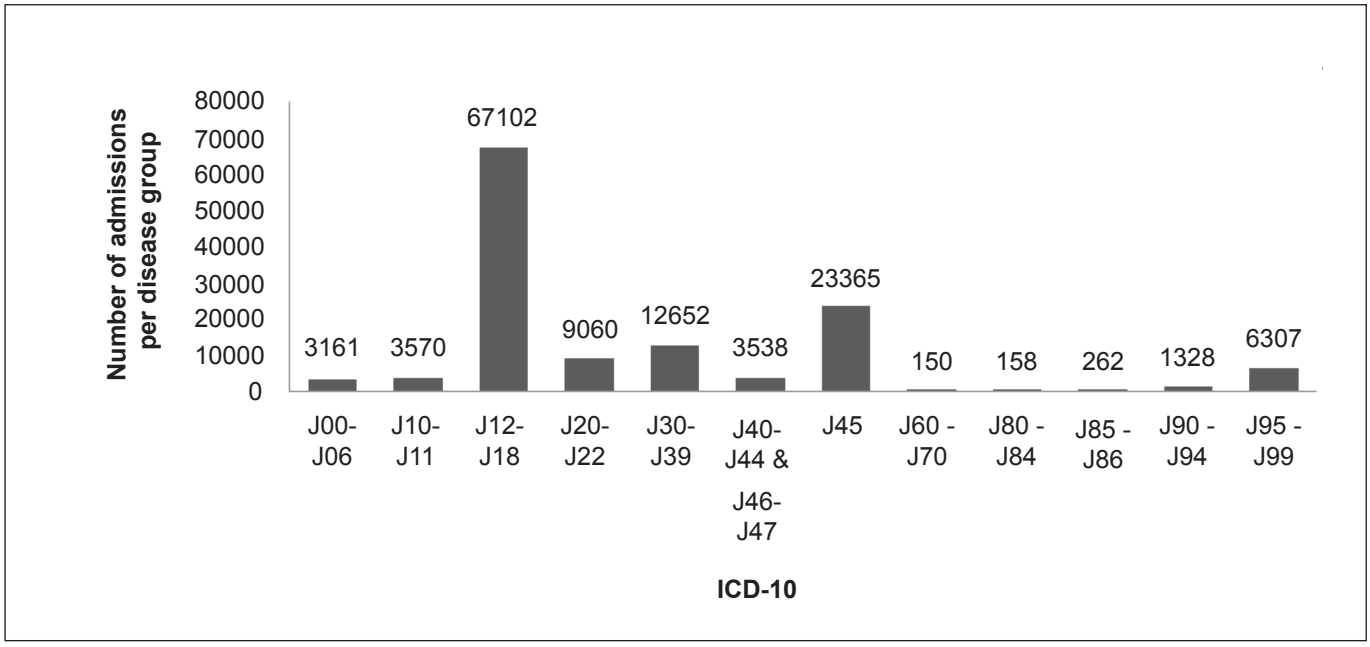
Graph 3 demonstrates that, particularly for the under-5s, admissions due to respiratory diseases follow a seasonal patterns, peaking at the start of autumn, with a plateau or lower magnitude peak during the winter and a trough during the summer. This profile demonstrates that transition from summer to the first cold periods has a greater effect on the incidence of respiratory diseases in younger children than the winter season proper. Additionally, there is a trend for the total number of admissions in the two youngest age groups to increase over the study period.

It will be observed in Graph 4 that, in general, the number of admissions increased during 2003-2004. The respiratory disease groups shown all have similar seasonality profiles, which are most evident for the most frequent diseases: the groups pneumonia and bronchopneumonia (PN-BCP), asthma and other upper respiratory diseases (OURD). Bronchiolitis is classified under other acute lower respiratory infections and, although they are not shown in Graph 4, these also have a similar seasonal pattern and a tendency to increase over the period analyzed. Of note is the increase in cases of admissions due to PN-BCP during 2003 and 2004, indicating that the observed increase in total admissions due to respiratory diseases over the study period is primarily caused by this group of respiratory diseases.

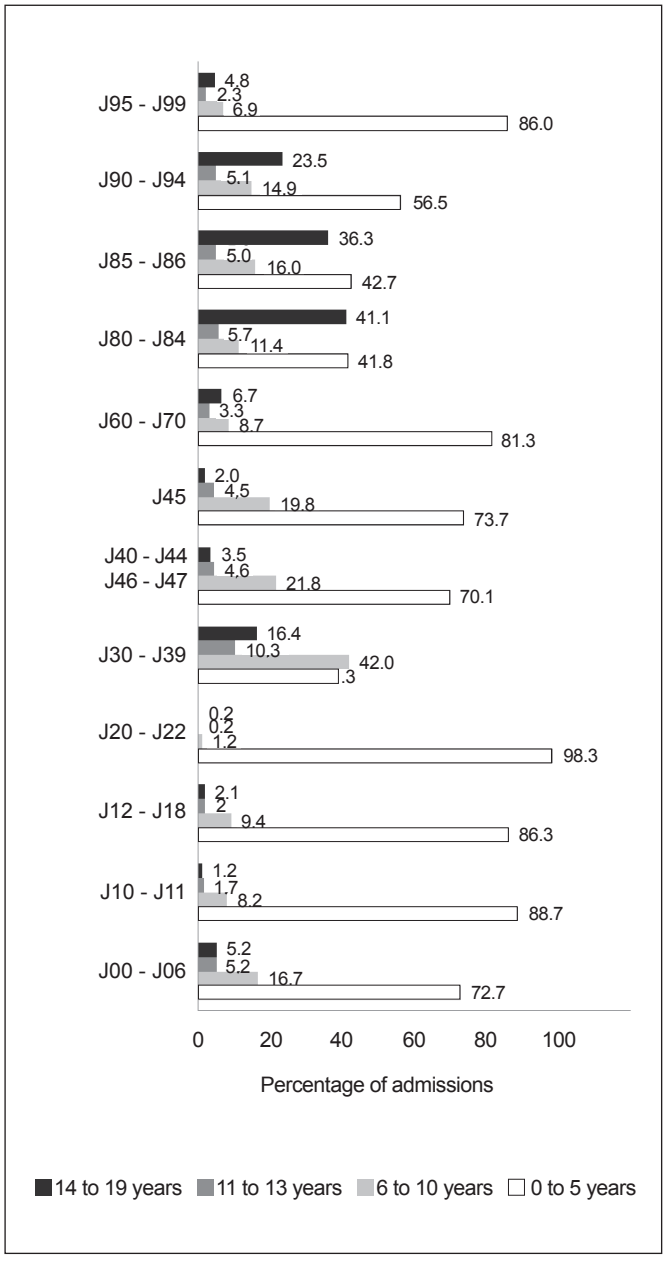
Discussion

This study show that admissions of children and adolescents due to respiratory disease were not distributed homogenously, with under-5s being most susceptible to admissions due to respiratory diseases. Furthermore, pneumonia and bronchopneumonia, asthma and other upper respiratory diseases were responsible for the majority of admissions. There is an obvious seasonality to admissions with the most significant peaks occurring during the transition between summer and autumn.

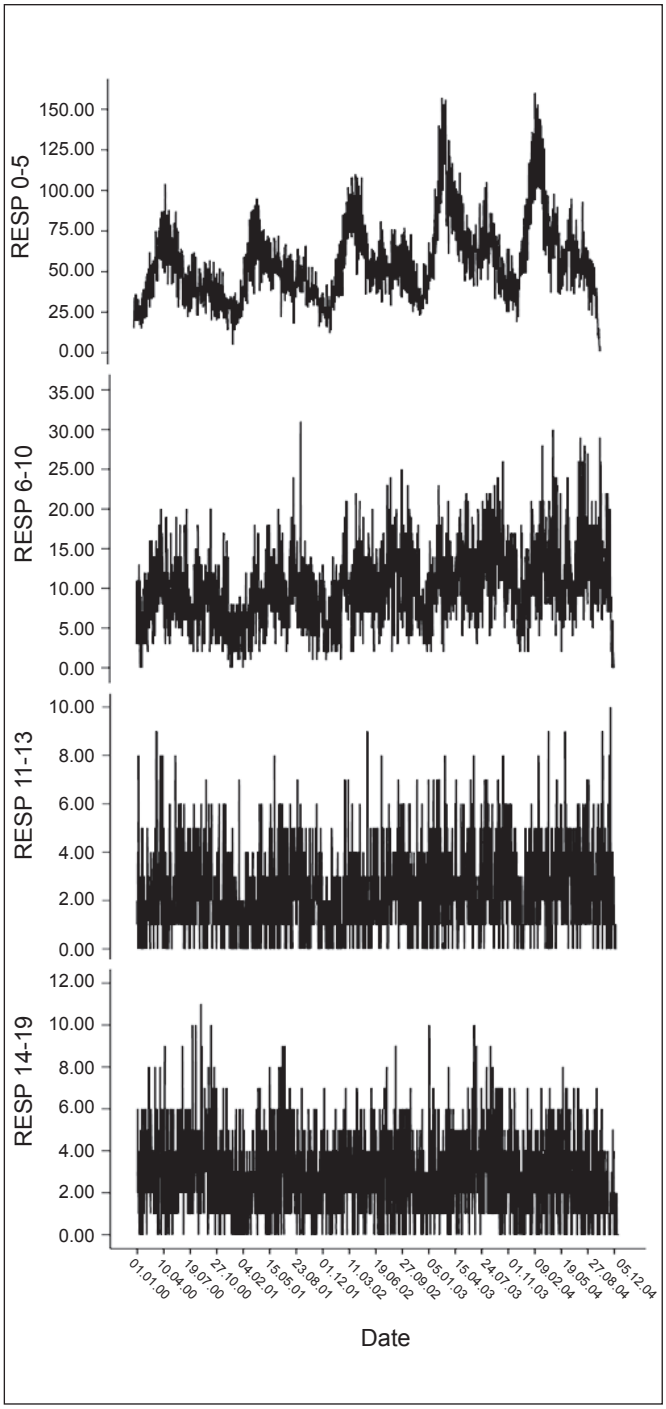
All epidemiological studies have their limitations and ecological studies do not break this rule. Nevertheless, this study design is very well suited to descriptive analysis and also to analysis of indicators derived from secondary data. Among the many different indicators of respiratory morbidity, those constructed using the hospital admission records from the SUS have proven highly trustworthy because of the quality of the data. Notwithstanding, it should be pointed out that the majority of these data relate to the section of the population who do not receive medical care on the private healthcare system and use services affiliated to the SUS. The percentage of the population treated on the SUS varies depending on the economic climate and the unemployment rate, but historically it does not fall below 50%[20].



Graph 1 - Distribution of number of pediatric admissions for respiratory diseases in the city of São Paulo from 2000 to 2004 by ICD-10 groups (J00–J99)

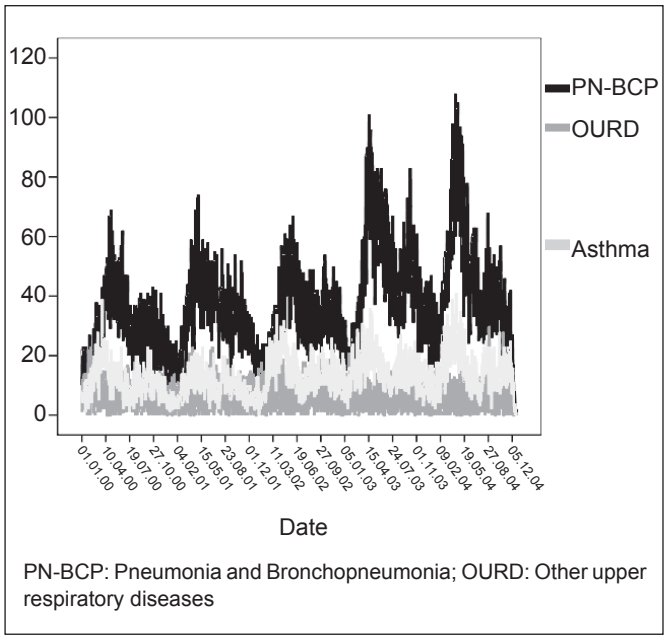


Graph 2 - Distribution of pediatric admissions for respiratory diseases diseases in the city of São Paulo from 2000 to 2004 by ICD-10 group and age group



Graph 3 - Seasonal distribution pattern of admissions for respiratory diseases (RESP) by age group (0-5 years, 6-10 years, 11-13 years or 14-19 years) from January 2000 to December 2004

The vulnerability of younger children compared to older children and adolescents, which is manifest in the higher proportion of admissions among under-5s, is in line with what has been reported by other authors[2,12,21]. This fact can be explained by the immaturity of their immune systems in combination with their narrower airways, which make it harder to remove foreign elements from the respiratory tract[17,22]. Children's bodies are also different in other ways, leading to increased oxygen consumption per kilo of body weight. One of these factors is the higher rate of heat loss, in turn a result of the ratio of body surface area to body weight, and another is their high growth rate. This increased oxygen demand means that larger quantities of air are inhaled and, as a result, exposure to the pollutants in tropospheric air is



PN-BCP: Pneumonia and Bronchopneumonia; OURD: Other upper respiratory diseases

Graph 4 - Seasonal distribution pattern of child and adolescent admissions for respiratory diseases by disease group from January 2000 to December 2004

also greater[23,24]. Furthermore, living conditions, nutrition and access to health services can impact on onset and severity of acute infections of the respiratory tract[17,18].

The principal causes of hospital admission of 14-to-19-year-olds were the interstitial (J80-J84) and suppurative (J85-J86) diseases, which are apparently more serious – serious enough to take adolescents to hospital and for them to be admitted. It is, however, interesting to note that in the 6 to 10 age group admissions were predominantly the result of the other upper respiratory diseases group, which includes hypertrophy of tonsils and adenoids, two of the principal causes of elective admissions.

With regard to the entire sample of children and adolescents, pneumonia and bronchopneumonia were the most common causes of admission and were responsible for more than half of all admission records. This finding is in line with what has been observed in other studies undertaken in other locations. [1,12] Asthma is also recognized as a disease with high morbidity and therefore the fact that it was the second most frequent cause of admissions was no surprise. Furthermore, it should be remembered that it is very common for acute respiratory infections to be concomitant, particularly pneumonia, bronchopneumonia and inflammatory diseases such as asthma[22,25].

The relationship between respiratory diseases and climate is very well-known and it is this that is responsible for the characteristic seasonal pattern of this group of diseases. However, as has already been demonstrated by other temporal studies conducted in the city of São Paulo, the period during which admissions underwent the greatest increase was not the winter, when temperatures tend to be at their lowest, but during the transition between summer and autumn, when the first cold fronts begin to arrive and sharp changes in temperature occur during short spaces of time. There is also a peak in admissions during the winter, but this is more due to increased levels of pollution than to lower temperatures[22,26]. The changes to the climate that have taken place over recent decades and which are related to global warming have led to higher temperatures during April, increasing the contrast with the colder month of May[23]. It appears that this thermal shock has brought the peak in admissions to SUS hospitals due to airway infections forward in the year[27].

One of the most important results of this study is the tendency for respiratory disease admissions to increase over the period analyzed. A similar effect has been observed with regards to respiratory diseases and related mortality among the elderly[28]. Respiratory morbidity in children and adolescents cannot be directly compared with mortality among the elderly. Nevertheless, it is of note that outcomes related to a single disease group exhibit similar tendencies in common areas. In this context, the changes to habitual climate patterns, leading to greater amplitude variation and extreme contrasts during a single day, acutely, or between the seasons of a year, as mentioned earlier[23], are one of the possible explanations for this behavior. Future investigations should seek more detailed explanations for this behavior, bearing in mind that in the city of São Paulo atmospheric pollution, which is an aggravating factor for respiratory diseases, is on the decline[29,30].

In addition to these environmental factors, socioeconomic conditions play an important part in respiratory disease incidence[31]. However, within this study design and the short time period analyzed, it was not possible to conduct specific analyses of the influence of socioeconomic characteristics or of variations in them. A longer time series with analysis of socioeconomic data, even if measured ecologically, would allow for a better assessment of this risk factor.

In summary, children under the age of five years were the most susceptible to respiratory diseases and pneumonia and bronchopneumonia were the respiratory diseases with greatest incidence over the period analyzed. Furthermore, there was a worrying tendency for admissions to increase over the study period and it is necessary to investigate in greater detail not only those risk factors which are recognized as being related to respiratory diseases, but also other risk factors which, in an urban environment, may also contribute to the behavior observed.

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