AIR POLLUTION AND CHILDREN HEALTH IN CURITIBA/BRAZIL

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Abstract

One of the aspects that characterize urban centers around the world is the quality of air that people breathe. In this point the situation has worsened in recent decades, as air quality fell largely of urban-industrial clusters to deemed public health issue. This research attempts to discuss the quality of air the Curitiba people breathe.

Data showed that in the years 1999 and 2000 were found positive correlations between children morbidity and contaminants smoke, NO2 and particulate matter due to respiratory diseases in Curitiba city. The involvement of respiratory diseases in children from 0 to 4 years in the cities of Curitiba and Almirante Tamandaré for the period of 1995 to 2005 showed a predominance in males. Throughout period of 40 months of data from IQA considered for Ouvidor Pardinho station, 1 every 2.7 days, was under Regular air quality situation, and every 58 days, 1 was presented with Inadequate air quality. The months of autumn and winter mainly, presented those of the highest number of days in such situations.

Key Words: Air pollution – public health – Curitiba - Curitiba's Metropolitan Region.

1. INTRODUCTION

One of the aspects that characterize urban centers around the world is the quality of air that people living in these places, breathe. The situation has deteriorated to such an extent in recent decades, air quality in the urban-industrial areas, largely on was considered a public health problem. In Curitiba, although pollution is not addressed by government agencies as a public health issue, the city is following this case with respect to concentrations of pollutants in the air and the impact this has brought to the health of its residents. Models of urban planning applied since the last 50 years to the city has not taken account of the problems arising from the effects of air pollution on the health of its population, because the pace of growth that the city has made in that period, the dow town area is where there is the highest indices of degradation of air quality. In Brazil and in many other countries, urban growth is played in the size of the fleet of vehicles on the city and is a major source of emissions of air pollutants. The fleet of vehicles is indeed the main source of emissions of pollutants in urban centers. In Curitiba the relationship between the fleet and the size of the population, systematically, is much worse than that prevailing in the city of Sao Paulo, famous for its poor air quality. This situation is portrayed as an example for the year 2005: the 100 inhabitants had 49 vehicles, while in Curitiba this proportion was 52 vehículos/100 people. Obviously, the size of the population in both cities is very different and therefore the amount of pollutants in the air that covers it. These differences also reflect the way the environmental agencies of the two cities combat to air pollution. Brazilian law follows the same parameters used in the main countries that practice the control of air pollution in its cities and industrial zones. Meanwhile, the indices for setting air quality is being questioned in many countries because of the need for re-evaluation in relation to the volume of the results are correlated to disease control, even in cases classified as good air quality.

2. THEORETICAL DISCUSSION

The atmosphere is the recipient of pollutants and acts primarily as a regulator of the concentrations of the pollutants released into the intra-urban air layer, as a result of dynamic processes peculiar to it. Parameters such as humidity, rain, wind, temperature and steady state is recognized as important determinants of air quality in cities (Danni-Oliveira, 1999). The characterization of weather types facilitates the understanding of this condition. As a example, weather types such as the polar air masses domain, creat dry and stable conditions that lead to bad air quality (Sobral, 1988). Corresponding situation can be presented in Curitiba, Sao Paulo and Santiago where there are such air circumstances. In general, the results showed poor health of the population of the municipality as a whole in terms of respiratory problems, especially the extreme age groups (Roseira et al, 2002). In general, surveys have indicated a serious relationship between the concentrations of pollutants such as CO2, NOx, O3, and SO3 with MP-related diseases of the respiratory and cardiovascular systems. The groups most affected by these diseases are children, the elderly and people with ill health (FREITAS et al, 2004; CETESB, 2008).

3. PROCEDURES

This article made use of the results of researches in the Pós-graduate Program in Geography of UFPR and existing data in the Monthly Bulletin of the Air Quality, published on the website by the Paraná Institute Environmental - IAP. The daily data of air quality indicators – IQA - from station's air quality at the Praça Ouvidor Pardinho in downtown Curitiba, corresponded to the period from May 2005 to September 2008 and
were obtained from the email www.iap.pr.gov.br. The IQA was originally developed in 1981 from the database and studies accumulated in the United States and Canada (Table 1). It is a mathematical tool designed to simplify the process of dissemination of air quality (CETESB, 2008). According to the IAP (2005), the indexes are made taking the air pollutant as the primary standard; therefore, taking the ozone layer as an example, through the main indicator for the concentration of half time - 160 mg/m³, the IQA is 100; if the concentration is halved (80 µg/m³), the level is 50. For every index there is a reaction over individuals health, taking into account the pollutants in an indiscriminate manner, as shown in Table 2.

4. DISCUSSION

The indices are used as parameters for defining IQA (Table 1) is being questioned in much of the world, because the close relationship between increased mortality and morbidity recorded in large urban centers and air pollution indices below the ones took as a reference. Because of this, the World Health Organization proposes to use the lower pollutants limits concentrations as pollution parameter to monitoring air quality. In Brazil, it is used CONAMA resolution 03/90, which divides the indexes of pollutants into two categories: those that represent the main standard and those that represent the secondary level. “You could say that the main patterns in the lower limit at which contamination can cause damage to people and their environment... [while]... secondary patterns indicate the maximum concentration of each pollutant should not be exceeded in order to be considered good air quality” (Danni-Oliveira, 1999), or can be understood as the maximum tolerable concentration of air pollutants as a short and medium aim (CETESB, 2008). The CONAMA resolution - 03/90 is a step to complete 20 years, a period in which the national scene in the population distribution has changed considerably. Data from the 2000 census indicated that about 81% of the Brazilian population lived in cities, while in 1990 the figure was 75%. In 1996, 46% of the urban population was concentrated in the most populated cities in the country: 36% in cities over 500,000 inhabitants and 12% in those with more than 100,000. Cities grew and continues to grow, a large majority in the intense rhythm. It should be remembered that the growth of cities doesn’t mean only more people in the urban area but also means all activities of production, transportation, housing, supplies, education, entertainment, etc. that create good or bad conditions to population cities’ live. Despite all the programs destined to improve fuel quality and even those who are in control of the number of vehicles used in transit national, state or municipal, what is present is an urgent need to review and adjust the control rules contamination in Brazil, face the new realities and new scientific findings that are appearing since the implementation CONAMA resolution.

<table>
<thead>
<tr>
<th>Air Quality Index (µg/m³)</th>
<th>Indices</th>
<th>MP₁₀ (µg/m³)</th>
<th>O₃ (µg/m³)</th>
<th>CO (ppm)</th>
<th>NO₂ (µg/m³)</th>
<th>SO₂ (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>0 - 50</td>
<td>0 - 50</td>
<td>0 - 80</td>
<td>0 - 4.5</td>
<td>0 - 100</td>
<td>0 - 80</td>
</tr>
<tr>
<td>Regular</td>
<td>51 - 100</td>
<td>50 - 150</td>
<td>80 - 160</td>
<td>4.5 - 9</td>
<td>100 - 320</td>
<td>80 - 365</td>
</tr>
<tr>
<td>Inadequate</td>
<td>101 - 199</td>
<td>150 - 250</td>
<td>160 - 200</td>
<td>9 - 15</td>
<td>320 - 1130</td>
<td>365 - 800</td>
</tr>
<tr>
<td>Bad</td>
<td>200 - 299</td>
<td>250 - 420</td>
<td>200 - 800</td>
<td>15 - 30</td>
<td>1130 - 2260</td>
<td>800 - 1600</td>
</tr>
<tr>
<td>Very bad</td>
<td>&gt;299</td>
<td>&gt;420</td>
<td>&gt;800</td>
<td>&gt;30</td>
<td>&gt;2260</td>
<td>&gt;1600</td>
</tr>
</tbody>
</table>


In the case of Curitiba, the focus of the text, the study by BAKONYI et al (2003) showed that in the period between 1999 and 2000 were found positive correlations (Table 2) between the morbidity due to respiratory diseases in children and some pollutants, even when the contaminants indices obey the legislation. It was investigated all the polluting effects on childhood respiratory diseases, for example, an increase of 40.4 µg/m³ in 3 days moving average of smoke was associated with an increase of 4.5% (95%) in consultations for respiratory illnesses (Table 2). Another aspect to be considered is that respiratory diseases in Curitiba have an unequal distribution based on the gender. Bakony and Danni-Oliveira (2007) through the database of DATASUS/MS analyzed the time series from 1995 to 2005 with respect to Respiratory Diseases, aiming to identify the gender most affected in the age group of 0 to 4 years. The results showed the men as more prone to all the observed years. In Curitiba Metropolitan Region (CMR), was also searched the town of Almirante Tamandaré, where the results appear to be similar to the registered at the capital, ie on the morbidity, the male was more inclined in all years of the series. In relation to the mortality, analysis showed boys as the most affected, except for the years 2003 and 2004 where the female shows more individuals and the years 1996 and 1999 where the numbers were identical. Such information should be seriously considered, because the distribution of these diseases by gender will help in the composition of the situation of children in Curitiba Metropolitan Region’s public health actions. The literature shows that the proportion of air pollution X public health presents a high degree of social differentiation. Therefore, groups of poor people are the most vulnerable in situations of exposure to air pollutants. In the town of Araucaria (CMR), the investigation by Souza (2006) showed that in areas classified as low quality of life due to the socio-economic parameters, it was found the highest rates of respiratory illnesses, even in conditions classified IQA as good. In Curitiba, the air quality data for the period under review is to highlight the preponderance of cases of good air quality.
(Figure 1) rather than the one classified as normal (Figure 2). Apparently, this situation would put the city of Curitiba in a very comfortable situation considering the air quality issues, even more that the data showed very few days over inadequate air quality classification (Figure 3). In fact, the situation is not as it seems, at first because of the results presented by BAKONYI et al (2003) mentioned above, including those by Souza (op. cit). And secondly, because it is recorded to regulate the rate of damage to health-risk groups, especially children and the elderly. Whereas there is still a need to revise the levels of pollution indicators discussed above, perhaps the real classification of air quality in Curitiba will be part of the classes of further deterioration of the health of its residents. For the IQA's 40 months data period considered, it was observed that for each 1.8 days with Well Index, there is 1 day with Regular Index. Considering also the total number of days, to each 58 days there is 1 day with Inadequate air quality. This simple accounting, however, doesn’t express the distribution of the Regular days, that reflect a continuous action of contaminants on health. Figure 2 shows the wide variety of days distribution considered as Regular throughout the months.

<table>
<thead>
<tr>
<th>Variables</th>
<th>NO₂</th>
<th>O₃</th>
<th>Temperature</th>
<th>Humidity</th>
<th>Respiratory Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM</td>
<td>0.53*</td>
<td>0.23*</td>
<td>-0.35*</td>
<td>-0.36*</td>
<td>0.29*</td>
</tr>
<tr>
<td>Smoke</td>
<td>0.46*</td>
<td>0.20*</td>
<td>-0.17*</td>
<td>-0.08*</td>
<td>0.22*</td>
</tr>
<tr>
<td>NO₂</td>
<td>1.00</td>
<td>0.17*</td>
<td>-0.30*</td>
<td>-0.28*</td>
<td>0.30*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

* Statistically significant correlation (p <0.05).

The urban atmospheric pollutants situations are well known in the literature. In Curitiba, in a study conducted by Danni-Oliveira et al (2002), showed the effect of rainfall, humidity and wind conditions in the air pollution dispersion. Similarly, the days variability distribution with Regular IQA were related to the determinants of the weather types rhythm in the winter time, more likely due air stability situations, and also to the lowest air moisture action, keeping the pollutants in air. In the fall, especially in the month of May, it is not uncommon there be many days under Regular air conditions (43 days) - Figures 2 and 3 - commonly associated with relative high temperature in this period. The months that are higher frequency of days with air quality regulation and inadequate are June (37 days), July (83 days) and August (69 days).

CONCLUDING REMARKS

This paper presents an analysis of the Air Quality Index - IQA surveys results conducted in Curitiba and Metropolitan Region and the occurrence of respiratory disease in its residents, and the frequency and distribution in recent IQA forty months recorded in the central area of the city. The results clear presented that severe respiratory diseases caused by the air pollutants are affecting children and elderly residents of Curitiba and Araucaria. These public health issues are occurring even in conditions where the air is considered good, according to the parameters used as indicators of air quality (IQA). In fact, by the IQA Model used at Curitiba, the days classified as Good are in considerable number, as the proportion is for each day with Regular IQA, there are 1.8 days with a Good standard. It is urgent, therefore, the environmental research institutes review and modify the air pollution indexes in CONAMA Resolution 03/90, which determines the air quality in Brazilian cities, as a result of existing new urban settings.
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