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ORIGINAL ARTICLE

Impact of air pollution in paediatric consultations in Primary Health Care: Ecological study☆

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Abstract
Objective: To study the correlation between the levels of environmental pollutants and the number of paediatric consultations related to respiratory disease in Primary Health Care.
Patients and methods: An ecological study is performed, in which the dependent variable analysed was the number of paediatric consultations in an urban Primary Health Care centre in Madrid over a 3 year period (2013–2015), and specifically the consultations related to bronchiolitis, recurrent bronchospasm, and upper respiratory diseases. The independent variables analysed were the levels of environmental pollutants. Coefficients of correlation and multiple lineal regressions were calculated. An analysis has been carried out comparing the average of paediatric consultations when the levels of nitrogen dioxide (NO_2) were higher and lower than 40 $\mu g/m^3$.
Results: During the period of the study, there were a total of 52,322 paediatric consultations in the health centre, of which 6,473 (12.37%) were related to respiratory diseases. A positive correlation was found between SO_2, CO, NO_x and NO_2 and benzene levels and paediatric consultations related to respiratory diseases, and a negative correlation with temperature. The number of consultations was significantly higher when NO_2 levels exceeded 40 $\mu g/m^3$. In the multiple lineal regression ($P = .0001$), the correlation was only positive between consultations and NO_2 levels (3.630, 95% CI: 0.691–6.570), and negative with temperature (−5.957, 95% CI: −8.665 to −3.248).
Conclusions: NO_2 environmental pollution is related to an increase in respiratory diseases in children. Paediatricians should contribute to promote an improvement in urban air quality as a significant preventive measure.

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PALABRAS CLAVE
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Impacto de la contaminación ambiental en las consultas pediátricas de Atención Primaria: estudio ecológico

Resumen
Objetivo: Estudiar la relación existente entre los niveles de contaminantes ambientales y la demanda por enfermedad respiratoria en las consultas pediátricas de Atención Primaria.
Pacientes y métodos: Estudio ecológico en el que la variable dependiente analizada ha sido la demanda en las consultas pediátricas de un centro de salud urbano de Madrid durante 3 años (2013-2015) por bronquiolitis, episodios de broncoespasmo y procesos respiratorios de vías altas. Como variables independientes se estudiaron los valores de contaminación ambiental. Se calcularon coeficientes de correlación y regresión lineal múltiple. Se comparó el promedio de consultas cuando los valores de dióxido de nitrógeno (NO_2) eran superiores e inferiores a 40 $\mu g/m^3$.
Resultados: Durante el periodo de tiempo estudiado hubo un total de 52.322 consultas pediátricas en el centro de salud, de las cuales 6.473 (12,37%) lo fueron por procesos respiratorios. Se encontró correlación positiva entre los niveles de SO_2, CO, NO_2, NOx, benceno y el número de consultas por procesos respiratorios y negativa con la temperatura y el O_3. El número de consultas por enfermedad respiratoria fue significativamente mayor cuando los niveles de NO_2 superaban los 40 $\mu g/m^3$. En la regresión lineal múltiple ($p < 0,0001$) solo se mantuvo la relación positiva de las consultas con los niveles de NO_2 (3,630; IC 95%: 0,691-6,570) y negativa con la temperatura (−5,957; IC 95%: −8,665 a −3,248).
Conclusiones: La contaminación ambiental por NO_2 está relacionada con el aumento de la enfermedad respiratoria en la infancia. Los pediatras deberíamos contribuir a propiciar la mejora de la calidad del aire como una importante medida preventiva.

Introduction

The World Health Organization (WHO) has been warning for years of the deleterious effects of environmental pollution on human health.[1] Global climate change is an indisputable fact, and human activity (industrial, commercial, residential, etc.) is a significant contributor to this change.[2] International organisations such as the European Environment Agency disseminate data periodically and warn that southern Europe will be one of the regions that will be most affected by the consequences of climate change.[3] Environmental factors and weather are determinants of the health of living organisms,[4–6] so it is exceedingly worrisome that seasons that used to be cold are now warm, that air quality regulations are often overlooked,[7,8] that a high percentage of vehicles in circulation are highly polluting and, ultimately, that pollution in cities has become the subject of press and broadcast news headlines.[9]

The paediatric population is particularly vulnerable to environmental conditions[10] due to social factors, as children spend long periods of time outdoors and are thus significantly exposed to pollution. Furthermore, they have distinct anatomical and physiological characteristics, and poorly developed defence mechanisms. More specifically, their respiratory tract and immune system are immature, the calibre of their airways is smaller and their respiratory rate greater compared to adults, so they inhale larger volumes of air per kilogram of body weight, all of which amplifies the effects of pollutants in their bodies and overwhelms their capacity to neutralise and eliminate these environmental pollutants. Despite the importance of this issue, few studies have analysed the impact on children's health[11] of exposure to high levels of pollutants, such as particulate matter smaller than 2.5 microns ($PM_{2.5}$) and 10 microns (PM_{10}), nitrogen dioxide (NO_2), nitric oxide (NO), ozone (O_3), carbon monoxide (CO), sulphur dioxide (SO_2), hydrocarbons such as benzene or nonmethane hydrocarbons (NMHCs).[12]

Considering the importance of air quality in our health and the considerable economic burden of the care provided for pollution-related diseases, we aimed to analyse the impact of environmental pollution in the number of paediatric primary care (PC) visits due to upper respiratory tract infections, bronchospasm and bronchiolitis.

Patients and methods

We conducted an ecological study in which we analysed data obtained from the software applications Seguimiento de Objetivos de Atención Primaria (Primary Care Objectives Followup [e-SOAP]) and Consult@web. These applications are available in the digital network available to PC professionals in the Community of Madrid and allow access to patient health records. The indicators we consulted through e-SOAP provided us with information regarding the population served and health care delivery, that is, the monthly number of visits and number of patient consultations per