

European Directives for Air Quality Analysis of the new limits in comparison with asthmatic symptoms in children

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Objectives

To analyse the air quality in Oporto Metropolitan Area (Oporto-MA) according to the previous legislation yet in application, as well as according to the new European Directives, aiming to evaluate i) if risks associated to SO₂ and particles are considered differently by the two analysed legislations; and ii) if the delay on the application of the EU Directives is associated to health risks. Special attention was given to the necessity of reducing pollutant concentrations, mainly of those that were more drastically reduced in European Directives (SO₂ and particles). The incidence of asthmatic symptoms in children was selected as indicator.

Method

Selected sites for air quality monitoring

Site I (S_I) is situated about 5 km far from the coastline, in an open area of a suburban industrial zone of Oporto city. It is situated on the west relative to the refinery and petrochemical plants, being influenced mainly by their atmospheric emissions as well as by other industrial emissions transported by prevailing winds from W and NW.

Site II (S_{II}) is located 6 km far from the coastline in a suburban rural area. This site is not significantly influenced by traffic, urban and industrial emissions in a direct way, being considered with background behaviour for atmospheric pollution in Oporto-MA.

Site III (S_{III}) is located in a reference area, clearly rural, without significant influences of anthropogenic emissions of atmospheric pollutants.

Analysis of asthmatic symptoms and asthma rates in children living in the area of the selected sites

Written questionnaires similar to those used for ISAAC were completed by the child parents or tutors. The children were studying on primary or secondary schools where the monitoring sites were installed (S_{II} and S_{III}) or at 300 m of the monitoring place (S_I).

Asthmatic children were identified if dyspnea and wheezing was referred in the absence of upper respiratory infections; this first asthma identification was confirmed through tests of bronchic reactivity with methacoline.

Three groups were considered: **children without asthmatic symptoms**, with **asthmatic symptoms** and **with asthma**.

A random sample of 720 children aged 6 to 11 years was analyzed.

Results

Exceedances relative to the previous legislation and to the new European Directives (1999 - 2001)

Legislation	Limits (µg ^m ⁻³)	S _I	S _{II}		
Previous	SO ₂ All	No	No		
	Particles (total) All	No	No		
European	Hourly: 350 ⁽¹⁾	No	No		
	Daily: 125 ⁽²⁾	Yes	No		
Directives	Daily: 50	1 st phase (2005) ⁽³⁾	Yes	Yes	
	Particles (PM ₁₀)	40	2 nd phase (2010) ⁽⁴⁾	Yes	Yes
		Annual: 40	1 st phase (2005)	Yes	Yes
	20	2 nd phase (2010)	Yes	Yes	

- (1) Not to be exceeded more than 24 times a year
(2) Not to be exceeded more than 3 times a year
(3) Not to be exceeded more than 35 times a year
(4) Not to be exceeded more than 7 times a year

Rates of asthmatic symptoms and asthma in children

	S _I	S _{II}	S _{III}	
Sample size	300	156	264	
Age	10-12	6-10	6-10	
Sex	Female (%)	60.2	59.5	51.2
	Male (%)	39.8	40.5	48.8
Asthmatic symptoms (%)	36.8	20.4	3.5	
Asthma (%)	10.3	6.1	1.2	

Considering the 95% confidence level, all the rates in Table 2 are significantly different, with the exception of asthma rates for S_I and S_{III} that, according to the sample size of asthmatic children, are not significantly different.

Conclusions

It was concluded that all kind of limits of the previous legislation were obeyed, either for SO₂ or particles. Nevertheless, the limits settled by EU were exceeded both for SO₂ and PM₁₀ revealing that even suburban areas have a background concentration of particles that does not guarantee the protection of public health, against to the conclusions obtained through the analysis of the previous legislation. Therefore, it can be concluded that the previous legislation and the EU Directives lead to completely different conclusions about the obedience to limits for the protection of public health.

The results showed that the EU limit for PM₁₀ was not obeyed even at the reference site, which suggests that it is exaggeratedly low, being expectable a lot of difficulties for implementing its obedience. Accordingly, effects on asthmatic symptoms and asthma were not observed at the reference site even when the limits were not obeyed. The pollen effect in spring and the traditional viral respiratory infectious of winter were more important than the PM₁₀ concentrations, if they belong to the range of the restrictive limits settled by EU Directives, or if they even are slightly higher.

The results showed that SO₂ can influence the rate of asthmatic symptoms, but PM₁₀ can influence also the rate of asthma confirmed through the methacoline tests. The background concentration of PM₁₀ in Oporto-MA can influence the worsening of asthma in children not guarantying the protection of public health.

Studies involving much more schools should be carried out to increase the sample sizes, aiming to confirm some of the conclusion obtained. Nevertheless, it could be concluded that the risks associated to SO₂ and particles are considered differently by the two analysed legislations, which means that the delay on the application of the much more restrictive EU Directives can be associated to health risks. In spite of the exaggeratedly low EU limit for particles, according to the effects observed on asthmatic symptoms and asthma in children, the concentrations of SO₂ and particles allowed in the previous legislation must be reduced to protect the public health.