HEALTH IMPACT ASSESSMENT OF AIR POLLUTION

ENHIS-1 PROJECT: WP5 HEALTH IMPACT ASSESSMENT

LOCAL CITY REPORT

Madrid

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Table of contents

Index

Summary of main findings for Madrid 3
Summary of HIA of outdoor air pollution in Madrid in ENHIS-1 4
Introduction 5
Sources of air pollution 6
Exposure data 7
Health data 9
Health Impact Assessment 10
Methodology 10
HIA scenarios 11
Findings 12
Discussion 13
Conclusion 13
References 14

Summary of main findings for Madrid

In 2002 the PM_{10} annual mean (SD) was 33,3 (14,0) µg/m^3, above the 1999/30/EC Directive limit value for 2010 (20 µg/m^3), and below that established for 2005 (40 µg/m^3). For the summer period of the same year, the mean (SD), P5 (5th percentile) and P95 of the maximum daily 8-hour moving average concentration of ozone (O_3) were 70,1 (15,9), 46,1 and 97,2 µg/m^3.

Regarding children, infant mortality in Europe is quite low and consequently, the expected attributable number of deaths related to air pollution is also very low. All other things being equal, the reduction of the annual average levels of PM_{10} to 20 µg/m^3 would prevent 3,3 total postneonatal deaths. If PM_{10} daily mean values were reduced to 20 µg/m^3 151,46 hospital respiratory admissions would be avoided.

As far as short-term effects of O_3 in summer are concerned, all other things being equal, each reduction by 10 µg/m^3 of the daily maximum 8-hour moving average concentrations would delay 39,54 deaths per year in the general population in the study area, 18,83 from cardiovascular diseases, and 18,94 from respiratory causes. In terms of hospital admissions, this would represent 6,78 respiratory admissions in the adult population and 61,00 in the population over 64 years.

Summary of HIA of outdoor air pollution in Madrid in ENHIS-1								
Health outcome	**Population**	**Pollutant**	**Period**	**Mean type**	**RR (for 10 µg/m^3 increase)**	*References*	**Number of attributable cases by scenario**[1]	
Mortality							**Ozone: Reduction by 10 µg.m^3**	**PM_{10}: Reduction by 5 µg/m^3**
Total mortality excluding external causes (ICD9 < 800 - ICD10 A00-R99)	All ages	O_3 8h max	Summer[2]	Daily	1.0031 (1.0017-1.0052)	Gryparis et al 2004	39.54 (21.68-66.32)	
Cardiovascular mortality (ICD9 390-459 - ICD10 I00-I99)					1.0046 (1.0022-0.0073)		18.83 (9.01-29.89)	
Respiratory mortality (ICD9 460-519 - ICD10 J00-J99)					1.0113 (1.0074-1.0151)		18.94 (12.40-25.31)	
Total postneonatal mortality	< 1 year	Corrected PM_{10}[3]	Year	Annual	1.048 (1.022-1.075)	Lacasaña et al 2005		1,27 (0.59-1.97)
Morbidity								
Hospital respiratory admissions (ICD9 460-519 - ICD10 J00-J99)	< 15 years	Measured PM_{10}	Year	Daily	1.010 (0.998-1.021)	Anderson et al 2004		52.48 (-10.53-109.91)
Hospital respiratory admissions (ICD9 460-519 - ICD10 J00-J99)	15 - 64 years	O_3 8h max	Summer		1.001 (0.991-1.012)		6.78 (-61.03-81.38)	
Hospital respiratory admissions (ICD9 460-519 - ICD10 J00-J99)	> 64 years				1.005 (0.998-1.012)		61.0 (-24.40-146.39)	

[1] For ozone: absolute reduction by 10 µg/m^3. For PM_{10} absolute reduction by 5 µg/m^3.

[2] Definition of summer period: 01 April – 30 September.

[3] PM_{10} reference papers for HIA on postneonatal mortality use gravimetric methods to measure PM_{10}. The Madrid air quality network uses automatic method (ß-attenuation method) and the local correction factor to compensate for loss of volatile compounds: is 1[1].

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[1] Estudio y evaluación de la contaminación atmosférica por material particulado en España. Intercomparación de equipos automáticos de medida de PM_{10} con el método de referencia en España. Instituto de Ciencias de la Tierra, CSIC, CIEMAT, CEAM, Instituto de Salud Carlos III. Julio, 2002

Introduction

- The city of Madrid is located on a plateau 600 meters above sea level between the Central Mountain System and the Toledo Mountains, in the centre of the Madrid Region.

Although its area is only 7.5% of the total area of the region, 57% of the population lives in the city. The Community of Madrid occupies the second place in gross internal product, with productivity mainly centered in the services sector. A 74.7% of the population works on services, 14.9% in the industry, 9.4% in construction and 0.8% in agriculture.

In 2001, the population has increased in around 165.000 persons since 1998, and presently amounts to 2.957.058 inhabitants. The population continues ageing. The proportion of the population older than 65 years has increased since 1998 from 17.8% to 19.1% in the year 2001.

In 2002, the annual daily mean for maximum temperatures was 21.2ºC, ranging from 6.4ºC in the Mars to 38.8ºC in June. The annual daily mean for minimum temperatures was 7.9ºC, ranging from -3.8ºC in February to 21.0ºC in June. The annual mean relative humidity was 60%.

- Air pollutants levels in Madrid City are within that established by current regulations. Most of them have reached minimum historical annual mean in 2002[2]. For PM_{10}, the downward trend of these levels in the previous years seems to be stabilized. Nevertheless, PM levels established by the E.C. Council Directive 1999/30 for the year 2010 have not yet been reached. In relation to O_3 level, presents and upward trend, although still remains bellow the limit values established by the European directives[2,3].

The City Council has launched an emissions reduction plan known as “Bases para un plan estratégico municipal 2003, para la reducción de las emisiones contaminantes a la atmósfera en el municipio de Madrid”[2,3].

The contemplated measures in this plan are focused mainly in air pollutants which can create problems to achieve the air quality standards. Some of these measures have already started in 2003. In general, the measures proposed in this plan are directed to following sectors:

- Buildings from the domestic and service sectors: the implementation of building measures, thermals, replacement of combustible…
- Industrial combustion and industrial processes
- Transport and combustibles distribution.
- Activities related to the use organic solvents
- Activities related to road transports
- Activities related to other vehicles and mobile machinery of municipal use
- Activities related to other ways of road transports: the rail network and the air traffic
- Activities related to agriculture, nature and green spaces

At the same time the Regional Environmental Ministry has recently published the “Plan Azul: Plan para la mejora de la Calidad del Aire en la Comunidad de Madrid”. The aim of this plan is

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[2] Libro Blanco de la Calidad del Aire en el Municipio de Madrid. Ayuntamiento de Madrid, 2003

[3] Ayuntamiento de Madrid. Área de Gobierno de Medio Ambiente y Servicio a la Ciudad. Dirección General de Calidad y Evaluación Ambiental. Sistema de Información Medioambiental. “El aire de Madrid. Memoria 2004”. Available in: http://www.mambiente.munimadrid.es

to improve air quality in all the Community of Madrid with actions on the short, medium and long term that will affect transportation, industry, housing and ecosystems[4].

- Cardiovascular diseases continue being the main cause of death in Madrid, and are responsible of a 31% of total mortality in the general population, followed by malignant tumors, that supposed a 29,2% of all the causes of death. Respiratory diseases and the diseases of the digestive system represent the 3rd and 4th causes of death in both sexes.

As regards children mortality, infant mortality rate in 2002 was 4,77 per 1000. All the components of infant mortality continue decreasing in the last years. The main cause of death in those below 1 year of age in both girls and boys are congenital malformations, followed by perinatal infections in boys and other congenital malformations in girls.

- The first health impact assessment (HIA) of air pollution on health in the city of Madrid was developed in the year 2002. This assessment was part of the Apheis project[5] and it was done for the year 1998 data.

- In the 3rd Apheis Madrid report, we brought up to date the HIA of air pollution in the city, referred to the year 2000. At the same time the number of health indicators to establish the impact was extended, including also years of life lost. The analysis estimated that reduction in the long-term of $PM_{2.5}$ levels to 15 µg/m^3, all other things being equal, would reduce mortality in Madrid by 562 deaths in one year, which would save 268.43 years of expected life for starting year of simulation. If the daily means of PM_{10} had been kept under 20 µg/m^3, in the short term 260 deaths and 538 hospital admissions could have been avoided in the year 2000.

- In this report, different scenarios were used to evaluate the effect of short and long-term exposure to particulate pollution and the short-term exposure to ozone

Also different tools and different estimates were used to evaluate the short and long-term impact of this particulate pollution on health (Tables 3,4).

For PM_{10}, short-term findings are expressed in terms of number of attributed hospital respiratory admissions per year in people under 15 years and long-term findings in terms of number of attributed postneonatal deaths per year.

For O_3, short-term findings are expressed in terms of:number of attributed deaths per year in general population.

- This work has been carried out within the framework of work package WP5 on health impact assessment of ENHIS-1 project (www.enhis.net).

Sources of air pollution

There is no heavy industrial activity affecting air quality. There is an important level of emission of air pollutants primarily due to the activity of the population. The transport constitutes the main source of air pollution, followed by that generated by heating boilers and, in a lower level, industry.

According to the results of the last mobility survey, developed by the Regional Transport Consortium (Consorcio Regional de Transportes) in 1996, there are 6.6 million mechanized travels in a standard day, 52.8% of them are done in public transport, and 47.2% in private vehicles. The total number of travels has increased by 20% from 1988 to 1996, while the population has increased only by 5% in the same period.

In Madrid traffic can be considered as one of the most harmful environmental factors for health[6].

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5 Health Impact Assesment of Air Pollution in 26 European Cities. Second year report 2000-2001.

6 "Informe sobre el Estado de Salud de la Población de la Comunidad de Madrid, 2003" Instituto de Salud Pública de la Comunidad de Madrid

Exposure data

The air quality network for the city of Madrid is managed by the Madrid City Council through the "Sistema Integral de Vigilancia, Predicción e Información de la Contaminación Atmosférica". In the year 2002, the network includes 25 monitoring stations which measure sulphur dioxide, PM_{10}, nitrogen dioxide, carbon monoxide, ozone, benzene, toluene, and also meteorological variables and noise levels.

In this report, year 2002, 21 stations were selected for PM_{10}. In respect to those used in Apheis3, we have included the data of 1 additional station and eliminated the data of 3 stations due the fact that they don't meet the established inclusion criteria. All of selected stations accomplished the criteria established for data completeness. All but one of them are traffic stations.

For measuring PM_{10}, the stations use ß-attenuation method. The correction factor, determined through a comparison study[7] between the automatic measurement method and the reference method, is 1.

For O_3 we selected 22 stations, all of them meet the criteria established for data completeness. The analytical method used is based in the ultraviolet absorption measurement method.

- The indicators have been calculated:

    - PM_{10}: daily exposure indicator has been calculated as the arithmetic mean of the daily concentrations of the stations.

    - Ozone: The daily maximum 1-hour indicator has been calculated as the arithmetic mean of the 1-hour maximum of the stations. The daily maximum 8-hour moving average of each day have been calculated as the arithmetic mean of the maximum 8-hour moving averages of the stations for the summer period (1st April to 30th September).

- The annual mean level (SD) of PM_{10} in Madrid was 33,3 (14,0) µg/m³, and P5 and P95 of the daily mean values were, respectively, 13,6 µg/m3 and 59,1 µg/m³. The mean (SD), P5 and P95 of the daily maximum 8-hour moving average concentrations of O_3 in summer were, respectively, 70,1 (15,9), 46,1 and 97,2 µg/m³, and those of the daily maximum 1-hour concentrations 60,7 (28,0), 17,8 and 105,6 µg/m³. (Table 1).

Table 1. Descriptive statistics for ozone and PM_{10} levels in Madrid 2002.

	O3 8h - summer	O3 1h max - year	PM10 - year
Number	183	365	365
Minimum	31	7	9
Percentile 5	46	18	14
Percentile 25	60	40	22
Median	70	58	32
Percentile 75	81	83	41
Percentile 95	97	106	59
Percentile 98	102	117	65
Maximum	115	136	78
Daily mean	70	61	33
standard error	16	28	14
% missing values	0,00%	0,00%	0,00%

- PM_{10} levels in Madrid during 2002:

Mean annual level is well below the limits established by 1999/EC Directive for 2005 (40 µg/m³). but still above that defined for 2010 (20 µg/m³)

[7] Estudio y evaluación de la contaminación atmosférica por material particulado en España. Intercomparación de equipos automáticos de medida de PM_{10} con el método de referencia en España. Instituto de Ciencias de la Tierra, CSIC, CIEMAT, CEAM, Instituto de Salud Carlos III. Julio, 2002

The 50 µg/m³ limit value for daily mean established in the European directive was exceeded 49 days above the 35 days permitted for 2005 and the 7 provided for 2010 (figure 3).

- O_3 levels:

The maximum daily eight hour mean has never exceeded the 120 µg/m³, limit established for protection of human health, which is a long term objective value defined by the 2002/3/CE Directive regarding environmental ozone (figure 1). Neither has it been exceeded in any moment the 180 µg/m^3 hourly mean which is the information level to population defined in the directive.(figure 2).

Fig 1. Distribution of daily O3 8h max in Madrid. Summer 2002

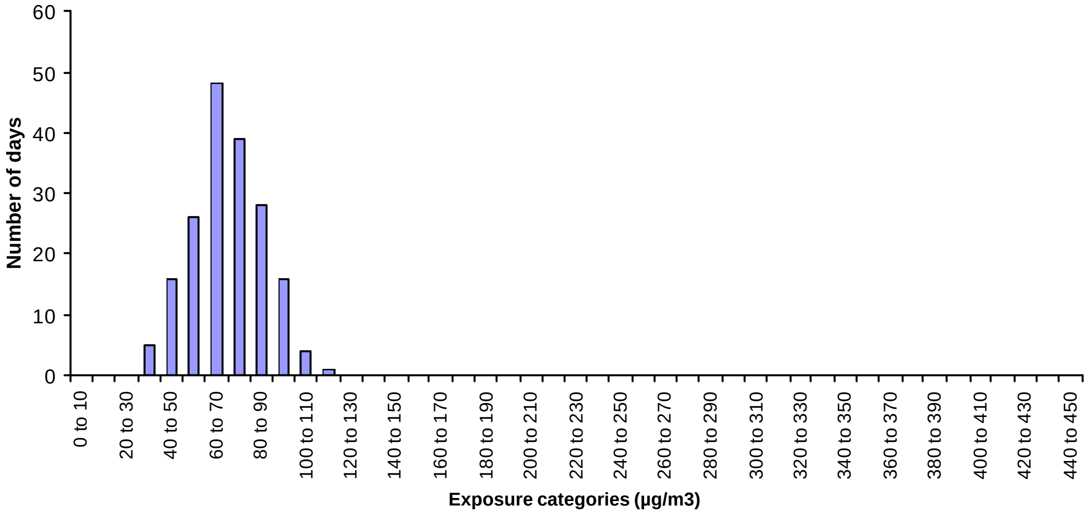


Fig 2. Distribution of daily O3 1h max in Madrid. Year 2002

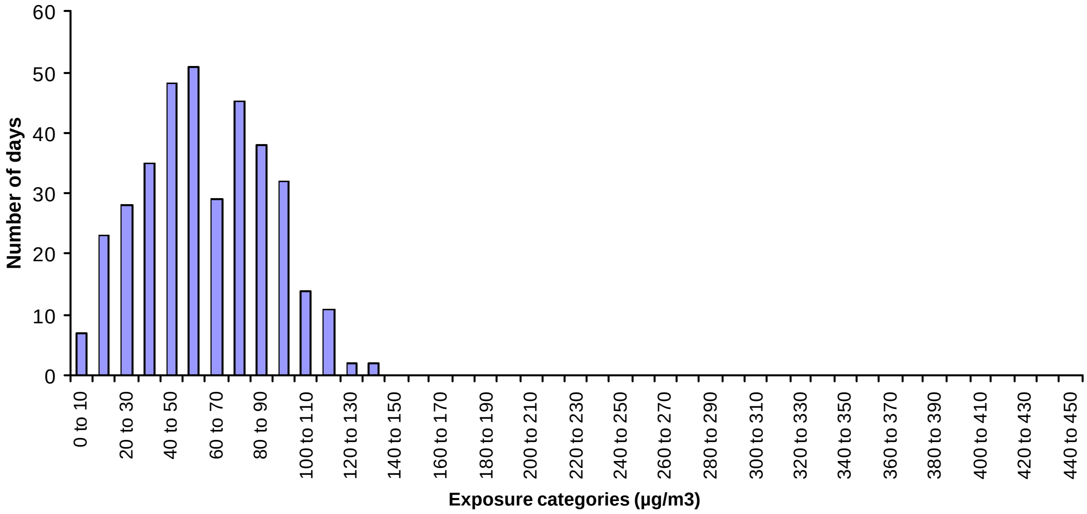
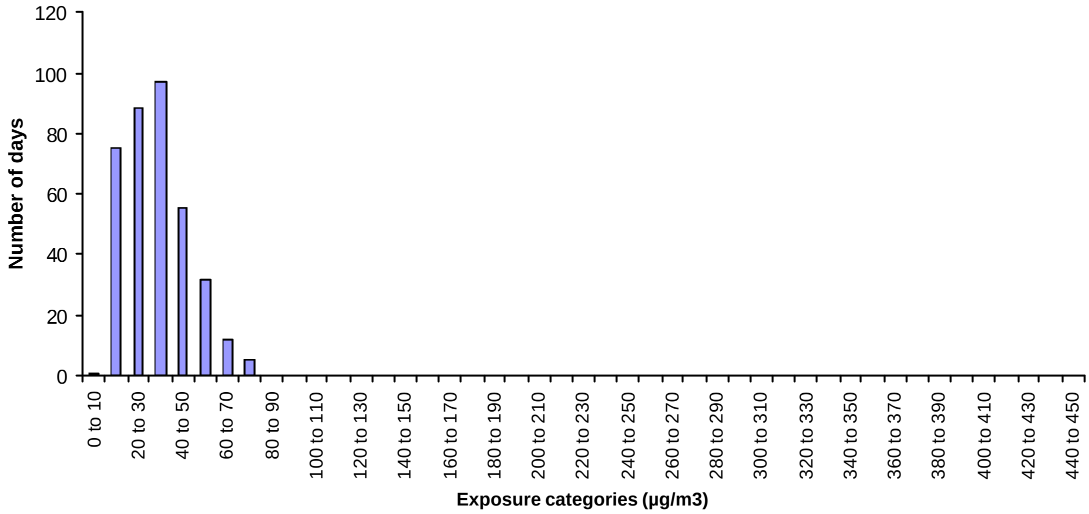


Fig 3. Distribution of daily PM 10 in Madrid. Year 2002



Health data

- We used the 2001 city census for the exposed population.

- The Mortality Register of the «Instituto de Estadística de la Comunidad de Madrid» provides the mortality data, coded using the International Causes of Diseases, ICD 10. The codification is automatic for 60% causes of death. Death registration is complete. The completeness of the data for the basic cause of death is 100%.

- Hospital admissions data used for current HIA have been obtained from a register, the «Conjunto Mínimo Básico de Datos al Alta Hospitalaria» (Hospital Discharge Minimum Standardized Data Set) for the year 2002. It includes all hospital admissions in the region. The data base is developed annually by the Consejería de Sanidad and it has to be completed compulsorily by all public and private hospitals in the region. The discharge causes are coded using the ICD9. Completeness is higher than 95%. The register follows a quality assessment programme.

- We did not include in the HIA post neonatal respiratory mortality and sudden infant deaths syndrome due to the lack of data. This has also been the case for asthma, cough and lower respiratory symptoms.

- The health outcomes analyzed for the Madrid HIA are shown in Table 2, in terms of number of cases and rates per 100 000.

- In 2002, the daily mean number of deaths was 71. The standardized mortality rate of Madrid using the European population (both sexes combined) for year 2000[8] is 629,08 per 100 000 inhabitants.

- The annual rate for respiratory emergency hospital admissions (ICD9: 460-519) ranges between 402,7 per 100000 in the population between 15 and 64 years and 3730,6 in the population older than 64.

[8] UNITED NATIONS. Population Division Department of Economic and Social Affairs. World Population Prospects: The 2000 Revision.

Table 2. Descriptive statistics for health outcomes in Madrid 2002

Health outcome	ICD9	ICD10	Annual deaths	Annual rate (per 100 000)	Daily mean (SD)	Daily rate (per 100 000)	Annual incidence rate (per 100 000)
POSTNEONATAL MORTALITY							
Total			54	190.2			
GENERAL POPULATION MORTALITY							
Total mortality all causes	<800	A00-R99			71 (12.6)	2,4	
Cardiovascular mortality	390-459	I00-I99			23 (5.8)	0,8	
Respiratory mortality	460-519	J00-J99			9,8 (4.4)	0,3	
MORBIDITY							
Hospital respiratory admissions - Age < 15 years	460-519	J00-J99					2109,3
Hospital respiratory admissions - Age 15 -64 years	460-519	J00-J99					402,7
Hospital respiratory admissions - Age > 64 years	460-519	J00-J99					3730,6

Health Impact Assessment

Methodology

Health impact of air pollution (AP) has been calculated as the annual number of health events attributable to AP in the target population. A causal relationship between AP and the effects is assumed, and therefore HIA can only be performed for those outcomes with sufficient evidence of causality. Once the effects with sufficient evidence of causal relationship with AP have been determined, the next step is to find the best exposure-response functions (ERFs) for each of the selected outcomes. Table 3 shows the result of a systematic review on these issues carried out by the Bilbao Apheis team[9] for WP5 of ENHIS-1. This table summarizes the health outcomes and ERFs deemed suitable for HIA according to the criteria established by WP5 with the advice of the air pollution experts of WP5[10].

Table 3. Health outcomes and Exposure-response functions (ERFs) selected for health impact assessment

	OUTCOME	POLLUTANT	ERFs	ORIGINAL SOURCE
CHILDREN - PARTICLES				
	Total postneonatal mortality (1 month-1 year)	PM_{10} Annual Mean	RR=1.048 (1.022-1.075) ?10µg/m³	Lacasaña et al 2005
ADULTS/GENERAL POPULATION				
	Total mortality all causes ICD9 <800 ICD10 A00-R99	Ozone Maximum 8 h Summer	RR= 1.0031 (1.0017-1.0052) ?10µg/m³	Gryparis et al 2004 (APHEA 2)
	Respiratory mortality ICD9 460-519 ICD10 J00-J99	Ozone Maximum 8 h Summer	RR= 1.0113 (1.0074-1.0151) ?10µg/m³	Gryparis et al 2004 (APHEA 2)
	Cardiovascular mortality ICD9 390-459 ICD10 I00-I99	Ozone Maximum 8 h Summer	RR= 1.0046 (1.0022-1.0073) ?10µg/m³	Gryparis et al 2004 (APHEA 2)

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9 Cambra K, Alonso E, Cirarda FB, Martínez-Rueda T. Bilbao APHEIS group. Selection of outcomes and exposure response functions for health impact assessment of particles and ozone. Review of the evidence. ENHIS project. WORK PACKAGE 5. Bilbao, February 2005. Http:

10 Ferran Ballester: Valencian School of Health Studies, Valencia, Spain; Sylvie Cassadou: National Institute of Public Health Surveillance, InVS, Toulouse, France; Fintan Hurley: Institute of Occupational Medicine, Edinburgh, Scotland, UK; Nino Künzli: University of Southern California, Division of Occupational and Environmental Health, Los Angeles, CA, USA; Odile Meckel: Institute of Public Health NRW (LOEGD), Bielfeld, Germany; Hans-Guido Mücke: WHO Collaborating Center (Air)-Federal Environmental Agency, Berlin, Germany; Nikolaos Stilianakis: Institute for Environment and Sustainability, European Commission – JRC, Ispra, Italy.

To be coherent with mortality findings, it was decided, with the experts' advice, to include RRs of hospital admissions in the health impact assessment calculations, even if they were not statistically significant. More concretely, it was decided that if there was not any new RR published by the time of making the calculations, the RRs for respiratory hospital admissions from Anderson's meta-analysis could be used, although they were not statistically significant (see Table 4). The rationale for that is that if there is sufficient evidence to accept a causal relationship between air pollution and respiratory mortality -both in children-PM and adults-O_3- we should easily accept that there will also be an impact on hospital admissions.

Table 4. Complementary Exposure-response functions (ERFs) for health impact assesment on respiratory hospital admissions for children (particles) and adults (ozone)

	OUTCOME	POLLUTANT	RR	SOURCE
CHILDREN - PARTICLES				
	Respiratory hospital admissions 0-14 Y ICD9 460-519 ICD10 J00-J99	*PM_{10}* Daily Mean	*RR= 1.010 (0.998-1.021) ?10µg/m^3*	*Anderson 2004*
ADULTS/GENERAL POPULATION				
	Hospital respiratory admissions 15-64 Y ICD9 460-519 ICD10 J00-J99	*Ozone Maximum 8 h*	*RR=1.001 (0.991-1.012) ?10µg/m^3*	*Anderson et al 2004*
	Hospital respiratory admissions >64 Y ICD9 460-519 ICD10 J00-J99	*Ozone Maximum 8 h*	*RR=1.005 (0.998-1.012) ?10µg/m^3*	*Anderson et al 2004*

Finally, HIA needs defining the evaluation scenarios, i.e. the hypothetical scenario with which we want to compare the current air pollution situation. We calculate the impact on health of the (current) air pollution levels in the city that are above the pollution level of the evaluation scenario. In other words, the attributable number of health events (deaths, hospital admissions…) calculated for each scenario represents the number of events that would be prevented if, all other things being equal, air pollution levels were reduced to the evaluation scenario level. These evaluation scenarios are based on the objectives and limits established in 1999/30/CE, and 2002/3/CE Directives.

HIA scenarios

- To evaluate the effect of short and long-term exposure to particulate pollution and the short-term exposure to ozone we have used different scenarios:

1 - HIA scenarios for PM_{10}

1.1.- Scenarios for HIA on **short-term** effects of PM_{10} and **hospital respiratory admissions** in people under 15 year (< 15)

1.1.1 Reduction of PM_{10} levels to a 24-hour value of **50 µg/m^3** in all days exceeding this value (Limit of 1999/30/CE Directive)

1.1.2. Reduction of PM_{10} levels to a 24-hour value of **20 µg/m^3** in all days exceeding this value

1.1.3 Reduction **by 5 µg/m^3** of all the 24-hour values

1.2.- Scenarios for HIA on **long-term** effects of PM_{10} and **postneonatal mortality total**

1.2.1 Reduction of the annual mean value of PM_{10} to a level of **40 µg/m^3** (Limit of 1999/30/CE Directive for 2005)

1.2.2 Reduction of the annual mean value of PM_{10} to a level of **20 µg/m^3** (Limit of 1999/30/CE Directive for 2010)

1.2.3 Reduction **by 5 µg/m^3** of the annual mean value of PM_{10}

2.- HIA scenarios on short-term effects of Ozone

2.1 Daily maximum 8-hour moving average concentration and **mortality** in general population

2.1.1 Reduction of O_3 daily maximum 8-hour moving average concentrations to **120 µg/m^3** in all days exceeding this value (Limit for health protection of 2002/3/CE Directive)

2.1.2 Reduction **by 10 µg/m^3** in the daily maximum 8-hour moving average concentrations.

Findings

The annual number of postneonatal deaths attributable to PM_{10} levels higher than 20 ?g/m^3 was 3,30 (95%CI: 1,51 – 5,18), which is equivalent to an annual rate of 11,87 deaths per 100 000 (95%CI: 5,43 – 18,64).

if the annual mean of PM_{10} was reduced by 5 µg/m³, all other things being equal, the number of postneonatal deaths will be reduced in 1,3 deaths (Table 5).

Table 5. Potential benefits of reducing PM_{10} levels. Absolute numbers and rates (per 100 000 children) (95% confidence limits) attributable to the health effects of PM_{10}.

	PM10 reduction	**Number of attributable cases per year**	**Annual rates (per 100.000)**
POSTNEONATAL MORTALITY	**Annual mean levels**		
Total	by 5 µg/m^3	1,27 (0,59-1,97)	4.59 (2.12-7.09)
	to 20 µg/m^3	3,30 (1,51-5,18)	11.87 (5.43-18.64)
	to 40 µg/m^3	NA	NA
MORBIDITY	**Daily levels**		
Hospital respiratory admissions <15 y	by 5 µg/m^3	37,2 (-7,5-77,8)	10,2 (-2,1-21,4)
	to 20 µg/m^3	107,3 (-21,2-227,3)	29,3 8-5,8-62,4)
	to 50 µg/m^3	9,0 (-1,8-19,0)	2,5 (-0,5-5,5)

NA: Not applicable (air pollution levels are lower than the scenario level)

Regarding short-term effects of O_3, each reduction by 10 µg/m^3 of daily maximum 8-hour moving average concentrations would delay 39,54 (95%CI: 21,68 – 66,30) deaths per year in the study area, 18,83 (95%CI: 9,01 – 29,89) from cardiovascular diseases, and 18,94 (95%CI: 12,40 – 25,31) from respiratory causes. As can be seen O_3 attributable health effects, both in cardiovascular mortality and respiratory mortality are approximately equal.

Table 6. Potential benefits of reducing ozone daily levels. Absolute numbers and rates (per 100 000 inhabitants) (95% confidence limits) attributable to the health effects of ozone.

	OZONE reduction	**Number of attributable cases per year**	**Annual rates (per 100.000)**
MORTALITY	**Daily 8-h max**		
Total excluding external causes	by 10 µg/m^3	39,54 (21,68- 66,32)	1,34 (0,73-2,24)
	to 120 µg/m^3	NA	NA
Cardiovascular	by 10 µg/m^3	18,83 (9,01- 29,89)	0,64 (0,30-1,01)
	to 120 µg/m^3	NA	NA
Respiratory	by 10 µg/m^3	18,94 (12,40- 25,31)	0,64 (0,42-0,86)
	to 120 µg/m^3	NA	NA
MORBIDITY	**Daily 8-h max**		
Hospital respiratory admissions 15-64 y	by 10 µg/m^3	4,1 (-36,7-48,9)	0,2 (-1,8-2,4)
	to 120 µg/m^3	NA	NA
Hospital respiratory admissions > 64 y	by 10 µg/m^3	51,3 (-20,5-123,2)	9,1 (-3,6-21,8)
	to 120 µg/m^3	NA	NA

NA: Not applicable (air pollution levels are lower than the scenario level)

Discussion

The results of this HIA complete those of previous HIA carried out under the Apheis Project, and back the perception that reduction of concentrations of atmospheric pollutants such is O_3 and particulate matter can bring health benefits even with the moderate levels registered in the city of Madrid. presented in this report complete those obtained in previous HIA of PM_{10} in the city of Madrid under the Apheis Project. It gives emphasis to the perception that a reduction in the actual levels of air pollutants such us O_3 and particulate matter, can result in public health benefits even at the moderate levels registered in the city of Madrid.

O_3 concentrations meet the limit values established for 2005 and the long term objectives defined in the 200/3 CE Directive. Regarding particulate matter, with 2002 concentrations, limit values for 2005 and 2010 established in the European regulations would not be meet.

In order to be coherent with the rest of the participating cities, and following experts advice, we have included the HIA for short term effects in morbidity of O_3 and particulate matter in spite of the fact that the RRs used to calculate those effects are not statically significant. Thus, the results must be considered only an approximation to the health effects of those pollutants as long as statically significant RRs are not available.

This study brings forward information about HIA regarding particulate matter and Ozone in the city of Madrid, but as regional managers we relieve that it World be interesting to extend the HIA to the rest of the territory of the Community of Madrid.

As previously mentioned, both the City council and the Regional Government are implementing plans to improve the air quality of the City and the Community of Madrid.

Conclusion

The mortality impact of O_3 concentrations is less than that found in Aphiis for PM_{10} but it is not insignificant.

HIA is an important tool in the development of environmental policy and its application is needed to quantify the heath impact of other environmental hazards.

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