Air pollution and hospitalisations for first myocardial infarction (MI) in the HEAPSS* cohort

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AIRNET
A Thematic Network on Air Pollution and Health

NERAM
Network for Environmental Risk Assessment and Management

* **HEAPSS: Health Effects of Air Pollution on Susceptible Subpopulations**

Aims

HEAPSS study aims to determine whether air pollution increases the risk of first acute myocardial infarction (MI) in general population, or the subsequent risk of cardiac events among patients who have survived their first MI. Of particular interest in the study are effects of ultrafine particles (particles <0.01 μm).

The associations between 1. MI and air pollution will be reported here.

Methods

HEAPSS cohort consists of patients hopitalised for their first acute MI during city-specific enrolment periods within the years 1992-2000 in 5 European cities. Patients were recruited either from hospital admission registries (Helsinki, Stockholm, Rome) or from MI registries (Augsburg, Barcelona). The two types of registries have different upper age limits (table 1).

Air pollution data was collected from existing networks of fixed outdoor monitors. Ultrafine particles were measured for almost two years in all cities using condensation particle counters (CPC). Daily concentration of ultrafine particles was estimated for the entire study period using measurements of gaseous air pollutants, particles, and meteorology.

Statistical analyses were accomplished using Poisson regression adjusted for the effects of meteorology on MI.

Results

There were almost 27 000 cases of acute myocardial infarction during the patient enrolment period (table 1). The bulk of the MI cases were found in the study centres where hospital admission records were utilized. Thus, results of these centers drive the pooled results.

Daily air pollution levels were higher in southern European cities than in the northern cities. Highest CO levels were found in Rome, and highest SO2 levels in Barcelona (table 1).

City-specific correlation coefficients between measured and estimated ultrafine particles concentrations ranged from 0.88 to 0.91.

Correlation coefficients (Barcelona not yet available) between ultrafine particles and CO ranged from 0.48 to 0.83, and between ultrafine particles and PM10 from 0.06 to 0.53 (PM10, particles <10 μm; in Augsburg PM10 estimated using other variables).

Increase of 10 000 ultrafine particles/cm^3 was associated with 1.1 % increase in the risk of 1. MI (table 2). Increase of 1 mg/m^3 carbon monoxide was associated with 2.8% increased risk of MI. PM10 or SO2 were not consistently associated with the incidence of MI, nor were O_3 or NO_2 (data not shown).

Table 1. Number of hospitalised first myocardial infarction cases, and daily air pollution levels (median)

	Augsburg	Barcelona	Helsinki	Rome	Stockholm
Hospitalized cases	1694	1467	5148	8799	9555
% men	75	78	52	67	58
Age limits	35-74	35-79	35-	35-	35-
Air pollution					
Ultrafine particles [1]	12400	-	13600	46000	11800
PM_{10} (μg/m^3)	43.5 [1]	57.4 [1]	21.0	48.5	12.5
CO (mg/m^3)	0.9	0.9	0.4	2.3	0.4
SO_2 (μg/m^3)	4.6	11	3.3	4.6	2.9

[1] *Estimated using other variables*

Table 2. Associations between daily air pollution levels and incidence of first myocardial infarction. Pooled results of 5 cities (4 in ultrafine particles)

	Exposure	Rate ratio	Confidence limits
Ultrafine particles	**Current day**	**1.013**	**1.000-1.026**
	Previous day	1.001[1]	0.959-1.045
CO	**Current day**	**1.028**	**1.002-1.055**
	Previous day	1.010	0.984-1.038
PM10	Current day	1.003	0.995-1.011
	Previous day	1.002	0.994-1.010
SO2	Current day	1.000	0.996-1.004
	Previous day	1.003	0.999-1.006

[1] *city-specific estimates heterogenous*
-rate ratios calculated for a change of 10000/ 1 cm3 in UF, 1 mg/m3 in CO, 10 μg/m3 in PM10, 1 μg/ m3 in SO2
-in bold results that are significant (p< 0.05)

Discussion

Although air pollution effects differed between individual cities, according to our pooled results acute exposure to CO and ultrafine particles increases the risk of hospitalisation for a new myocardial infarction. Both of these pollutants are linked to local traffic emissions. Thus, the study suggests that by regulating vehicle exhaust emissions detrimental effects associated with air pollution could be diminished. As no associations were observed with PM10, routine monitoring of finer PM fractions (ultrafine particles/PM2.5) should be considered.

Current study provides a database of cross-European ultrafine particle measurements. There's still a lack of long measurement series of both ultrafine particles and PM2.5. In this study, retrospective estimation of ultrafine particles was tried for the first time - successfully. However, as other pollutants were used to estimate ultrafine particles, the possibilities to separate health effects between ultrafine particles and other pollutants are limited. Estimation of PM2.5 using the collected airport visibility data is under consideration.

Hospital admissions represent only a fraction of all MIs in the population since acute fatal events are often not hospitalized. Associations between air pollution and incidence of all MIs will be analysed in 3 study centres where appropriate mortality data is available. In all 5 centres, personal characteristics possibly modifying the effects of air pollution are being evaluated.

HEAPSS study was funded by European Union (QLK4-CT-2000-0708)