



# Assessment of Air Pollution Impacts on Human Health Using AirQ+

European Network on New Sensing Technologies for Air  
Pollution Control and Environmental Sustainability -  
EuNetAir

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WHO/Europe, European Centre for Environment and Health

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# Air pollution impacts on health: measurement issues and tools

This presentation is threefold:

- 1) what is related to the issue of exposure and real pollution conditions?
- 2) How to deal with the estimate of the magnitude of the most important effects of air pollution in a given population?
- 3) Which tools have been developed by WHO



# From exposure to impacts

A simulation, built in netlogo, shows how space-time activity patterns can be measured (\*).

Epidemiological studies have quantified the concentration-response functions that link single air pollutants to health (\*\*)

(\*) Mudu P., Terracini B., Martuzzi M. (2014) Human Health in Areas with Local Industrial Contamination.

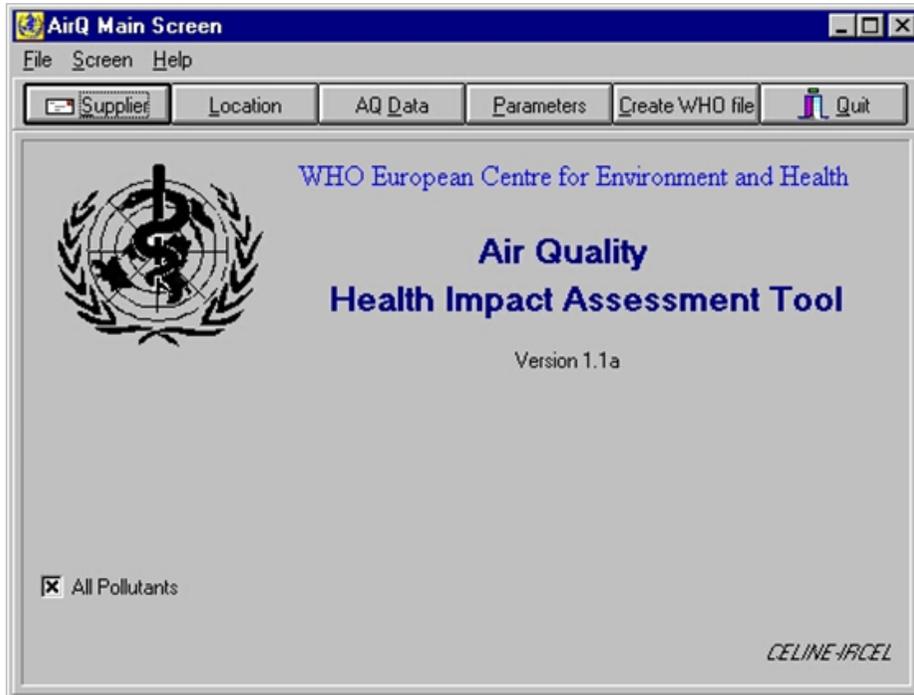
([www.euro.who.int/en/publications/abstracts/human-health-in-areas-with-industrial-contamination](http://www.euro.who.int/en/publications/abstracts/human-health-in-areas-with-industrial-contamination))

(\*\*) World Health Organization (2006) Air quality guidelines: global update 2005: particulate matter, ozone, nitrogen dioxide, and sulfur dioxide. World Health Organization

([http://www.euro.who.int/data/assets/pdf\\_file/0005/78638/E90038.pdf?ua=1](http://www.euro.who.int/data/assets/pdf_file/0005/78638/E90038.pdf?ua=1)).

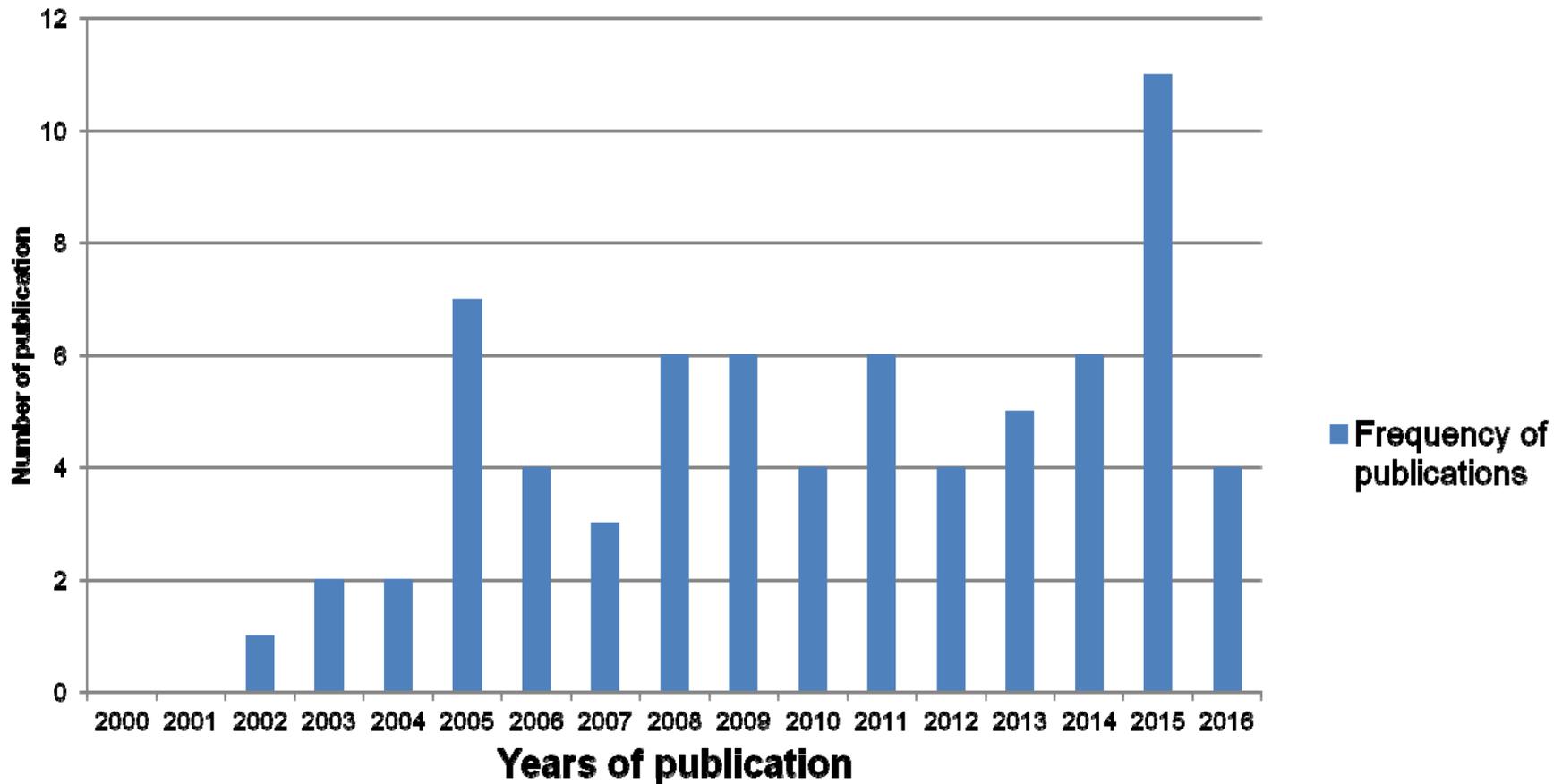
# AirQ

Developed between 1998 and 2004, online until 2016



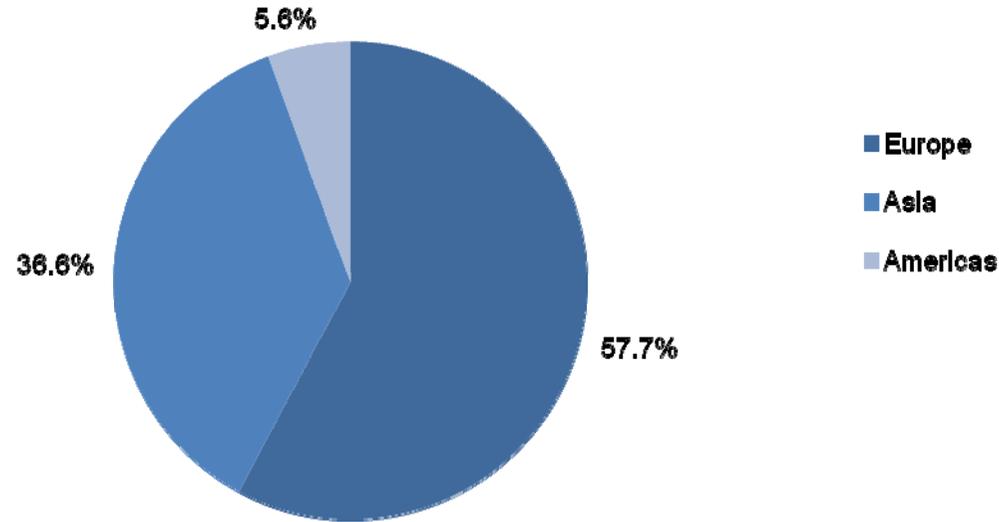
# 71 publications using AirQ for HIA identified between 2002 and 2016

- Type: 35 scientific journals study + 30 reports + 6 thesis



Language: English, Spanish, Italian, French, Hungarian, Persian

# Location of AirQ use in 2000 – 2016



The analysis with AirQ was applied to a single city in most cases, except in 15 publications where the target area covered multiple cities. The average size of the target population was 2,558,493 people. Most analysis focused on population of more than 1 million people (57% of publications).

## EU

- Italy
- Spain
- Hungary
- Germany
- Sweden
- Estonia
- Poland
- Croatia
- UK
- France
- + Aphea study in 23 countries

## Asia

- Iran
- Korea
- Sri Lanka
- Taiwan
- Thailand
- Japan

## South America

- Bolivia
- Peru

# Pollutants assessed by AirQ 2000 – 2016

Pollutants	Studies (frequency)	Studies (percentage)
PM <sub>10</sub>	46	64.8
PM <sub>2.5</sub>	20	28.2
NO <sub>2</sub>	15	21.1
O <sub>3</sub>	9	12.7
SO <sub>2</sub>	8	11.3
TSP	3	4.2
BS	2	2.8
CO	1	1.4
NO <sub>x</sub>	1	1.4
TSP	1	1.4

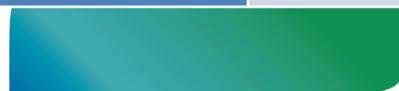


REGIONAL OFFICE FOR Europe

EUROPEAN ENVIRONMENT  
AND HEALTH PROCESS

# Health endpoint frequency

Health end points	Studies (frequency)	Studies (percentage)
Total mortality	41	57.7
Hospital admission due to respiratory disease	35	49.3
Cardiovascular mortality	32	45.1
Respiratory mortality	31	43.7
Life table analysis	30	42.3
Hospital admission due to cardiovascular disease	27	38.0
Chronic obstructive pulmonary disease	16	22.5
Acute respiratory infection	3	4.2
Asthma	3	4.2
Acute myocardial infection	3	4.2
Years Lost due to Disability	1	1.4
Lung cancer mortality	1	1.4
Disability-Adjusted Life Year	1	1.4
Cardiopulmonary mortality	1	1.4
Acute bronchitis	1	1.4



# What is AirQ+?

A user-friendly software  
to estimate the magnitude  
of the most important and best recognized  
effects of air pollution in a given population



# What is AirQ+ for?

For calculating **estimates**  
that support **decision-makers**  
to develop appropriate **actions**  
to protect **public health**



# AirQ+ uses

AirQ+ is designed to calculate:

- How much of a particular health effect is attributable to selected air pollutants?
- Compared to the current scenario, what would be the change in health effects if air pollution levels changed in the future?



# AirQ+ target users

AirQ+ is designed for  
**public health or environmental specialists**

with minimum knowledge of  
atmospheric modelling, statistical methods,  
epidemiology or GIS



# AirQ+ estimates

- Burden of disease from long-term exposure to air pollution at current levels
- Burden of disease associated to changes in air pollution levels (both decreases and increases)
- Health impacts attributable to changes in short-term exposure to air pollution
- Years of Life Lost (YLLs) due to air pollution exposure



# AirQ+ is downloadable online

Link:

<http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/activities/airq-software-tool-for-health-risk-assessment-of-air-pollution>



# AirQ+ welcome screen

The screenshot shows the AirQ+ web application interface. At the top, there is a blue header with the World Health Organization logo and the text "AirQ+ (Do NOT distribute or quote!)". On the right side of the header, there are buttons for "Glossary" and "Disclaimer". Below the header, the main content area is titled "Projects Overview" and contains a tree view of project categories and sub-items. A yellow circle highlights this tree view, with a callout box labeled "Menu". To the right of the tree view, the text "Welcome to AirQ+" is displayed, followed by the instruction "Start new analysis or select an existing analysis from the list on the left." Below this text, there is a list of menu items: "What is AirQ+?", "Getting started", and "Acknowledgments". A red circle highlights the "What is AirQ+?" item, with a callout box labeled "Documentation". At the bottom of the main content area, there is a button labeled "+ Create new Analysis", which is circled in green. A callout box labeled "Start analysis" points to this button. At the bottom of the screen, there are logos for the World Health Organization, the European Environment and Health Process, and other related organizations.

**Menu**

**Documentation**

**Start analysis**

World Health Organization

AirQ+  
(Do NOT distribute or quote!)

Projects Overview

- Long-term Effects
  - CountryData LT
    - New Life Table Evaluation
    - New Life Table Evaluation
  - CityData (PM2.5)
    - AAP PM2.5 long-term adult mortality
    - AAP PM2.5 adults mortality IER (1)
  - New Location (PM2.5) [converted]
    - New Impact Evaluation
  - CityData
  - CityData (PM2.5)
    - AAP PM2.5 adults mortality IER (2)
  - Ozone (O3)
    - New Impact Evaluation
  - Solid Fuel test (Solid Fuel Use)
    - ALRI for children
- Short-term Effects
  - CityData (PM2.5)
  - New Impact Evaluation

What is AirQ+?

Getting started

Acknowledgments

+ Create new Analysis

World Health Organization  
REGIONAL OFFICE FOR Europe

EUROPEAN ENVIRONMENT AND HEALTH PROCESS

# Example of analysis: impacts from long-term exposure to PM<sub>2.5</sub> on adult mortality

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**World Health Organization**

**AirQ+**  
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Impact Evaluation Detailed Results

**Impact Evaluation (PM2.5)**

Evaluation Name: AAP PM2.5 long-term adult mortality

**Health Endpoint**

Health Endpoint: Mortality, all (natural) causes (adults age 30+ years)

Incidence (per 100 000 per year): 939.7300000000001 Pop. at risk (14.53%): 160620

**Calculation Parameters**

Calculation Method: log-linear Formula:  $RR(X) = e^{B(X - X_0)}$

Relative Risk: 1.062 Lower: 1.04 Upper: 1.083

Cut-off Value  $X_0$  (see formula): 10

Mean Concentration X: 27.95

Advanced

Calculate

**Results (last calculation 2016-04-25 13:17:16)**

	Central	Lower	Upper
Estimate Attributable Proportion	10.24%	6.8%	13.34%
Estimated # of Attributable Cases	154	103	201
Estimated # of Attributable Cases per 100 000 Population at Risk	96.18	63.88	125.32

Comments



# AirQ+ :

## Pre-loaded vs user-supplied data

### Pre-loaded datasets

- Relative Risks (RRs) for selected pollutant health end-points pairs
- conversion factors between PM2.5 and PM10 at the national level
- worldwide solid fuel use statistics at the national level.

### Data to be supplied by the users

- Air pollution  
(e.g., average levels or frequency of days with specific levels)
- Population exposed (e.g., number of adults aged  $\geq 30$  years)
- Health (e.g., baseline rates of health outcomes)



# AirQ+ :

## Pre-loaded vs user-supplied data

### Users can also:

- change default RRs or
- load their own data for pollutants not included in AirQ+ if RRs are available.



# THANK YOU VERY MUCH FOR YOUR ATTENTION

## Contacts

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## Web sites

Air quality and health: [euro.who.int/air](http://euro.who.int/air)

Environment and health: [euro.who.int/envhealth](http://euro.who.int/envhealth)

*AirQ+ is co-funded by the German Ministry of Environment (BMUB)*

