AirQ+: key features

Air pollution is the most important environmental risk factor to health. The World Health Organization, Regional Office for Europe, has developed AirQ+ within its activities on air quality and health[1]. Basic information on air pollution and health is available in the WHO website[2].

AirQ+ is designed to calculate the magnitude of the impacts of air pollution on health in a given population. It handles long- and short-term exposure to ambient air pollution from several pollutants, and long-term exposure to household air pollution from solid fuel use.

AirQ+ can be used for any city, country or region to estimate:

1) How much of a particular health outcome is attributable to selected air pollutants?

2) Compared to the current scenario, what would be the change in health effects if air pollution levels changed in the future?

All calculations performed by AirQ+ are based on methodologies and concentration-response functions established by epidemiological studies. The concentration – response functions used in the software are based on the systematic review of all studies available and their meta-analysis.

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[1] The user is invited to read the web site for air quality and health by the WHO Regional Office for Europe: http://www.euro.who.int/en/health-topics/environment-and-health/air-quality

[2] The user is invited to read the "Frequently Asked Questions: Ambient and Household Air Pollution and Health. Update 2014" available at the WHO website: http://www.who.int/phe/health_topics/outdoorair/databases/faqs_air_pollution.pdf

TABLE 1. AIR POLLUTANTS, TYPES OF EXPOSURE AND HEALTH ENDPOINTS HANDLED BY AIRQ+

Health outcome		ICD-10	Exposure									
			Ambient air pollution									Household air pollution
			Long-term					Short-term				Long-term
			$PM_{2.5}$	PM_{10}	NO_2	O_3	BC	$PM_{2.5}$	PM_{10}	NO_2	O_3	Solid fuel use
Mortality	Mortality, all (natural) causes		x		x		x	x	x	x		
	Mortality, ALRI (children 0-4)	J10-J22	x									x
	Mortality, COPD (adults 30+)	J40–J44, J47	x									
	Mortality, COPD (women 30+)	J40–J44, J47										x
	Mortality, COPD (men 30+)	J40–J44, J47										x
	Mortality, IHD (adults 25+)	I20–I25	x									
	Mortality, IHD (women 25+)	I20–I25										x
	Mortality, IHD (men 25+)	I20–I25										x
	Mortality, LC (adults 30+)	C33-C34, D02.1-D02.2, D38.1	x									
	Mortality, LC (women 30+)	C33-C34, D02.1-D02.2, D38.1										x
	Mortality, LC (men 30+)	C33-C34, D02.1-D02.2, D38.1										x
	Mortality, Stroke (adults 25+)	I60-I63, I65-I67, I69.0-I69.3	x									
	Mortality, Stroke (women 25+)	I60-I63, I65-I67, I69.0-I69.3										x
	Mortality, Stroke (men 25+)	I60-I63, I65-I67, I69.0-I69.3										x
	Mortality, respiratory diseases	J00-J99				x					x	
	Mortality, CVDs	I00-I99									x	
	Postneonatal infant mortality, all-cause			x								
Prevalence/ incidence	Prevalence of bronchitis in children			x								
	Prevalence of bronchitis symptoms in asthmatic children aged 5-14				x							
	Incidence of chronic bronchitis in adults			x								
	Incidence of asthma symptoms in asthmatic children								x			
Hospital admissions	Hospital admissions: CVD (including stroke)							x				
	Hospital admissions, CVD (without stroke)										x	
	Hospital admissions: respiratory diseases							x	x	x		
RADs/work days lost	Work days lost, working age population only							x				
	Restricted activity days (RADs)							x				
	Minor restricted activity days (MRADs)										x	

Acronyms: International Classification of Diseases (ICD); Acute lower respiratory disease (ALRI), chronic obstructive pulmonary (COPD), Ischaemic heart disease (IHD), lung cancer (LC), cardiovascular diseases (CVD), restricted activity days (RADs), minor restricted activity days (MRADs), particulate matter less than 2.5 microns ($PM_{2.5}$), particulate matter less than 10 microns (PM_{10}), nitrogen dioxide (NO_2), ozone (O_3), black carbon (BC)

Which data must be provided by the user?

For ambient air pollution (PM, NO₂ and BC), the user needs to input the following data:

- Air quality data:

- Average concentration, for long-term exposure effects

- detailed concentration (frequency of days with particular pollutant concentration values), for short-term exposure effects;

- Data for population at risk (for example: the total number of adults aged ≥ 30 years);

- Health data, such as baseline rates of health outcomes in the population studied;

- A cut-off value for consideration (for example 10 μg/m³ for $PM_{2.5}$); and

- Relative Risk (RRs) values *if different from the default ones provided by WHO*;

- Population data and mortality data, both stratified by age, when using the life table analysis. Examples for calculations, including life table calculations are provided in the AirQ+ tutorial.

For ozone, the user needs to input the following data:

- Ozone is a special case and the user should have data in the specific format for Ozone (see the information text active when performing ozone calculations).

For household air pollution, the user needs to input the following data:

- Data for population at risk (for example: the total number of children < 5 years of age);

- Percentage of total population using solid fuel for cooking heating and lighting;

- Health data, such as baseline rates of health outcomes in the population studied; and

- Relative Risk (RRs) values *if different from the default ones provided by WHO.*

In all cases, the user has the option of using values for a pollutant not included in AirQ+ if RRs and other input data are available. In this situation, it is highly recommended to use results from a meta-analysis rather than from a single local study.

Default values available

To facilitate calculations, AirQ+ includes default values for:

- RRs for selected pollutant health end-points pairs;

- conversion factors between $PM_{2.5}$ and PM_{10} at the national level; and

- worldwide solid fuel use statistics at the national level

Limitations of AirQ+

Some caveats regarding AirQ+ should be kept in mind since deliberate simplifications are present in the methodology, such as:

- models consider ambient air pollution monitoring data as a proxy indicator of population exposure

- calculations do not account for multiple exposure cases or multipollutant scenarios

- morbidity estimates present low reliability due to difficult conformity in the assessment of health outcomes related to hospital admissions

- household air pollution RRs are based on studies carried out in situations of very high pollution.

The estimates generated by AirQ+ carry some uncertainties as they rely on information from concentration-response functions, which are based on a number of assumptions.

The underlying scientific evidence on health effects from ambient air pollution used in the software comes mainly from studies conducted in Western Europe and North America. As a result, the applicability of the results generated by the software for assessments carried outside of these regions can be associated with additional uncertainties and should be considered with caution and involves expert judgment.

"The HRAPIE experts expressed concern that the premature deaths attributed to short-term changes of PM2.5 concentration were already accounted for in estimations of the effects of long-term exposure. They therefore recommended that quantification of the effects of short-term exposure should be done for information only; it is not proposed as an alternative to quantification of long-term PM2.5 exposure" (WHO Regional Office for Europe, 2013: 19).

Note: AirQ+ is not designed to calculate risk assessment estimates related to an accident (for example an explosion).

AirQ+ estimates

AirQ+ calculates the following estimates:

1) attributable proportion of cases;

2) number of attributable cases;

3) number of attributable cases per 100 000 population at risk;

4) proportion of cases in each category of air pollutant concentration;

5) cumulative distribution by air pollutant concentration;

6) Years of Life Lost.

For more details see the Glossary document in the software and the example files accompanying the software.