Seasonal variation of population exposure to air pollution

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Air Pollution is a major public health concern and improving the characterization of population exposure to air pollutants occurring both indoor and outdoor is a key element from both epidemiological and health prevention point of view. One of the major epidemiological issue is understanding why air pollution and airborne particles in particular show increased risk per unit increment during the summer compared to the winter season (Samoli et al., 2014; Biggeri et al., 2004).

In this work we present the results of a study undertaken in the urban area of Modena (Italy) aiming at improving the characterization of population exposure in the different seasons. Population of interest was elderly people which are the most vulnerable to short term effects of air pollution.

The indoor environment were uninhabited because one of the main goal of the study was to assess the trend in population exposure of air pollution coming from outdoors without considering specific indoor sources.

Both indoor and outdoor monitoring were simultaneously carried out at a residential setting in two different periods of the year. Based on a survey conducted in a previous project we characterized general behaviours of elderly people in terms of opening windows. We simulated this behaviour in different periods of the year opening every day the windows based on a specified protocol. During the warm season some windows of the apartment were opened at 8:00 a.m. and closed at 10:00 p.m.. During the cold season the windows were opened for only half an hour from 8:00 to 8:30 a.m..

Air exchange rates were calculated during each monitoring campaign increasing the CO2 indoor concentrations and observing their decay rate.

Measurement periods lasted 15-days each (2-17 July 2014 and 4-18 December 2014). Measurement of PM2.5 were carried out both with optical method (DustTrak, TSI) as well as gravimetric method (Skypost, Tecora). DustTrak data were at 1-min temporal resolution and were corrected using regression function between optical and gravimetric daily data. Filters from gravimetric samplers were used to analyse chemical composition of particles in terms of ions, metals, organic and elemental carbon. A Particle Size Spectrometer (FMPS, TSI) provided size distribution of particles in the 5.6-560 nm interval and Ultra-Fine Particle (UFP) concentration (time resolution 1-min). A switching unit alternatively activated indoor and outdoor inflow with a switch time of 10 min.

Indoor and outdoor concentration of two gaseous pollutants were also measured. High frequency concentrations of carbon monoxide were monitored using a electrochemical sensor (T15n, Langan). Nitrogen dioxide were measured using passive samplers (Radiello).

We found significant differences between season in the characteristics of most measured parameters. Indoor/Outdoor ratios varied across the monitoring periods. Relevant differences were also found for air pollutant concentrations and chemical composition of particles. Results have been put in relation with the findings of epidemiological studies.

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References

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