Background and objective A number of studies in the Mediterranean area showed much higher (up to 10 times higher) short term health effects of airborne particles (e.g. mortality) during the warm compared to the cold season. We analyzed whether seasonal variability of air exchange rate and of various metrics of airborne particles may be responsible of these differences in the health effects.

Conclusions We found relevant differences between seasons in the I/O relationships of various physical and chemical characteristics of particulate matter. Air exchange rates are not capable to entirely explain the seasonal variability of the health effects. Higher percentage of sulfates, vanadium and nanoparticles for a unit PM$_{2.5}$ concentration could play a role in increased toxicity during the summer season.

Methods

Two 15-days monitoring campaigns were conducted in February and June 2014. Measurements were performed simultaneously indoor and outdoor in an uninhabited apartment in the city of Modena (Italy). The city is located in one of the most urbanized, industrialized and polluted areas of Europe. Measurements included size distribution, mass and chemical composition of PM$_{2.5}$ (metals, ions, organic and elemental carbon). Air Exchange Rates were measured in both seasons in open as well as closed windows. We simulated the typical behaviour of elderly people in regulating natural ventilation based on the data collected on an hourly basis in a previous survey.

Results

PM$_{2.5}$ mass and UFP concentration

Much higher I/O ratio during the warm compared to the cold season both for PM$_{2.5}$ (0.91 vs 0.51) and UFP (1.01 vs 0.55).

Size distribution

Relevant differences in size distribution between seasons with much higher percentage of particles below 30 nm during the warm season but with higher percentage of particles below 30 nm.

Chemical composition

Very similar indoor and outdoor mean concentrations of all chemical components during the warm season.

Dramatic drop of nitrates from outdoor to indoor during the cold season.

Higher absolute (and obviously relative) concentrations of Vanadium during the warm compared to the cold season.

Much lower proportion of sulfates during the cold season, both indoor and outdoor.

Contacts: Zauli Sajani Stefano – Arpae Emilia-Romagna – Via Begarelli 13, 41121 Modena (Italy) Tel +39 059 433626 E-mail: szauli@arpae.it