HEO1

PARHEALTH

Health effects of particulate matter in relation to physical-chemical characteristics and meteorology

DURATION OF THE PROJECT
Phase 1: 15/12/2006 – 31/01/2009
Phase 2: 01/02/2009 – 31/01/2011

BUDGET
799.730 €

KEYWORDS
Air pollution, fine particulates matter, physical-chemical characteristics, cardio-pulmonary disease, meteorology, biomarkers of effect

CONTEXT

Numerous studies have shown a strong association between daily mortality and fine particulates air pollution. However, component-specific toxicity has not been characterized well. In this regard the research unit of lung toxicology (KULeuven) collected unique data for Belgium on the association between fine particulates air pollution and mortality (total, cardiovascular and respiratory mortality) showing that the effects of air pollution are much stronger in summer than in winter, even in our temperate climate. Until now, we can only speculate about the mechanisms underlying the much stronger association between mortality and particulates during warmer periods, even though particulate levels reach higher values in the winter.

PROJECT DESCRIPTION

This project aims at reducing the health risks and health costs attributable to particulate pollution, through the identification its components that are responsible for the adverse health effects.

Objectives

1. To investigate the short-term effects of particulates (both mass and physical-chemical characteristics) and ozone using sensitive endpoints of cardiovascular and respiratory responses in two susceptible segments of the population (children and elderly) in which the parameters will be measured in the same person within the same day (before and after ozone peak) and across seasons on days with relatively high and low concentrations of fine particulates in the ambient air which will allow to determine possible threshold levels of PM and ozone in an integrated approach.
2. Optimizing advanced analytical techniques for identification and quantification of specific organic compounds on particulates.
3. To explore the component-specific toxicity (chemical and physical) of particulates in association with meteorological conditions.

Methodology

In a cohort of children and a cohort of elderly, the network will measure cardiovascular and respiratory parameters in the same person within the day and across seasons and evaluate their relationship with both physical properties and specific inorganic and organic components associated with particulates. This specific experimental design will allow us to study the particulate induced effects, in association with ozone peaks, independently of the direct meteorological effects.

INTERACTION BETWEEN PARTNERS

Children and elderly represent two segments in the population which are susceptible for the short-term effects of air pollution. In this regard the unit of Lung Toxicology (KULeuven) showed that ultrafine carbon particles may pass rapidly into the systemic circulation and showed significant effects of air pollution for the elderly on total and cardiovascular mortality, while the unit of Occupational Medicine and Toxicology of the UCLouvain (Brussels) studied effects –mainly ozone- on lung inflammation in children. In line with evidence gained from this previous work, the project will study the effects of air pollution non-invasively with a focus on both the cardiovascular and respiratory systems. B. Nemery and T. Nawrot coordinate the project and are responsible for the recruitment of elderly. A. Bernard and M. Nickmilder (Unité

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de toxicologie industrielle et de médecine du travail de UCLouvain) are in charge for the recruitment of children and the measurement of inflammatory parameters. The component-specific toxicity of particulates will be determined by the department of Organic Chemistry UGent and Environmental Chemistry of the UAntwerpen). The Royal Meteorological Institute, Brussels will deliver meteorological parameters which will be linked to component-specific toxicity of particulates, furthermore they will broadcast peak ozone and particulate air concentrations to organize the field work at those days.

EXPECTED RESULTS

Elucidating the component specific toxicity and the pathophysiology of the association between cardiopulmonary effects of particulate exposure may open an important new avenue for the prevention of cardiopulmonary complications and the environmental regulations of particulate air pollution. An improved knowledge on which chemical compounds are associated with the adverse health effects will achieve cost-effective reductions in health risks to populations. In view of the high prevalence of cardiopulmonary illness, even a small benefit in terms of preventable cases, will lead to an appreciable decrease in morbidity, an increase in longevity, and in turn, to a decrease in health care costs. This project will also advise the National and Regional Governments on environmental regulations, permissible levels of particulate exposure with characterisation of specific compounds, and strategies to identify at an early stage subjects at an increased cardiopulmonary risk.

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