New tools for integrated, personalized and dynamic exposure assessment

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New and emerging technologies enable researchers to get a detailed view on exposure of individuals to air pollution. Next to the external exposure, it might be a bonus to get an idea of the internal exposure with the aim of reducing exposure misclassification and reducing biases toward the null in epidemiologic studies.

Air quality monitors are shrinking and personal monitoring becomes feasible for a large number of pollutants. Moreover, monitoring is no longer exclusively for lab technicians, with pilot studies showing the potential of community-based participatory sensing. When air pollution measurements are combined with information on geographic position, physical activity and personal diary data, inhaled doses of particles can be computed and strategies to reduce exposure can be offered to individuals.

Several examples of innovative exposure assessment strategies are presented.

- Portable aethalometers measuring Black Carbon on a high temporal resolution, without being intrusive to volunteers, were distributed among 62 participants in Flanders. The use of this air quality device was combined with an electronic diary to register time-activity patterns. A GPS-logger was integrated in the diary. This research revealed that home-based activities contribute most to exposure to BC, but this is largely driven by the time spent at home. On the other hand, trips contribute most to inhaled doses of BC due to the higher inhalation and elevated concentrations in the transport microenvironment.
- The same portable aethalometers were distributed together with GPS-loggers amongst community guards in Antwerp in a pilot study. They carry these devices in their normal working routine. Data are automatically fed into a database and processed into air quality maps and personal exposure patterns. Processed data of this mobile network can be accessed via a standardized web interface.
- A SenseWear Armband can be used to accurately track the physical activity of volunteers participating in an exposure study. The system incorporates an accelerometer, a step counter, and it measures energy expenditure and level of physical activity (sleep, sedentary, moderate, vigorous, very vigorous). Participants can register timestamps when for example changing activities. Based on this information breathing rates or other relevant health parameters can be derived easily and linked to air quality measurements.