



STATEMENT

Synopsis of Research Report 97

HEALTH
EFFECTS
INSTITUTE

Identifying Subgroups of the General Population That May Be Susceptible to Short-Term Increases in Particulate Air Pollution

BACKGROUND

Epidemiologic analyses of mid-20th-century air pollution episodes such as the 1952 London Fog indicated that excess mortality was associated with elevated air pollution, and the excess mortality was concentrated among people with preexisting cardiovascular, and especially respiratory, diseases. More recently, smaller associations with mortality have been consistently reported at much lower air pollution levels. However, because these studies used routinely collected mortality data obtained from death certificates, few of the studies could describe in detail the clinical conditions of the decedents preceding their deaths. Therefore, studies that could address this issue were needed.

APPROACH

In 1994, HEI requested applications for studies that would provide more information on the conditions of individuals before death, to further understanding of the mortality-particulate matter association. Dr Mark Goldberg and his colleagues at McGill University in Montreal, Quebec, received funds to conduct a time-series study in Montreal, where data from the Quebec Health Insurance Plan were available, as well as mortality and air pollution data. Because of the comprehensive nature of this health insurance database, the investigators were able to link individual deaths in Montreal to medical information up to 5 years before death. These data were then used in conjunction with clinical expertise to define susceptible groups and to assess risk of death in those groups for three different indices of particulate matter. The investigators had two major objectives: (1) to determine whether concentrations of particles in the ambient air of Montreal were associated with daily all-cause and cause-specific mortality and (2) to determine whether groups of the population had higher than average risks of death from exposure to particles.

RESULTS AND INTERPRETATION

The investigators report total and specific causes of death associated with the average level of air pollution measured the same day and 2 days prior to death (a 3-day mean lag). Three measures of particulate matter were used: coefficient of haze (COH), total sulfate measured at the monitoring station in Sutton, Quebec (150 km southeast of Montreal), and a predicted estimate of particulate matter 2.5 mm or smaller in aerodynamic diameter (PM_{2.5}) that was calculated from daily COH, sulfate, and airport visibility data. Other particulate matter measures were analyzed and are in appendices available on request from the Health Effects Institute and from the HEI web site. For each of the three particle measures, the investigators reported an association with mortality from respiratory diseases and other nonaccidental deaths, including diabetes. Additionally, COH was associated with increases in cancer deaths in general and the subset of lung cancer deaths; sulfate measured at the Sutton site was associated with mortality from coronary artery disease and cardiovascular diseases. Positive associations for other underlying causes of death were not found. All associations were generally stronger among those 65 years of age and older.

Analyses were also conducted for three groups of health conditions present before death (cancer, cardiovascular diseases, and respiratory diseases). The effects of the three particle measures varied somewhat by subset of disease. Subjects with acute lower respiratory disease, congestive heart failure, and a combined group of any cardiovascular diseases died at higher rates for increases in each of the three particulate matter measures. Associations with COH and predicted PM_{2.5} were reported for subjects with cancer, chronic coronary artery disease, and any coronary artery disease, and effects of sulfate were shown for those with acute and chronic upper respiratory disease. No associations with the three measures of particulate

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This Statement, prepared by the Health Effects Institute, summarizes a research project conducted by Dr Mark S Goldberg and colleagues of McGill University, Montreal, Quebec. The complete Report, *Identifying Subgroups of the General Population That May Be Susceptible to Short-Term Increases in Particulate Air Pollution: A Time-Series Study in Montreal, Quebec*, can be requested from HEI (see reverse side).

GOLDBERG 97

matter were observed for those with airways disease, acute coronary artery disease, or hypertension.

Dr Goldberg and colleagues have made a unique effort to address some of the limitations of mortality outcomes data that have been used in most earlier studies of air pollution and daily mortality. Their study has advanced current methods and scientific understanding in several ways through the linkage of a provincial insurance database with mortality and air pollution databases. The results suggest that persons with certain preexisting cardiac or respiratory conditions are at short-term increased risk of mortality due to ambient particulate matter. Observed apparent discrepancies between results using case definitions based on the Quebec Health Insurance Plan data

and those using the more conventional death certificate information should be more thoroughly explored. Also, some other clinical conditions were identified for a possible association with increased risk of mortality. In particular, the investigators identified persons with cancer or diabetes, as well as those who had not received medical services in the year before death, as being at an increased risk of death. These results merit additional investigation.

Further analyses with this data set could advance understanding of who might be at greatest risk of mortality at levels of air pollution currently observed in the cities with relatively low air pollution levels.