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Long-Term Effects of Traffic-Related Air Pollution on Mortality in a Dutch Cohort (NLCS-AIR Study)

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Abstract and Introduction

Abstract

Background: Several studies have found an effect on mortality of between-city contrasts in long-term exposure to air pollution. The effect of within-city contrasts is still poorly understood.

Objectives: We studied the association between long-term exposure to traffic-related air pollution and mortality in a Dutch cohort.

Methods: We used data from an ongoing cohort study on diet and cancer with 120,852 subjects who were followed from 1987 to 1996. Exposure to black smoke (BS), nitrogen dioxide, sulfur dioxide, and particulate matter $\leq 2.5 \mu\text{m}$ ($\text{PM}_{2.5}$), as well as various exposure variables related to traffic, were estimated at the home address. We conducted Cox analyses in the full cohort adjusting for age, sex, smoking, and area-level socioeconomic status.

Results: Traffic intensity on the nearest road was independently associated with mortality. Relative risks (95% confidence intervals) for a $10\text{-}\mu\text{g}/\text{m}^3$ increase in BS concentrations (difference between 5th and 95th percentile) were 1.05 (1.00-1.11) for natural cause, 1.04 (0.95-1.13) for cardiovascular, 1.22 (0.99-1.50) for respiratory, 1.03 (0.88-1.20) for lung cancer, and 1.04 (0.97-1.12) for mortality other than cardiovascular, respiratory, or lung cancer. Results were similar for NO_2 and $\text{PM}_{2.5}$, but no associations were found for SO_2 .

Conclusions: Traffic-related air pollution and several traffic exposure variables were associated with mortality in the full cohort. Relative risks were generally small. Associations between natural-cause and respiratory mortality were statistically significant for NO_2 and BS. These results add to the evidence that long-term exposure to ambient air pollution is associated with increased mortality.

Introduction

Although air pollution concentrations have decreased substantially over the last several decades, recent studies from the United States found associations between long-term exposure to air pollution and cardiopulmonary and lung cancer mortality (Abbey et al. 1999; Dockery et al. 1993; Jerrett et al. 2005; Laden et al. 2006; Miller et al. 2007; Pope et al. 1995, 2002). Cohort studies from Europe have tended to confirm the U.S. findings (Filleul et al. 2005; Gehring et al. 2006; Hoek et al. 2002; Nafstad et al. 2004), but the emphasis has been on different pollutants and on different exposure assessment methods. The U.S. studies have used data from single monitoring stations to characterize exposure of subjects living in that city, or spatial interpolation from multiple monitoring stations. Most European studies have estimated exposure at the home address using dispersion or stochastic modeling and variables such as living close to busy roads. In a previous Dutch study in 5,000 subjects, a random sample from a full cohort ($n \sim 120,000$), cardiopulmonary and all-cause mortality were associated with living close to a major road, with relative risks of 1.95 [95% confidence interval (CI), 1.09-3.52] and 1.41 (95% CI, 0.94-2.12), respectively (Hoek et al. 2002). In this article we extend this work to the full cohort with a much larger number of deaths and with an improved exposure assessment method.

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