breakout ABSTRACT

VISION to REALITY 2005

TITLE

Approaches for Assessing Exposure to Traffic-Related Pollution for Tracking

THEME

Advance Environmental Public Health Science and Research

KEYWORDS

traffic, mobile sources, toxic air pollutants, criteria air pollutants, modeling, GIS

BACKGROUND

Exposure to traffic exhaust is ubiquitous in the urban environment and its components are associated with numerous human health outcomes, including cancer, respiratory, and reproductive endpoints. Mobile sources are major contributors of pollutants such as particulate matter, carbon monoxide, and toxic air contaminants such as volatile organic compounds. Several different approaches to measuring exposure to traffic exhaust have been proposed, but are problematic due to issues such as exposure misclassification, requirements and assumptions of the data models, and cost.

OBJECTIVE(S)

We evaluated four models of assessing exposure to traffic exhaust including census-block group traffic density, distance-weighted traffic proximity, land-use regression, and a meteorological emissions model (ADMS-Urban), integrated into ArcView 3.3 GIS.

METHOD(S)

Palmes diffusion tubes measuring NO2 were placed for two weeks in 38 locations in San Diego County, CA and in 51 locations in Alameda County, CA in Fall 2003 and Fall 2004, respectively. Models were evaluated using rank correlations of predicted traffic and measured NO2 values for proximity measures, with validation samples for land-use regression, and with fractional bias and factor of 2 analyses for ADMS-Urban. Resulting models were linked to a series of asthma cases and non-respiratory diagnoses controls from a combined private/public source dataset from the California Environmental Health Tracking Program.

RESULT(S)

The precision of Palmes tubes was 0.5 ppb in San Diego and 1.0 ppb in Alameda Counties. NO2 values ranged from 8.1 to 28.7 ppb (mean=15.0, sd=4.7) in San Diego and from 15.4 to 38.9 ppb (mean=25.9, sd=5.5) in Alameda. Land-use regression was able to predict NO2 levels in validation samples within 2.1 ppb on average. Preliminary analysis of ADMS-Urban showed that all predicted values were within a factor of two of the observed values. Gaussian-weighted traffic proximity measured at a 550-ft. buffer showed a rank correlation of 0.44 ($p<0.01$).

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DISCUSSION/RECOMMENDATION(S)

Tracking programs need to employ the simplest, most accurate, and least expensive measures of exposure to traffic exhaust in order to examine relationships with multiple health outcomes. The integrated meterological-emission model showed good prediction on preliminary analysis but requires considerable inputs and expertise. The land-use regression approach had excellent prediction and robustness and requires fewer inputs. This study illustrates the practicality of several methods of modeling traffic exposure which can be linked to health outcomes in an analytic setting. Assessing exposure to air pollutants from traffic should be a continued research priority for the Tracking Program.

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