

## TITLE

Ambient Ozone (O<sub>3</sub>) Concentrations and Childhood Hospital Admissions due to Respiratory Disease in New York State, 1991–2001

## THEME

Advance Environmental Public Health Science and Research

## KEYWORDS

ozone, childhood asthma, case crossover, GAM, time series, ARIMA

## BACKGROUND

Previous studies of ambient ozone (O<sub>3</sub>) exposure on the effect of childhood respiratory disease have produced inconsistent findings. Many studies covered short time periods or were limited to small geographic areas.

## OBJECTIVE(S)

To estimate the association between O<sub>3</sub> and childhood admissions due to respiratory diseases in New York State (NYS) by using different time series methods.

## METHOD(S)

The study population includes 0-17 year-old children residing in NYS in 1991–2001. The cases were defined as the children who were admitted to a hospital with a principal diagnosis of respiratory disease (ICD-9 codes 491, 492, 493, 496, and 466, 490 for 0-4 year-olds) between 1991 and 2001. NYS was divided into 16 buffer regions according to the O<sub>3</sub> dispersion patterns and correlation with O<sub>3</sub> monitors. The regions with the five highest respiratory admission rates (including New York City (NYC) and the Richmond, Elmira, Lake Ontario, and Capital regions) were selected for analysis. The 24-hour average and maximum, and the 8-hour average and maximum of ambient O<sub>3</sub> measurements were linked to daily hospital admissions. Seasonal effects, day-of-week effects, daily average temperature, relative humidity, and barometric pressure were controlled. Lag effects of O<sub>3</sub> on respiratory admissions were also examined. Case-crossover analysis was conducted using two methods selecting controls: symmetric bi-directional (SBI) and time-stratified. In addition, General Additive Models (GAM) and Autoregressive Integrated Moving Average (ARIMA) models were used to estimate the associations. Admission counts were used in case-crossover and GAM methods, while admission rates (calculated by dividing admissions by census population) were used in ARIMA analysis. The results for the full year and for the O<sub>3</sub> season only (April to October in NYS) were also compared.

## RESULT(S)

The results of the case-crossover, GAM, and ARIMA analyses all indicated that in the O<sub>3</sub> season, an increase in the 8-hour maximum O<sub>3</sub> with a one-day lag was significantly associated with an increase in respiratory admissions in NYC. A 10 ppb increase in O<sub>3</sub> (8-hour maximum) was associated with an increase of 0.32% to 0.51% (depending on the analysis method) in respiratory admissions. In the Richmond region, 10 ppb increase in O<sub>3</sub> (8-hour maximum) with a 2-day lag

was associated with an increase of 2.16% to 3.63% in respiratory admissions. In the Elmira, Lake Ontario, and Capital regions, positive associations were found for one- or two-day lags, but these associations were not statistically significant. For the full year, significant positive associations were found in NYC and the Richmond region by GAM only, but not by case-crossover design.

## **DISCUSSION/RECOMMENDATION(S)**

This study demonstrates a statistically significant positive association between ambient O<sub>3</sub> concentrations and childhood respiratory admissions in NYC and the Richmond regions during 1991–2001, but not in other areas. The potential health effects of O<sub>3</sub> concentrations appear small and vary by geographic regions, but are consistent with other research findings.

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