HEALTH EFFECTS INSTITUTE

STATEMENT

Synopsis of Research Report 148

Impact of Regional Air Quality Improvements During the Atlanta Olympic Games

INTRODUCTION

In recent decades, there have been substantial reductions in ambient concentrations of most combustion-related pollutants in the United States, Europe, and elsewhere. Because the cost of pollution-control technologies and enforcement of regulations to achieve increasingly lower concentrations of air pollutants can be relatively high, it is important to determine whether regulations and other actions taken to improve air quality are effective in reducing emissions, reducing the public's exposure to air pollutants, and ultimately achieving the intended improvements in public health. Traffic is an important source of air pollutants to which a large segment of the population is exposed, especially in urban areas. Many locations around the world are implementing actions to reduce traffic congestion. Although such measures may not be specifically designed to reduce air pollution concentrations, it is possible that they may lead to improved air quality. There is increasing interest in evaluating whether this is the case.

Dr. Jennifer Peel of Colorado State University proposed to evaluate the effect of a short-term, temporary intervention to reduce traffic congestion during the 1996 Summer Olympic Games in Atlanta, Georgia. A previous study of the Atlanta traffic intervention by Friedman and colleagues had shown a decrease in acute care visits for pediatric asthma and a concomitant decrease in concentrations of ozone, PM_{10} (particulate matter with an aerodynamic diameter $\leq$ 10 µm), and carbon monoxide during the Olympic Games compared with the weeks before and after the games. However, important questions remained unanswered. It was not clear to what extent normal seasonal patterns in pollutant concentrations or health outcomes may have influenced the results. It is also possible that health care usage during the Olympic Games changed because residents may have changed their behavior because of the games.

Peel and colleagues proposed to address these questions by evaluating wider time windows surrounding the Olympic Games period and extending the analyses to earlier and later years and to broader geographic areas. They also proposed to evaluate additional respiratory and cardiovascular disease outcomes in different age groups. The HEI Research Committee thought that the additional analyses would enhance our understanding of the possible effects of this temporary traffic intervention on health outcomes and recommended the study for funding.

APPROACH

Peel and colleagues used emergency department data for 1995 though 2004, which had been collected as part of the Study of Particles and Health in Atlanta, to examine the associations between daily air quality and daily emergency department visits for cardiovascular and respiratory outcomes. The database had data for more than 25,000 emergency department visits, for all causes, made by Atlanta residents to 12 hospitals (including 2 pediatric hospitals) during the Olympic Games. The investigators also obtained daily ambient air quality and meteorologic data for five central counties within the Atlanta area as well as for more rural sites in Georgia and for six other urban areas in the Southeastern United States. In addition, they obtained traffic data from the Georgia Department of Transportation, which in 1996 conducted traffic counts at 18 sites within the five counties studied.

The investigators compared mean pollutant concentrations and traffic counts between the Olympic and baseline periods using a time-series

This Statement, prepared by the Health Effects Institute, summarizes a research project funded by HEI and conducted by Dr. Jennifer L. Peel at Colorado State University, Fort Collins, CO, and colleagues. The complete report, *Impact of Improved Air Quality During the 1996 Summer Olympic Games in Atlanta on Multiple Cardiovascular and Respiratory Outcomes,* can be obtained from HEI or our Web site (see next page)

approach. Numbers of daily emergency department visits were analyzed using Poisson generalized linear models. The 73-day period of interest included the 17 days of the Olympic Games and 28 days immediately before and after the games (baseline periods). Primary analyses were performed of emergency department visits for the 73-day period in 1996 as well as for the surrounding years (1995 and 1997–2004). Secondary analyses were conducted on the short 73-day time series (1996 Olympic and baseline periods only), similar to the analyses by Friedman and colleagues. The investigators conducted a number of sensitivity analyses using generalized estimating equations to evaluate the effects of model choices and choices of baseline periods on the estimates.

RESULTS AND INTERPRETATION

Peel and colleagues successfully conducted an extensive evaluation of health outcomes associated with air quality changes during the Olympic Games in Atlanta that critically expanded the initial evaluation by Friedman and colleagues. They confirmed that Atlanta experienced a significant decline in ozone concentrations of 20% to 30% during the Olympic Games, with less pronounced decreases in concentrations of carbon monoxide, PM_{10}, and nitrogen dioxide. Importantly, Peel and colleagues found that similar declines in ozone concentrations were observed throughout Georgia and the Southeastern United States. In its independent review of the study, the HEI Health Review Committee agreed with the investigators that the regional nature of the reduction in ozone concentrations was due to meteorologic conditions; this has made it difficult to assess whether and to what extent the measures to reduce traffic during the Olympic Games contributed to air quality improvements in downtown Atlanta.

The investigators reported up to a 20% decline in weekday peak morning traffic counts at four sites in Atlanta and declines of 2% to 15% at the remaining sites; the observed declines were somewhat smaller than that reported by Friedman and colleagues (i.e., 22.5%). In addition, the daily total number of cars commuting into Atlanta was not changed. Thus, it remains unclear whether the measures to improve traffic flow during the Olympic Games had significantly reduced traffic or improved air quality.

In their primary analyses, which were adjusted for seasonal trends in air pollutant concentrations and health outcomes during the years before and after the Olympic Games, the investigators did not find significant reductions in the number of emergency department visits for respiratory or cardiovascular health outcomes in adults or children. They reported that the risk estimates often had large confidence intervals, indicating uncertainty in the results, and that they were sensitive to the choice of analytic model. Because the 17-day period of the Olympic Games was short, it is possible that the daily number of emergency department visits was too low to adequately test the hypothesis that health outcomes would be affected. When they analyzed the 73-day period comprising the Olympic and adjacent baseline periods without adjusting for similar trends in surrounding years (secondary analyses), Peel and colleagues observed reductions in emergency department visits for upper respiratory infections for all age groups and for pediatric ages during the Olympic Games, but they could not confirm the observation by Friedman and colleagues that the number of pediatric emergency care visits for asthma was substantially reduced during the Olympic Games. (It should be noted that Peel and colleagues used a different database.)

The Committee thought that the study by Peel and colleagues was designed carefully, but noted that it was constrained by the short duration of the intervention, the small reductions in air pollution concentrations, the low daily numbers of emergency department visits, difficulty of isolating the effects of an intervention from usual temporal patterns in health care usage, and a lack of control areas. Although the investigators examined important potential confounders that were not addressed in the study by Friedman and colleagues, the retrospective nature of the study limited their ability to evaluate behavioral changes — such as Atlanta residents potentially leaving the city during the Olympic period — that may have influenced the results.

This study illustrates the importance of evaluating appropriate time windows surrounding interventions, properly adjusting for seasonal and other trends that may influence the results, and using control areas. Evaluation of short-term air quality interventions remains challenging, especially one as short as 17 days, because changes in meteorologic conditions could easily overwhelm any changes that might be due to the intervention. More broadly, this study emphasizes the importance of examining the full chain of events that might result from any such intervention — for example, asking first whether the intervention actually reduced traffic, then asking whether that reduction in traffic resulted in improved air quality, and then finally examining whether any observed improvements in air quality actually resulted in health improvements.

HEALTH EFFECTS INSTITUTE

101 Federal Street, Suite 500
Boston, MA 02110, USA
+1-617-488-2300 phone
+1-617-488-2335 fax

pubs@healtheffects.org
www.healtheffects.org