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Risk of Cardiovascular Morbidity and Mortality in Relation to Temperature

Robert Mathes*, Kazuhiko Ito and Thomas Matte

New York City Department of Health and Mental Hygiene, Queens, NY, USA

Objective

To examine the effects of temperature on cardiovascular-related (CVD) morbidity and mortality among New York City (NYC) residents.

Introduction

Extreme temperatures are consistently shown to have an effect on CVD-related mortality [1, 2]. A large multi-city study of mortality demonstrated a cold-day and hot-day weather effect on CVD-related deaths, with the larger impact occurring on the coldest days [3]. In contrast, the association between weather and CVD-related morbidity is less clear [4, 5]. The purpose of this study is to characterize the effect of temperature on CVD-related emergency department (ED) visits, hospitalizations, and mortality on a large, heterogeneous population. Additionally, we conducted a sensitivity analysis to determine the impact of air pollutants, specifically fine particulates (PM2.5) and ozone (O3), along with temperature, on CVD outcomes.

Methods

We analyzed daily weather conditions, ED visits classified as CVD-related based on chief complaint text, hospitalizations, and natural cause deaths that occurred in NYC between 2002 and 2006. ED visits were obtained from data reported daily to the city health department for syndromic surveillance. Inpatient admissions were obtained from the Statewide Planning and Research Cooperative System, a data reporting system developed by New York State. Mortality data were obtained from the NYC Office of Vital Statistics. Data for PM2.5 and O3 were obtained from all available air quality monitors within the five boroughs of NYC. To estimate risk of CVD morbidity and mortality, we used generalized linear models using a Poisson distribution to calculate relative risks (RR) and 95% confidence intervals (CI). A non-linear distributed lag was used to model mean temperature in order to allow for its effect on the same day and on subsequent days. Models were fit separately for cold season (October through March) and warm season (April through September) given season may modify the effect on CVD outcomes. For our sensitivity analysis, we included PM2.5 and O3 in our model.

Results

During the cold season, CVD-related ED visits and hospitalizations increased, while mortality decreased, with increasing mean temperature on the same day and lagged days. Extremely cold temperature was associated with a small increase of same day in-hospital mortality though generally cold temperatures did not appear to be associated with higher mortality. The opposite was observed in the warm season as ED visits and hospitalizations decreased, and mortality increased, with increasing mean temperature on the same day and on lagged days. Our sensitivity analysis, in which we controlled for PM2.5 and O3, demonstrated little effect of these air pollutants on the relationship between temperature and CVD outcomes.

Conclusions

Our results suggest a decline in risk of a CVD-related ED visit and hospitalization during extreme temperatures on the same day and on recent day lags for both cold and warm seasons. In contrast, our findings for mortality indicate an increase in risk of CVD-related deaths during hot temperatures. No mortality effect was observed during cold temperatures. The effects of extreme temperatures on CVD-related morbidity may be explained by behavioral patterns, as people are more likely to stay indoors on the coldest and hottest days.

Keywords

Morbidity; Mortality; Cardiovascular; Temperature

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*Robert Mathes
E-mail: rmathes@health.nyc.gov