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Surveillance of Heat-related Morbidity: Relation to Heat-related Excess Mortality

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Objective

To describe the extent to which heat-illness indicators increase with extreme heat and to evaluate the association among daily weather, heat-related illness and natural cause mortality.

Introduction

The impact of heat on mortality is well documented [1-3] but deaths tend to lag extreme heat and mortality data is generally not available for timely surveillance during heat waves. Recently, systems for near-real time surveillance of heat illness have been reported [4] but have not been validated as predictors of heat related mortality. In this study, we examined the associations among weather, indicators of heat-related ambulance calls and emergency department visits and excess natural cause mortality in New York City (NYC).

Methods

We analyzed daily weather conditions, emergency medical system (EMS) calls flagged as heat-related by EMS dispatchers, emergency department (ED) visits classified as heat-related based on chief complaint text, and natural cause deaths. EMS and ED data were obtained from data reported daily to the city health department for syndromic surveillance. We fit generalized linear models to assess the relationships of daily counts of heat related EMS and ED visits to natural cause deaths after adjustment for weather conditions during the months of May-September between 1999 and 2008.

Results

We observed an increase in mean total calls to EMS and a decrease in mean total visits to EDs during 10 observed heat waves (maximum heat index ≥ 90° F (Fahrenheit) for four or more consecutive days with the first three days ≥ 95° F and at least one day ≥100°F) in NYC between 1999 and 2008. Both EMS and EDs experienced an increase in heat-related incidents during heat waves though the increase in heat-related EMS calls was much greater. A modest increase in mean natural cause deaths was also observed. Controlling for temporal trends, an 11% (95% confidence interval (CI): 5-18) and 7% (95% CI: 4-9) increase in natural cause mortality was associated with an increase from the 50th percentile to 99th percentile of same-day and one-day lagged heat-related EMS calls and ED visits, respectively. After controlling for both temporal trends and weather, we observed a 10% (95% CI: 4-16) increase in natural cause mortality associated with one-day lagged heat-related EMS calls and a 5% mortality increase with one-day lagged ED visits (95% CI: 2-8).

Conclusions

Heat-related EMS calls and ED visits lagged one day predicted natural cause mortality in our temporal and weather-adjusted model. In particular, risk of mortality rapidly increased as the number of heat-related EMS calls approached high levels (>100 heat-related calls/day). Heat-related illness can be tracked during heat waves using EMS and ED data which are indicators of heat associated excess natural cause mortality during the warm weather season.

Keywords

Surveillance; Heat; Morbidity; Mortality

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