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Evaluating the relationship between heat-related ED visits and weather variables

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Objective

Correlation and linear regression analyses were completed to evaluate the relationship between a heat-related illness (HRI) classifier using emergency department (ED) chief complaint data and specific weather variables as predictors, in Ohio.

Introduction

The ability to estimate and characterize the burden of disease on a population is important for all public health events, including extreme heat events. Preparing for such events is critical to minimize the associated morbidity and mortality (1,2). Since there are delays in obtaining hospital discharge or death records, monitoring of ED visits is the timeliest and an inexpensive method for surveillance of HRI (1). Aside from air temperature, other environmental variables are used to issue heat advisories based on the heat index, including humidity and wind (3). The purpose of this study was to evaluate the relationship between HRI ED visits and weather variables as predictors, in Ohio.

Methods

Syndromic surveillance data from ED visits were collected and analyzed from Ohio's syndromic surveillance application, Epi-Center, for July 2011. Since the physical effects of HRI can vary greatly and affect multiple body systems, a specific classifier was created to query ED visits that were likely related to HRI and was defined as chief complaints referencing heat 'exhaustion or exposure', dehydration or hyperthermia. Measurements for weather variables included temperature, dew point, humidity, pressure and wind speed. The average daily values of these variables were calculated from seven geographically representative cities in Ohio and used as a surrogate for statewide data. These data were obtained from Weather Underground, which collects data from Automated Surface Observations System (ASOS) stations located at airports throughout the United States. These data were analyzed via time-series analyses and stratified by age group and gender. Correlation and linear regression analyses were performed, using SAS v 9.2 to determine which weather variables were the best predictors of HRI, as defined by ED chief complaint data.

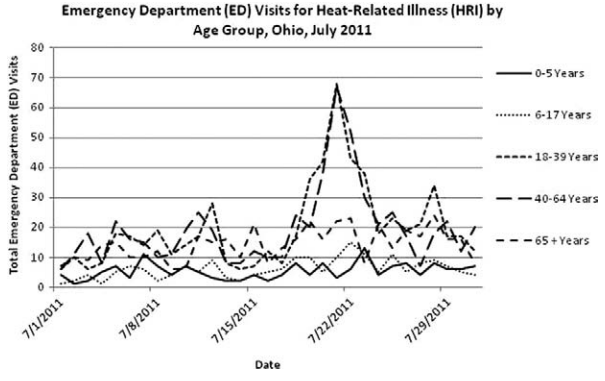

Fig. 1.

Results

During the third week of July 2011, Ohio experienced a heat wave with multiple heat advisories throughout its various cities. The total ED visits related to HRI peaked on July 21 (n = 170, 107 males, 63 females), which was also the day with the highest maximum temperature (97.4 F). A time-series chart of these ED visits by age group is shown below. The data show that the most sensitive populations (ages 0-5 and 65 and older) were the least affected and likely were adhering to the heat advisories. The 18–39- and 40–64-year-old age groups were most affected by the heat. Pearson correlation showed a strong relationship between HRI visits and mean temperature and dew point ($r = 0.76$ and $r = 0.66$), $p < 0.0001$. Multiple linear regression analyses were completed to determine which weather variables were the best predictors with HRI. The best model showed that for every 1 unit increase in ED visits, there was a 3.88 unit increase in mean temperature, independent of mean humidity and wind speed, $p < 0.0001$. The addition of mean dew point caused the model to have a high colinearity and was removed from the model.

Conclusions

These results suggest the advisories provided to the public during the heat wave in Ohio were most adhered to by the sensitive populations (very young and elderly). Middle-aged males were most susceptible to HRI during the peak of the heat wave. Temperature and dew point showed a strong relationship with HRI and were modeled as significant predictors of HRI. Additional analyses should be completed to further evaluate this relationship. Finally, obtaining patient diagnosis records from the hospital EDs would provide strength in validating the observed results.

Keywords

Heat-related illness; weather; predictor; classifier; correlation

References

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Citation: Emerging Health Threats Journal 2011, **4**: 11080 - DOI: 10.3402/ehtj.v4i0.11080
(page number not for citation purpose)