AMBIENT TEMPERATURE AND BIOMARKERS OF HEART FAILURE: A REPEATED MEASURES ANALYSIS

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Background and Aims: Extreme temperatures have been associated with increases in hospitalization and death from cardiovascular disease, and individuals with heart failure (HF) may be particularly vulnerable. We investigated associations between outdoor temperature (0-4 day moving averages) in the Boston area and biomarkers of inflammation and myocyte injury in a repeated-measures study of individuals with stable HF. We hypothesized that extreme temperatures would be associated with adverse effects, and that humidity would exacerbate these associations in the warm season.
Methods: We analyzed data from a completed clinical trial of 100 patients with HF randomized to 12 weeks of tai-chi classes or HF education control supplementing usual care. B-natriuritic peptide (BNP), C-reactive protein, and tumor necrosis factor-alpha were measured at 3 timepoints (baseline, 6 and 12 weeks). Endothelin-1 was measured at baseline and 12 weeks. We used mixed-effects models to evaluate associations with temperature**.** Models were adjusted for randomization arm, medical history and socioeconomic factors, weekday, and seasonality. We examined associations across all seasons and separately for the warm and cold seasons. Models of temperature and relative humidity were compared to models of apparent temperature, a marker of perceived temperature.
Results: The 100 participants provided 285 observations from 2005-2009. Significant associations were observed only with BNP levels. A 5 °C change in the 3-day moving averages of ambient and apparent temperature were associated with 12.4% (95% Confidence Interval (CI): (1.6,24.3)) and 13.5% (95% CI: 3.6, 24.3) higher BNP. Larger estimates were observed in the warm season (March – August). Apparent temperature was a more significant correlate of BNP than temperature and humidity together. Adjustment for ambient pollution did not substantially alter these associations.
Conclusions: We observed positive associations between temperature and BNP, a marker of HF severity. The magnitude and strength of these associations was greater in the warm season.