

# Short-term Effects of Fine Particulate Matter on Heart Rate in Heart Failure Patients

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## Conclusion

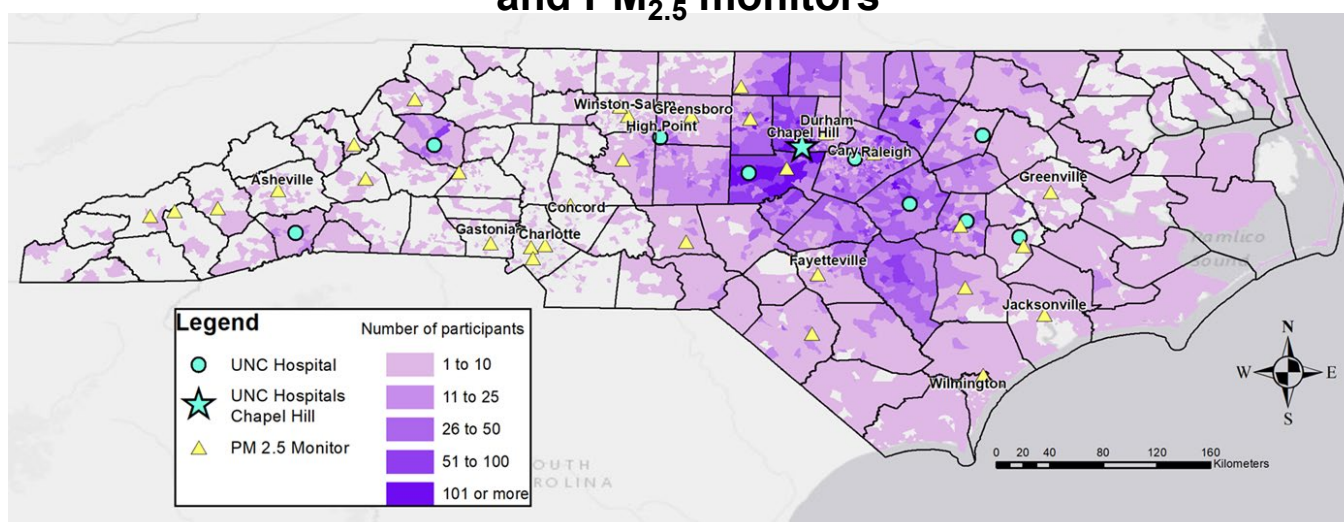
Elevated PM<sub>2.5</sub> is associated with increased heart rate in heart failure patients

### Background

- Air pollution particularly, particulate matter < 2.5 µm in diameter (PM<sub>2.5</sub>) and increased heart rate (HR) are significant risk factors for cardiovascular morbidity and premature mortality
  - yet, limited information is available for individuals with pre-existing disease
- We sought to examine:
  - the association between short-term PM<sub>2.5</sub> exposure and HR in heart failure (HF) patients, and
  - the potential effect modification by beta-blockers, a common medication class used to treat HF that modifies HR

### Results

Map of EPA CARES participant density, participating hospitals, and PM<sub>2.5</sub> monitors



### Methods

- HF Cohort:** 26,634 HF patients with 3,048,856 HR measurements taken between January 2014 and December 2016.
- PM<sub>2.5</sub>:** Satellite data, land use, and ground-based monitoring were combined to estimate daily PM<sub>2.5</sub> concentrations at 1km resolution. Immediate (lag 0), delayed (lag 1 to 4), and 5 day moving average (5dMA) exposures were computed at each primary address.
- Modeling Approach:** We used linear additive mixed models to associate PM<sub>2.5</sub> with HR while adjusting for age, sex, race, season, time-trend, daily temperature, and relative humidity, with a random intercept for individual.

	Heart Rate (N = 3 048 856)	Systolic (N = 2 553 553)	Diastolic (N = 2 546 880)
	Mean (SD)	Mean (SD)	Mean (SD)
Age (y)	66.8 (14.4)	67.4 (14.4)	67.4 (14.3)
Heart Rate (bpm)	82.2 (17.2)	81.8 (17.1)	81.8 (17.1)
Systolic Blood Pressure (mmHg)	127.4 (25.2)	127.4 (25.2)	127.4 (25.1)
Diastolic Blood Pressure (mmHg)	68.5 (14.4)	68.5 (14.4)	68.5 (14.4)
PM <sub>2.5</sub> (µg/m <sup>3</sup> )	8.95 (4.58)	8.96 (4.55)	8.96 (4.55)
Air temperature (°C)	16.8 (8.41)	16.8 (8.43)	16.8 (8.42)
Relative humidity (%)	66.5 (21.3)	66.5 (21.1)	66.5 (21.1)
Medication	N (%)	N (%)	N (%)
Beta Blocker	2 347 821 (77.0)	1 958 068 (76.7)	1 952 839 (76.7)
Calcium Channel Blocker	1 435 207 (47.1)	1 196 654 (46.9)	1 193 894 (46.9)
Antihypertensive	1 860 080 (61.0)	1 552 152 (60.8)	1 548 218 (60.8)
Diuretic	2 587 316 (84.9)	2 127 703 (83.3)	2 122 315 (83.3)
Study Subject	N (%)	N (%)	N (%)
Number of Individuals	26 634 (100)	26 654 (100)	26 655 (100)
African American	7 565 (28.4)	7 569 (28.4)	7 569 (28.4)
European American	18 168 (68.2)	18 184 (68.2)	18 185 (68.2)
Other Race	901 (3.4)	901 (3.4)	901 (3.4)
Male	13 829 (49.5)	13 847 (49.5)	13 846 (49.5)

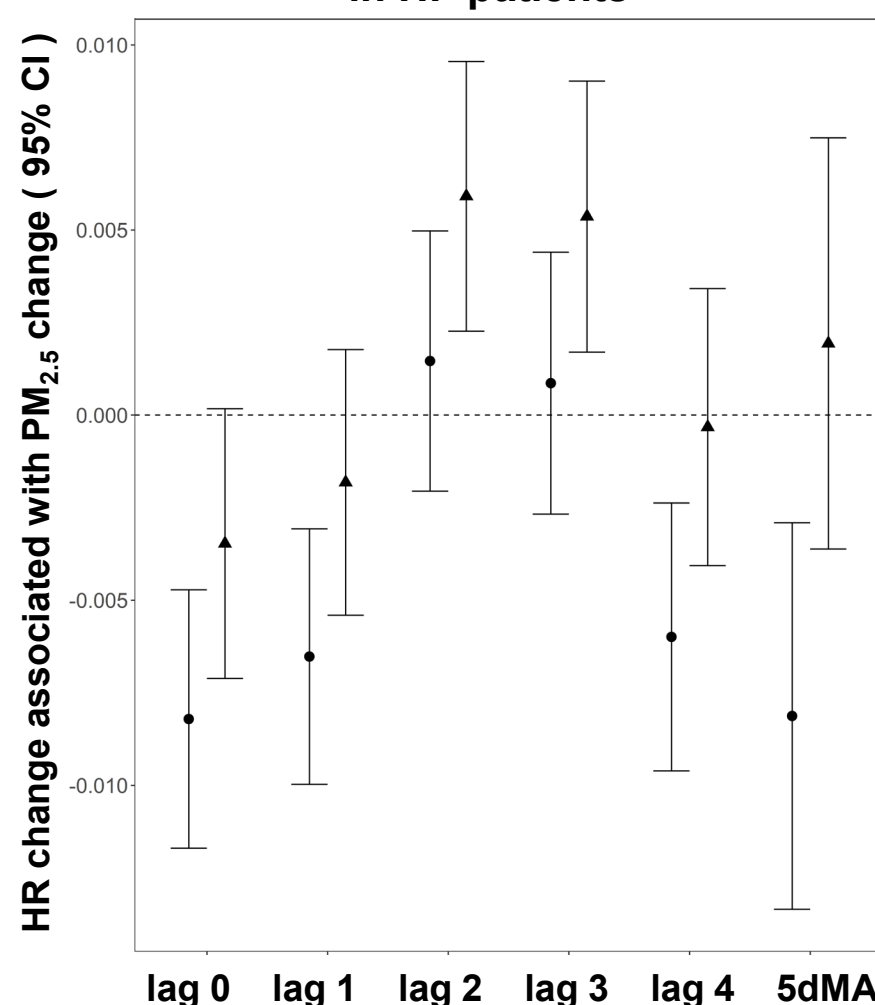
### Discussion

- Effect estimates of associations are small but consistent only in those time periods when people were not on beta-blockers
- Associations with heart rate indicate potential autonomic nervous system regulation by PM<sub>2.5</sub> with effect modification by beta-blocker medications

### Disclaimer

This work does not necessarily represent the views or policy of the US EPA. Any mention of tradenames does not constitute endorsement

Association between PM<sub>2.5</sub> and HR in HF patients



Subgroup: No Beta-Blocker Use

