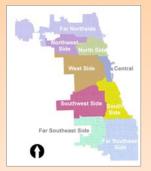# Mapping out the "hotspots":
# Examining the spatial patterns of heat morbidity in Chicago, Illinois

Chona Sister[1], Christopher Boone[2,3], Jay Golden[3,4], Donna Hartz[5], Wen-Ching Chuang[3,4]

In the face of global climate change, we face the likelihood of extreme weather events, and in turn, greater risk to disasters. Emphasizing that disasters result from the impact of hazards on vulnerable people, and that vulnerability varies differentially across a population, the present study seeks to examine the socio-economic factors that may render specific groups vulnerable to extreme heat events. Ultimately, results of this place-based vulnerability study, along with climate data, will help anticipate impacts of extreme heat events, and as such, inform mitigation and adaptation strategies for these.

## The study site



Chicago, Illinois and its neighborhoods
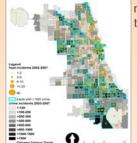
## Data sets used

Heat morbidity:
- 2003 to 2007 Heat-related dispatch data

Explanatory variables:
- 2000 Census tract variables as indices to:
  - neighborhood social ties
  - neighborhood-level socio-economic status
  - proportion of highly vulnerable or marginalized individuals (relative to race, age, sex and isolation)
- 2003 to 2007 Crime incident data

## Results

Pearson's r correlating heat incidents with the variables

| | 2003-2007 heat |
|---|---|
| 2003-2007 crime | 0.512 |
| pop count | 0.288 |
| over 65 yrs old count | 0.282 |
| % seasonal | 0.242 |
| % HH alone | 0.233 |
| % no vehicle | 0.183 |
| % 1 room | 0.182 |
| % Hispanic | -0.178 |
| % Black | 0.159 |
| % institutionalized | 0.124 |
| % renter | 0.118 |
| % female over 65 yrs old | 0.108 |
| % HH alone over 65 yrs old | 0.101 |
| pop density | 0.099 |
| % over 65 yrs old | 0.083 |
| owner vacancy rate | 0.075 |
| renter vacancy rate | 0.072 |



Heat incidents from 2003 to 2007

Using a regression model, the explanatory variables were not good predictors of heat incidents ($r^2 < 0.03$). However, grouping the tracts according to certain characteristics and running the regression across these 'subgroups' improved the ability of various combinations of the variables to predict heat incidents. Four of these subgroups are shown below.

### Tracts with >500 crime incidents



$r^2 = 0.429$
the explanatory variables:
- 2003-2007 crime
- % seasonal
- owner vacancy rate
- % 1 room
- % in group quarters
- % HH alone
- % HH alone & over 65 yrs old
- % over 65 years old
- % Hispanic (-)
- % no vehicle
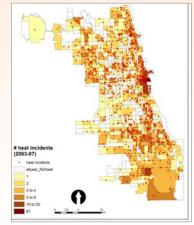
### Tracts with >20% poverty



$r^2 = 0.342$
the explanatory variables:
- population count
- 2003 to 2007 crime incident
- % African American
- population over 65 yrs old
- % householder alone
- % separated
- % widowed
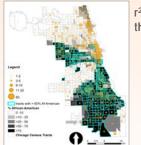- % divorced
- % naturalized
- % no vehicle
- % 1 room

### Tracts with >60% African American



$r^2 = 0.311$
the explanatory variables:
- 2003 to 2007 crime incident
- population count
- population over 65 yrs old
- % female over 65 years old
- % householder alone
- % naturalized
- % institutionalized

### Tracts with >500 over 65 years old



$r^2 = 0.496$
the explanatory variables:
- population count
- 2003 to 2007 crime incident
- % seasonal
- owner& renter vacancy rate
- % public assistance
- % poverty
- % no vehicle
- % 1 room
- % no fuel
- % no phone
- % householder alone
- % African American
- % separated
- % never married
- % divorced

## Summary of findings

- heat incidents are correlated with crime incidents, only to a lesser degree with the other variables

- "breaking apart" the City of Chicago into subgroups (e.g, high-crime areas, high poverty areas, areas with high proportion of elderly population, areas with high proportion of African-Americans), a combination some of the variables are able to predict 30 to 50% of the heat incidents

- there is no "one model" that can predict heat incidents across the City

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