Vulnerability to heat exposure at the county level in Florida

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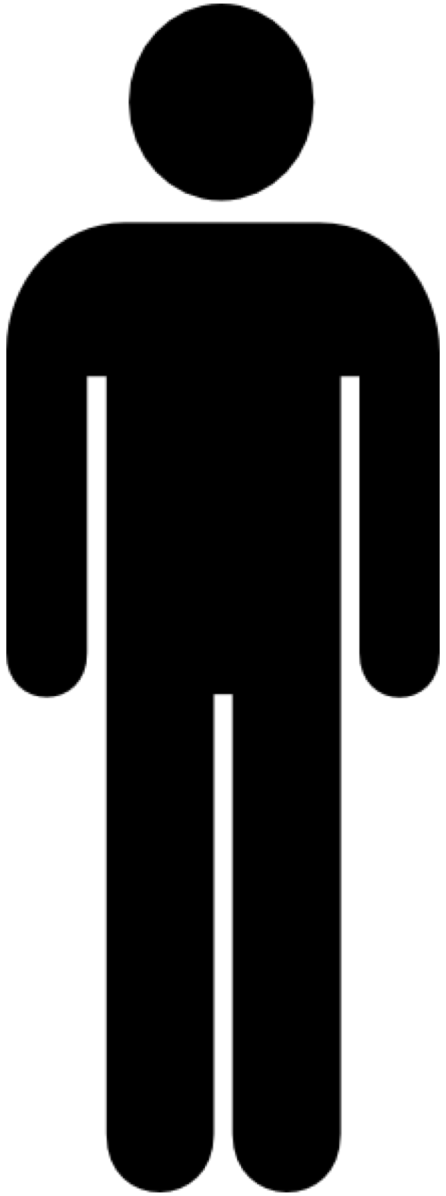
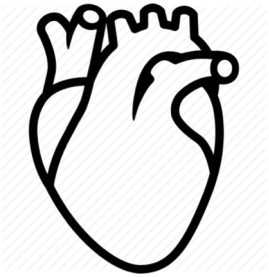
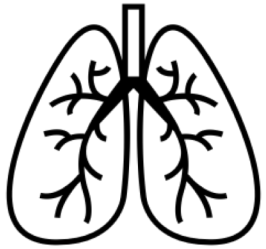
Background

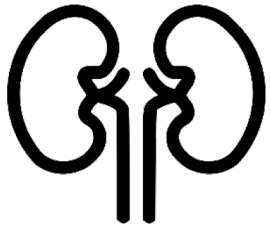




Cardiovascular illness



Respiratory illness



Renal illness

Dehydration

Heat-related illness

Cardiovascu
illness

piratory
ness

Excess deaths & illnesses

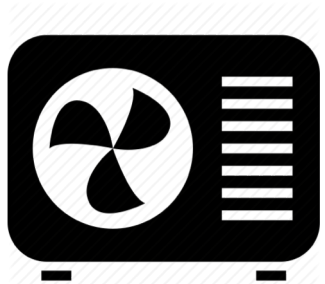
- **Europe in 2003: 15,000 Chicago in 1995: 700**

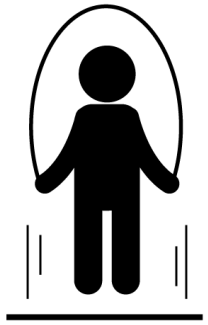
Renal
illness

Dehydration

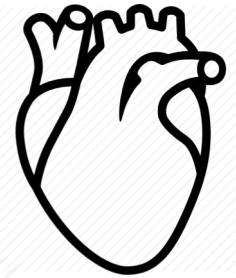
Heat-related
illness

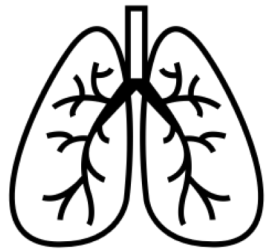
The impact of heat waves vary regionally

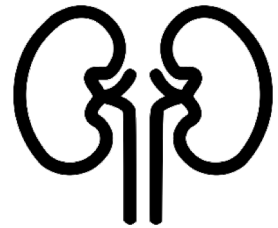




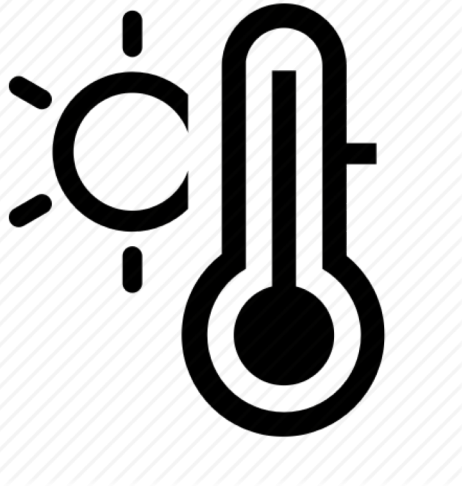
Behavioral pattern

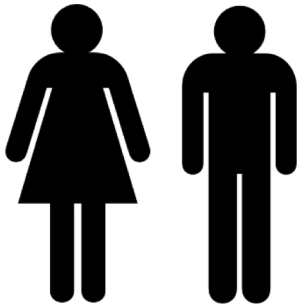


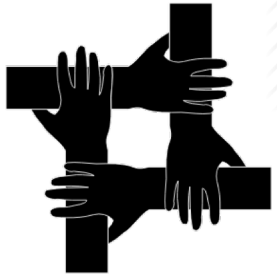




physiological acclimatization





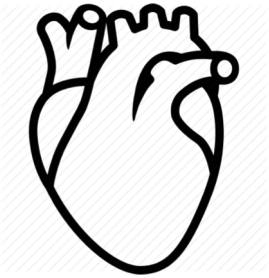


Demographic/socioeconomic factors

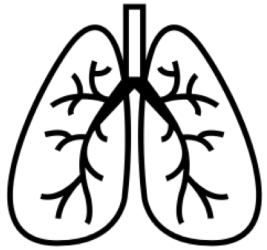
Other factors

Purpose

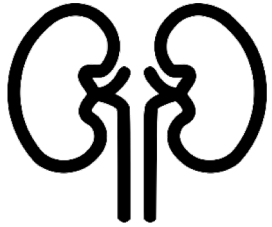
1) risk of heat exposure for each disease category (up to lag 5days)



Cardiovascular illness



Respiratory illness



Renal illness

Dehydration

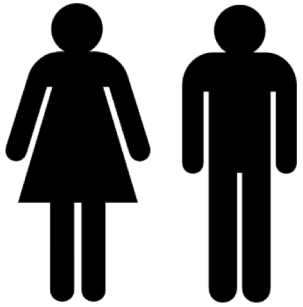
Heat-related illness

To know which disease is more sensitively related to heat exposure

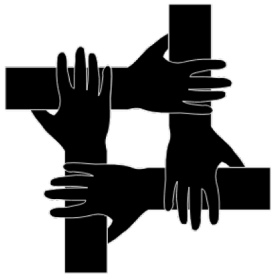
Purpose (Cont.)

2) risk of heat exposure for each subgroup

Age



Sex



Race / Ethnicity

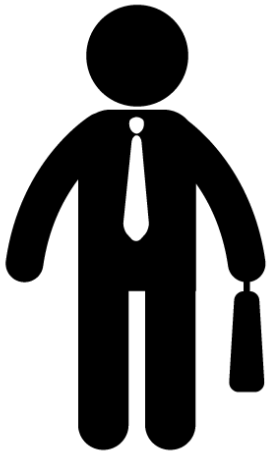
To know whether the impact of heat exposure is modified by age, sex, and race/ethnicity

Purpose (Cont.)

3) Spatial patterns of heat-related risk

Income

House

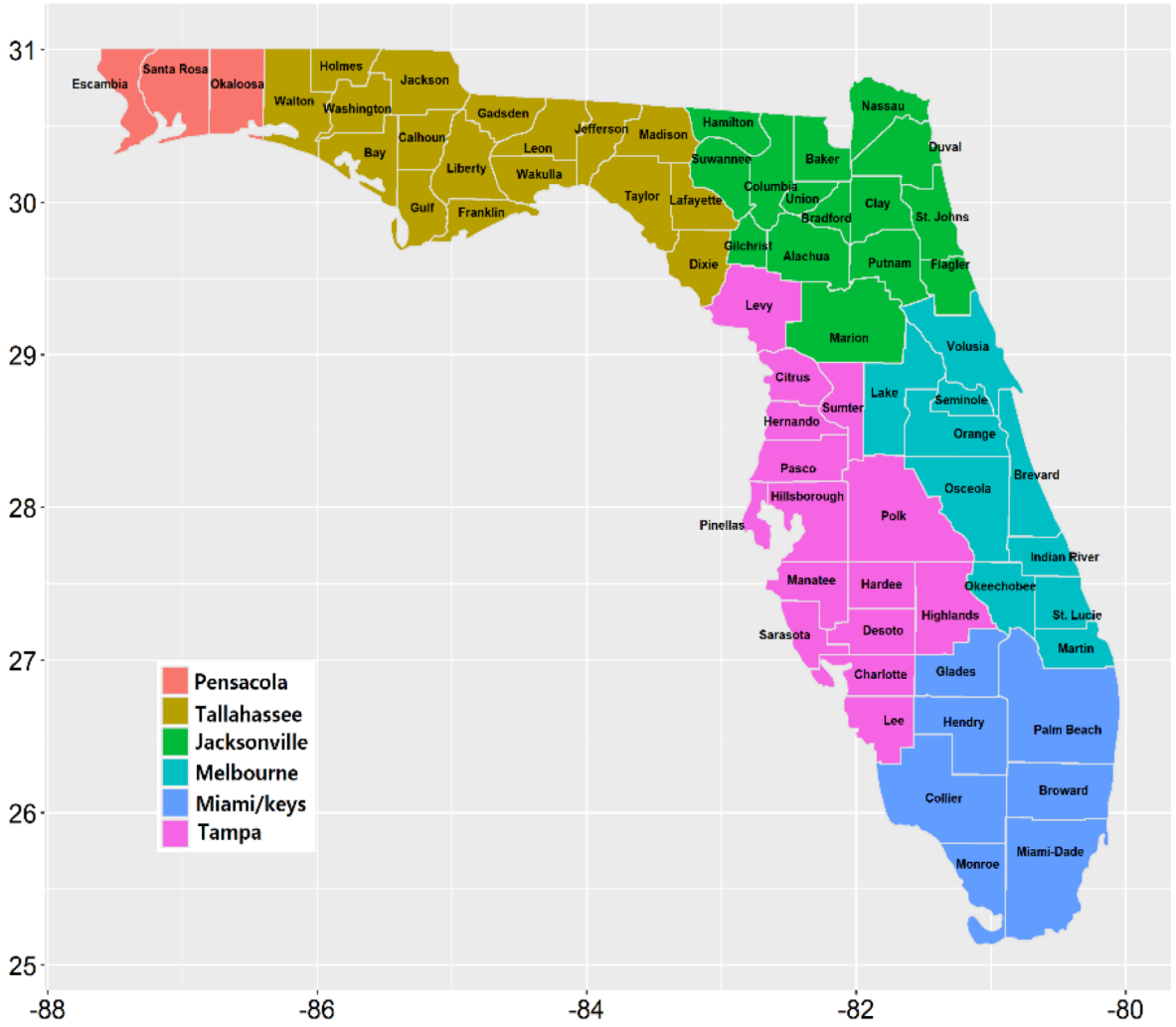


Employment

To find the relationship between the heat-related risk and county level socioeconomic/demographic variables

Research period and area

- Period: 2008 – 2012
  (May through September)
- Area: FL State at the county level (67 counties)
- (for simplicity) 67 counties to 6 sub-regions based on National Weather Service regions in Florida



Data

1) Health Outcome:

- Cardiovascular, dehydration, heat-related illness, renal and respiratory illness
- Emergency department (ED) and hospitalization admission (HSP)
- Age, sex, race/ethnicity

2) Weather data (NLDAS 2)

- Daily maximum temperature
- Daily minimum temperature
- Daily average temperature
- Discomfort index

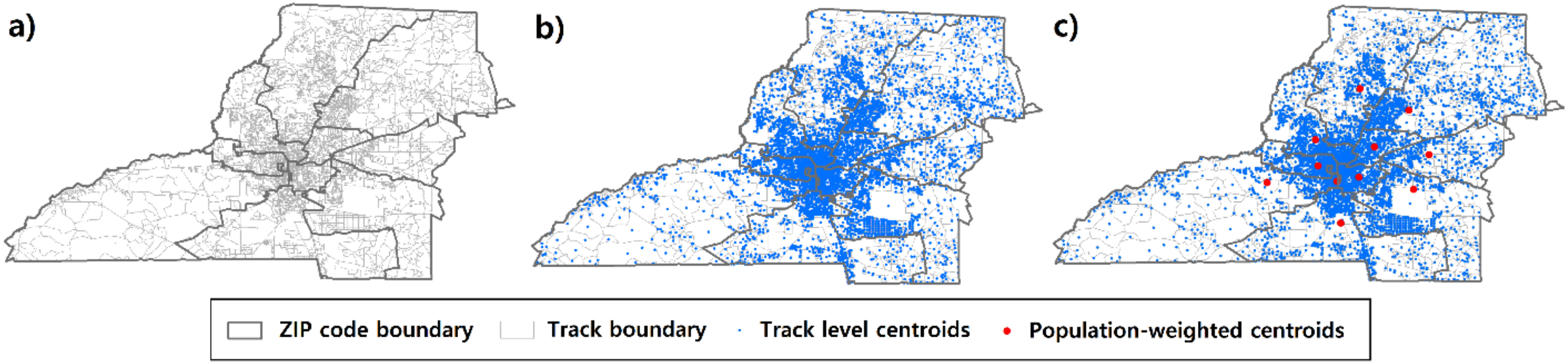
Data (Cont.)

3) 27 Demographic/socioeconomic variables at the county level (ACS)

Age: 1) median age, 2) population under 5, 3)over 65, 4) over65 and over in nursing facilities
sex: 1) female
race/ethnicity: 1) Anglo Americans, 2) African Americans, 3) other races, 4) Hispanic
One-parent family
Employment: 1) labor force, 2) unemployment rate, 3) farming occupation, 4) construction occupation, 5) installation occupation, 6) services occupation
Capital: 1) income, 2) gross rent, 3) house value, 4) households earning $10,000 or less, 5) earning $200,000 or more, 6) receiving food stamps, 7) population living below poverty level, 8) households having no car, 9) population with less than a high school diploma, 10) limited English proficiency, 11) median year structure built

Methodology

- Population-weighted centroid

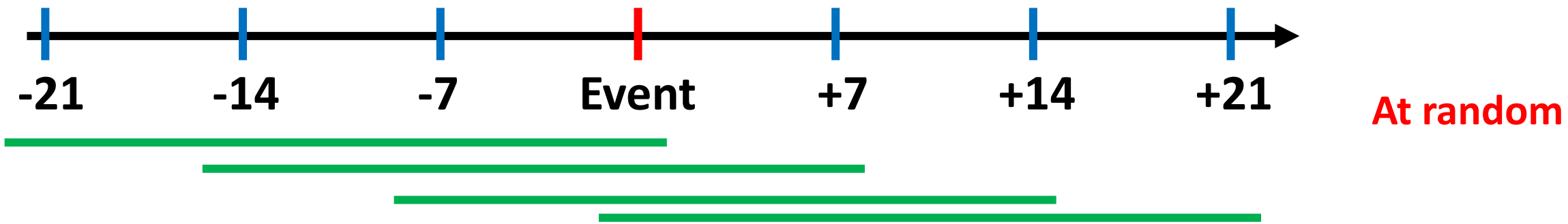


To link health data and temperature data

Methodology (case-crossover design)

- Study transient effects on risk of acute health events
- Semi-symmetric bidirectional, time-stratified design

- Comparing exposure levels for a given day (t) when outcome occurs vs. levels before (t – 7,14,21) or after (t + 7,14,21) the outcome
- Referent selection: ±7, ±14, ±21 (to control for weekly cycle)
- Stratum Window

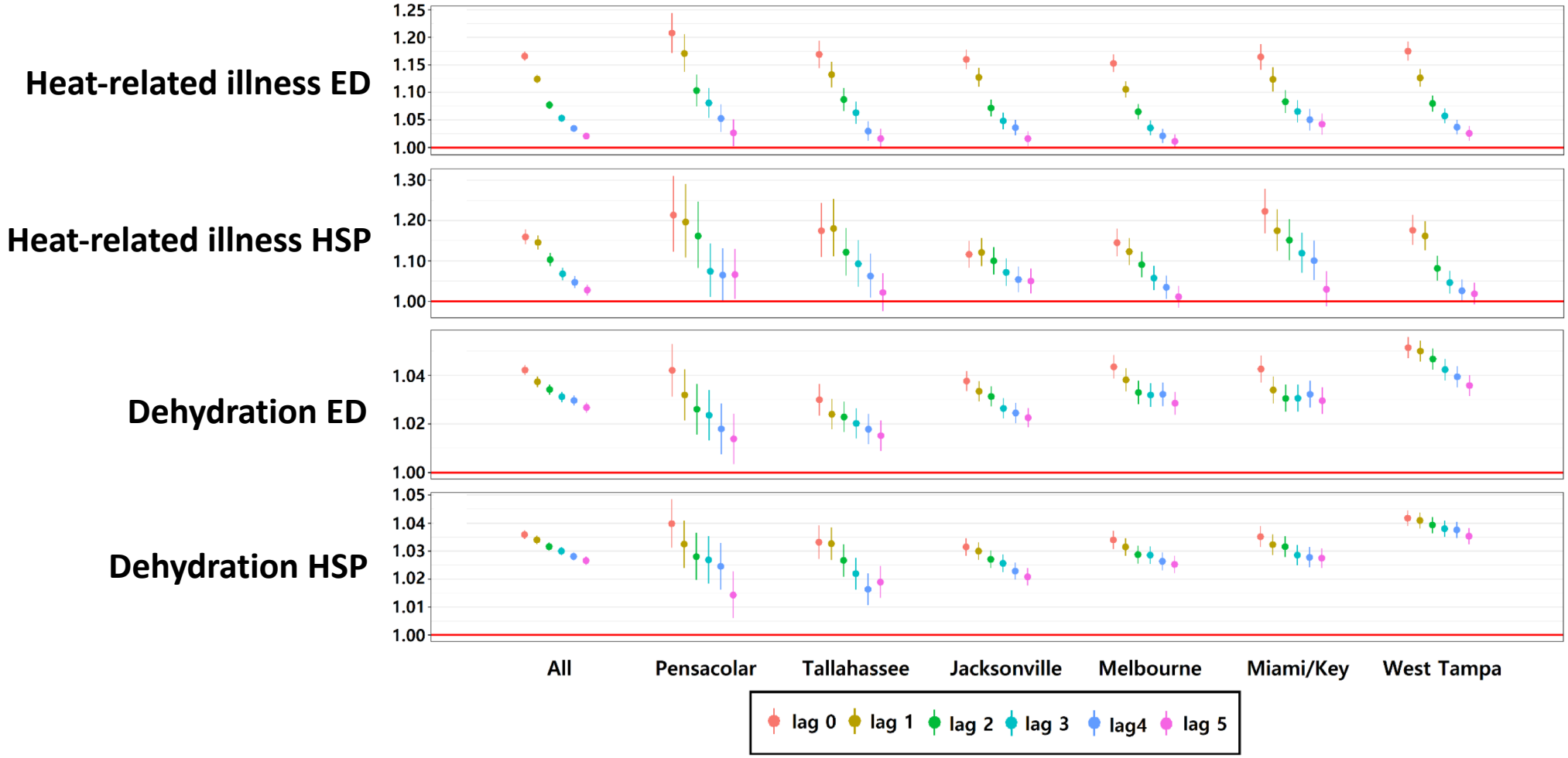


Methodology (Conditional logistic regression)

- The OR represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure for an increase of 1.0 unit change.
- OR=1 Exposure does not affect odds of outcome
  OR>1 Exposure associated with higher odds of outcome
  OR<1 Exposure associated with lower odds of outcome

- Washout period
  - 7 days for heat-related illnesses, respiratory diseases, dehydration
  - 28 days for cardiovascular and renal diseases

Result 1: Risk of heat exposure for each disease category



- HRI ED (1.15), HSP (1.15), dehydration ED (1.04) HSP (1.03)
- No lag effects
- Pensacola and Tampa showed high ORs

Result 1: Risk of heat exposure for each disease category

cardiovascular illness ED

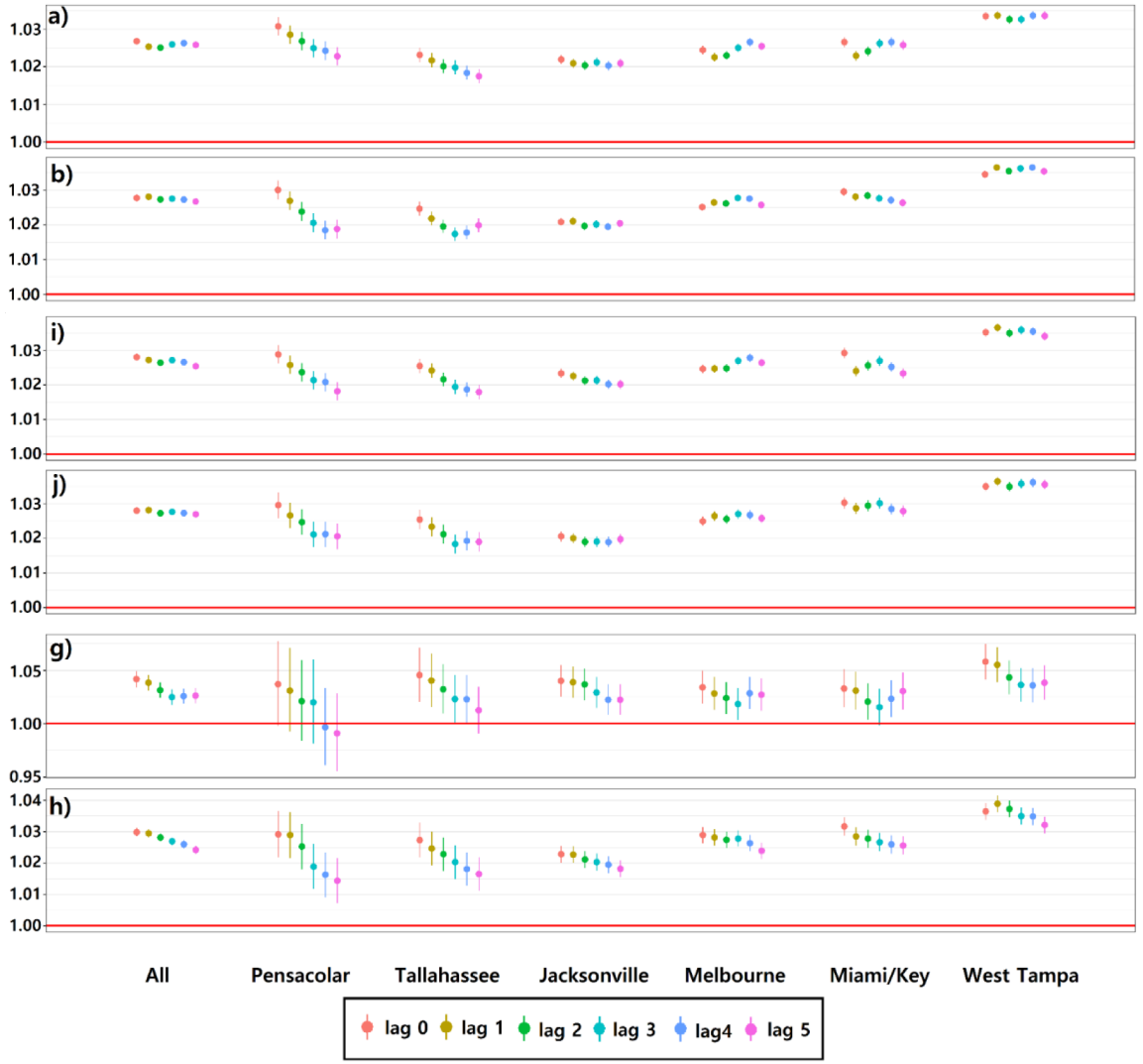
cardiovascular illness HSP

respiratory illness ED

respiratory illness HSP

renal illness ED

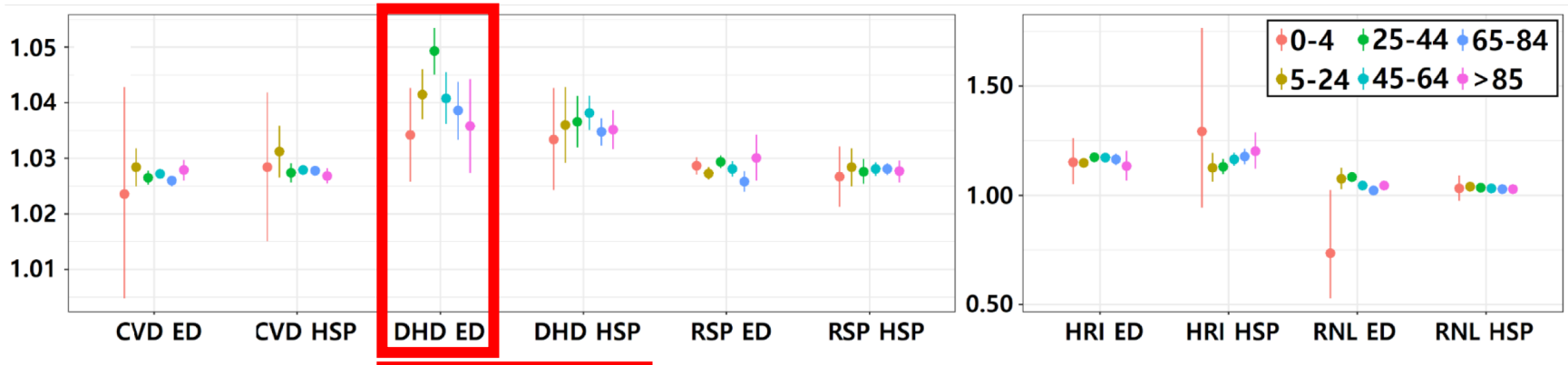
renal illness HSP



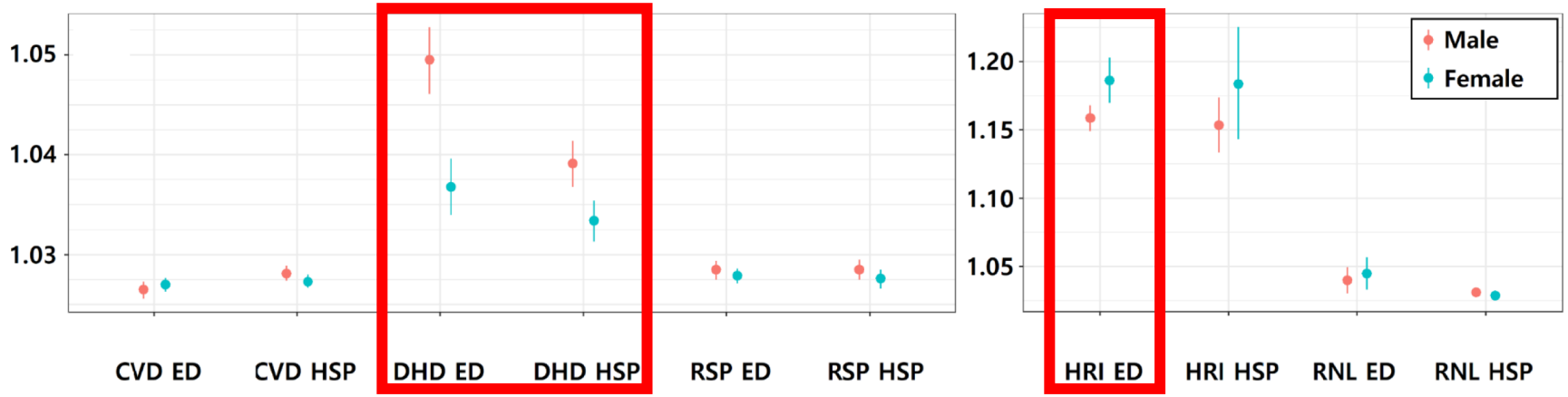
- Cardiovascular, respiratory, renal illness: 1.02 ~ 1.03
- No lag effects
- West Tampa showed high ORs

Result 2: Risk of heat exposure for each subgroup

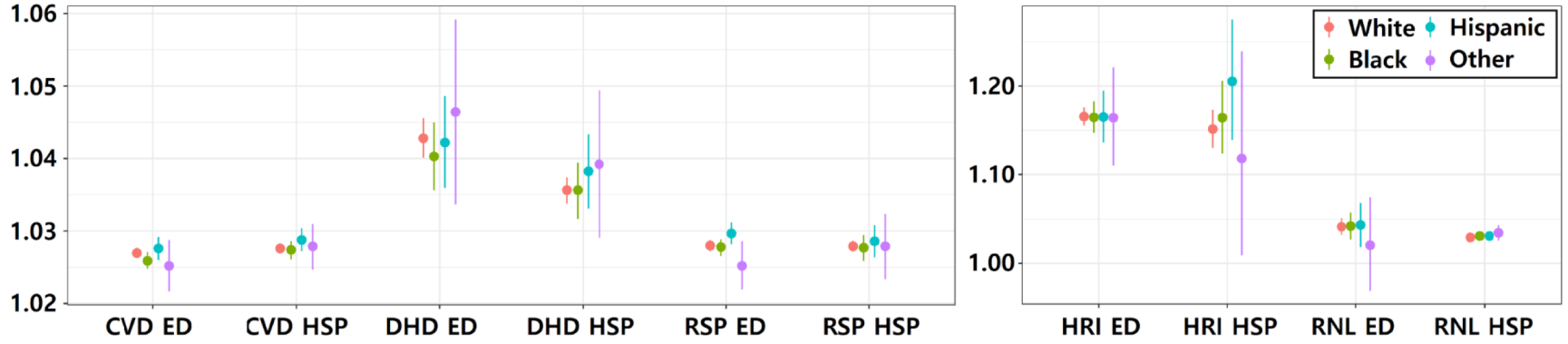
Age



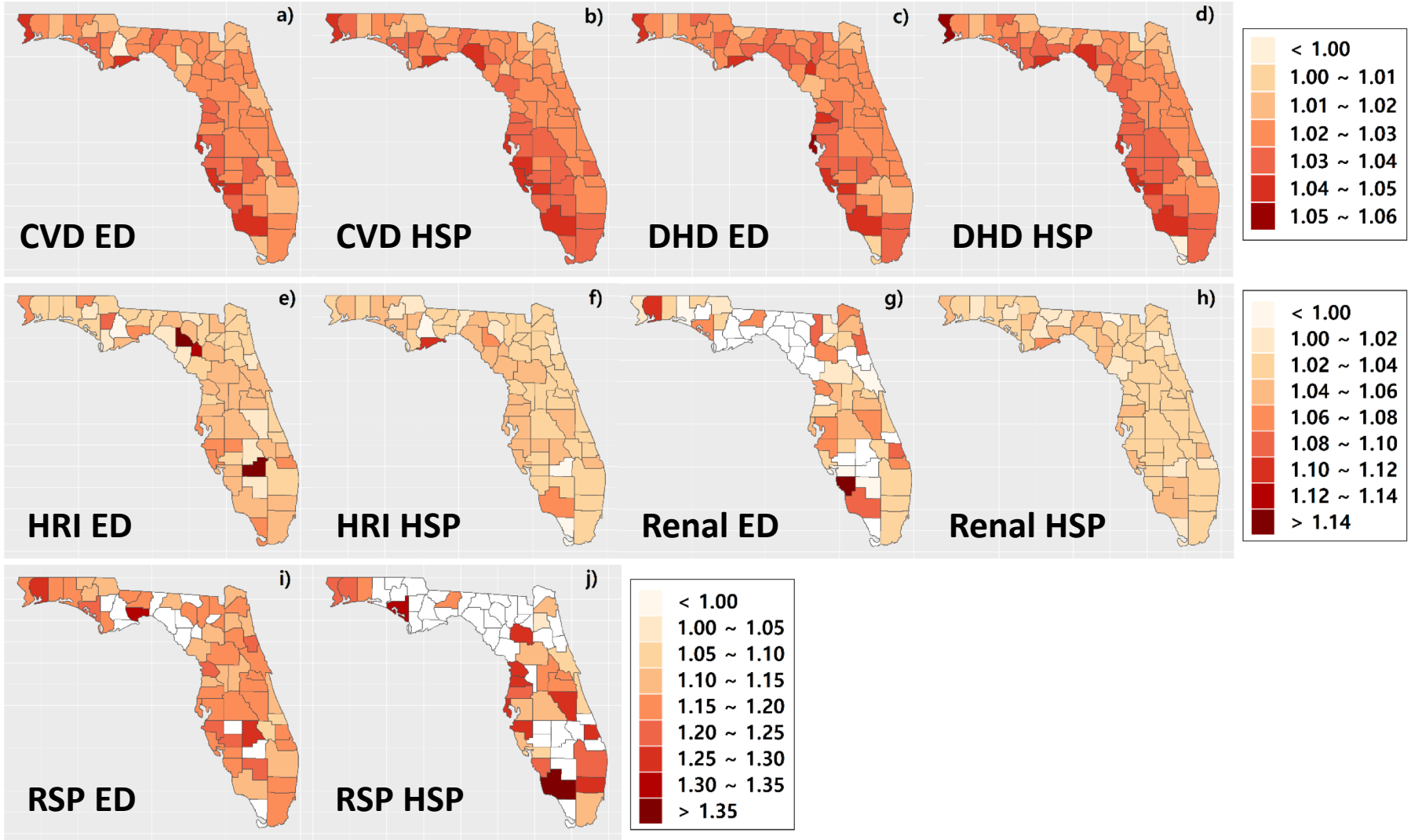
Sex



race/ ethnicity



Result 3: Spatial patterns of risk

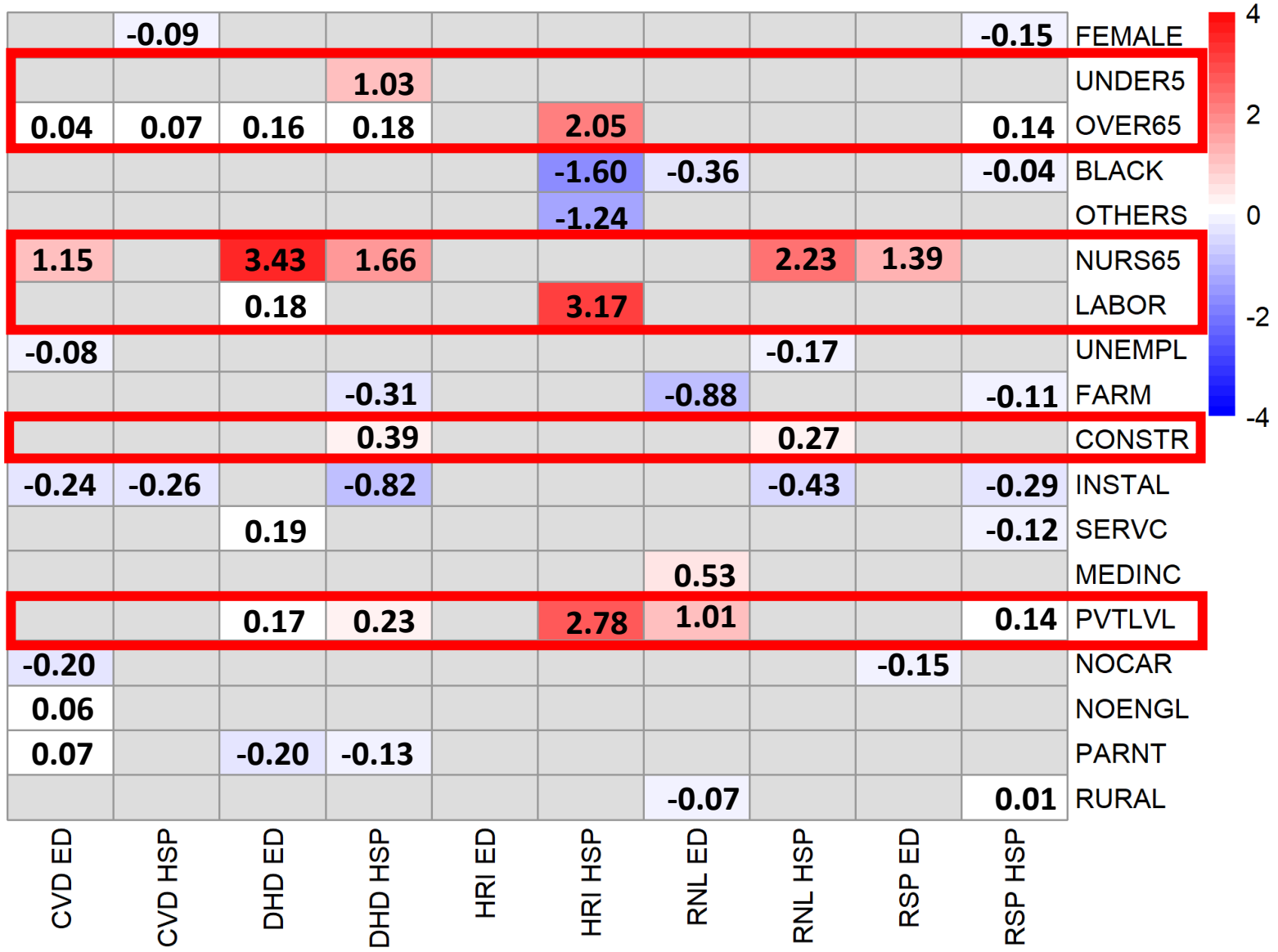


To understand the spatial patterns of risk, I used spatial lag model or GLMs

Result 3: Relationship between risk and socioeconomic variables

Positive associations

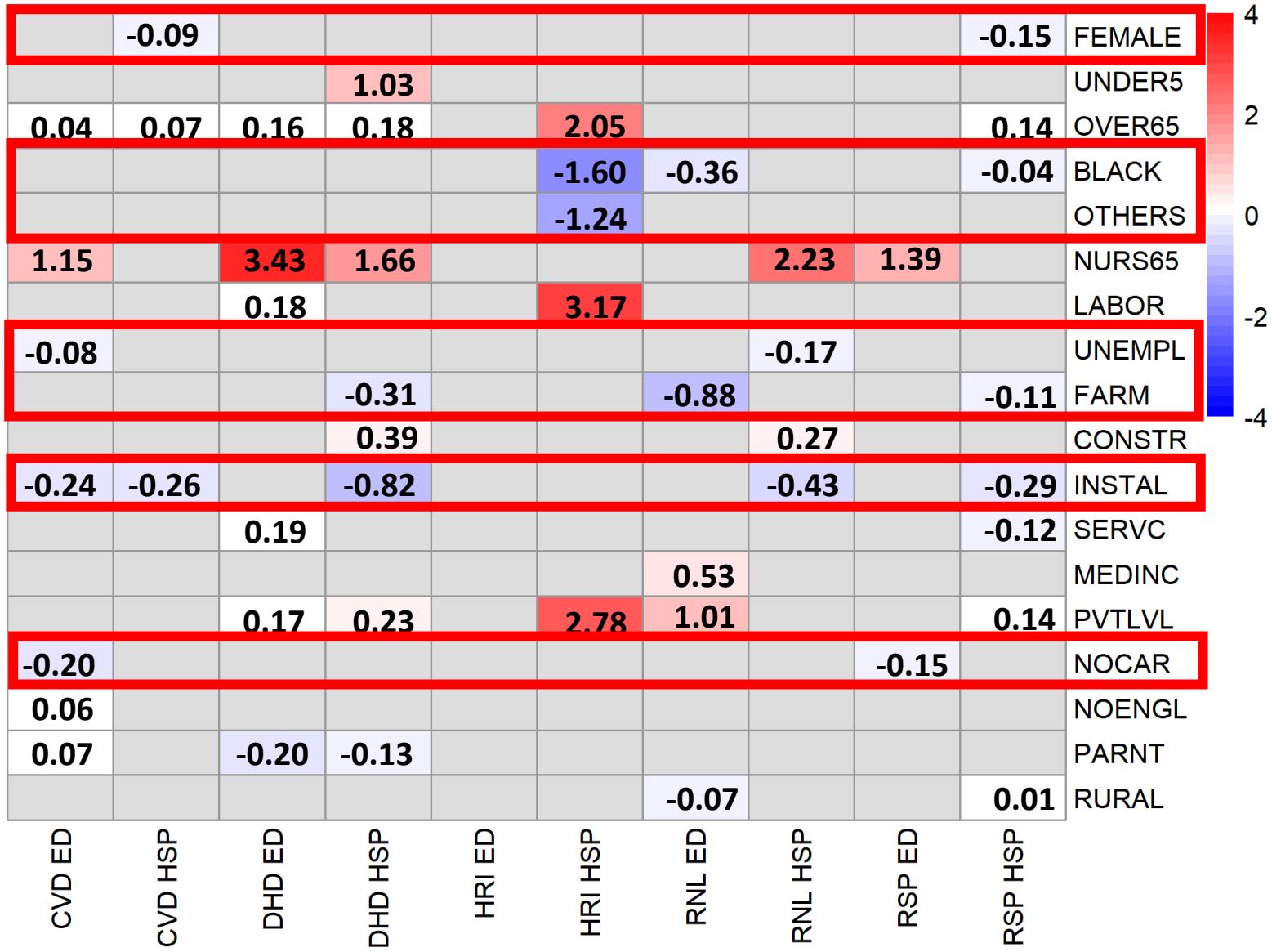
- Percent of population under 5
- Percent of population over 65
- Percent of population who are 65 and over in nursing facilities
- Percent of population 16 and older (labor force)
- Percent of the employed population 16 and older employed in construction and extraction occupations
- Percent of population 16 and older living below poverty level



Result 3: Relationship between risk and socioeconomic variables

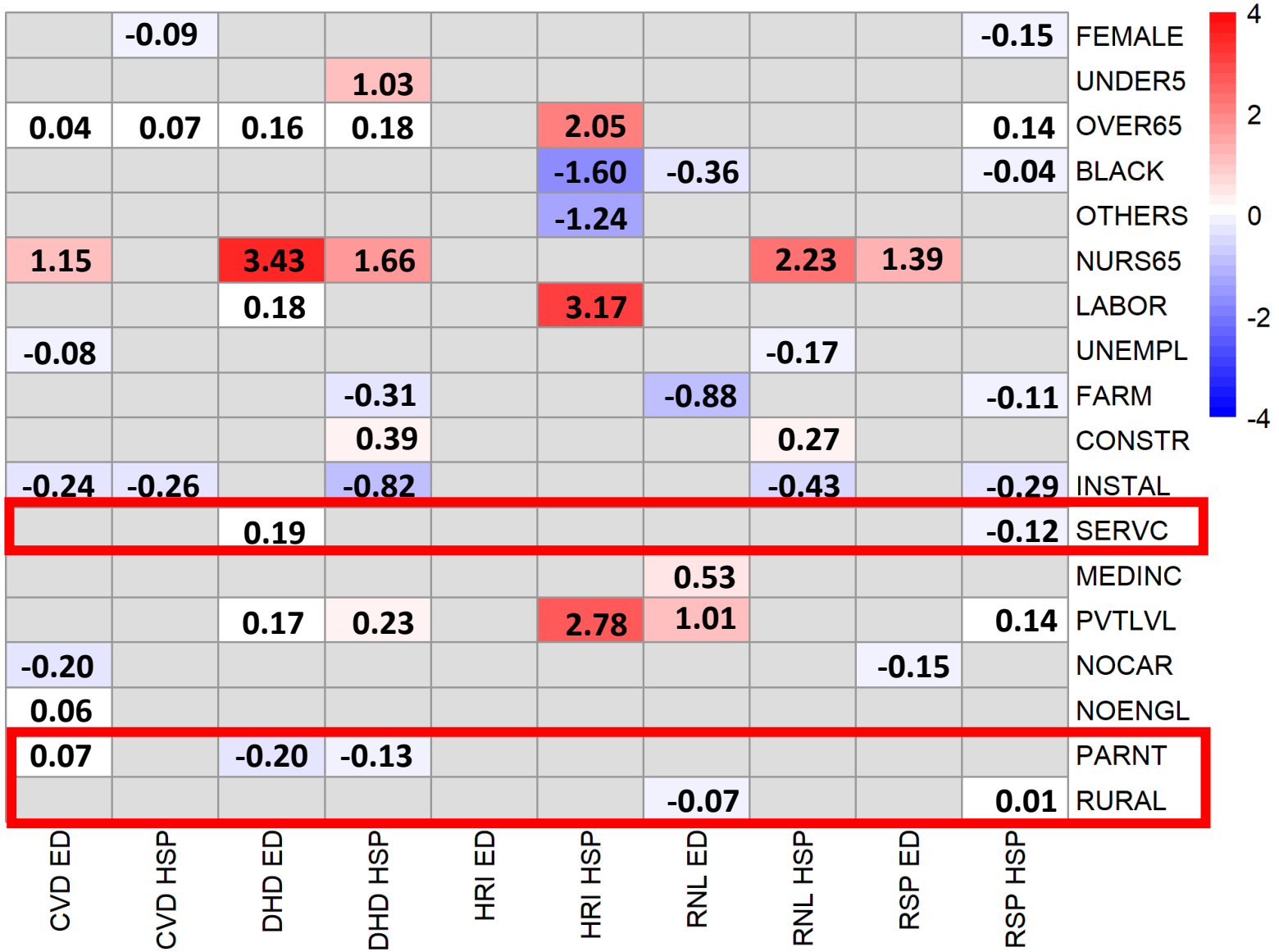
Negative associations

- Percent of population who are female
- Percent of population who are African Americans
- Percent of population who are other races
- Percent of population 16 and older who are not employed
- Percent of the employed population 16 and older employed in farming, fishing, mining, and forestry occupations
- Percent of the employed population 16 and older employed in installation, maintenance, and repair occupations
- Percent of housing units with no automobile



Result 3: Relationship between risk and socioeconomic variables

- Percent of the employed population 16 and older employed in services
- Percent of own children under 18 living in one-parent families
- Percent of population living in rural block groups



Summary

- Risk:
  Heat-related illness (1.15) > dehydration (1.04) > cardiovascular, respiratory, and renal illness (1.02 ~1.03)

- Subgroup:
  Age: dehydration age group btw 25-44 (1.05)
  Sex: dehydration M < F, Heat-related illness M > F
  Race: no significant difference

Summary

- Demographic/socioeconomic factors:
  Negative association:
  Female: cardiovascular, respiratory illness
  Black: heat-related, renal illness
  Other races: heat-related illness

  Positive association
  Under5: dehydration
  Over65: cardiovascular, dehydration, heat-related respiratory illness
  Nursing65: cardiovascular, dehydration, heat-related respiratory illness
  Construction: deh hsp (0.39) renal hsp (0.27)

Thank you

Jihoon Jung
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Data (Cont.)

3) 29 Demographic/socioeconomic variables at the county level

	Description
Age	Median age (years)
	Percent of population under 5
	Percent of population over 65
	* Percent of population who are 65 and over in nursing facilities
Sex	Percent of population who are female
Race/ Ethnicity	Percent of population who are Anglo Americans
	Percent of population who are African Americans
	Percent of population who are American Indian, Alaska Native, Asian, Native Hawaiian, other Pacific Islander, or other races
	Percent of population who are Hispanic
One-parent	Percent of own children under 18 living in one-parent families
Employment	Percent of population 16 and older (labor force)
	Percent of population 16 and older who are not employed (unemployment rate)
	Percent of the employed population 16 and older employed in farming, fishing, mining, and forestry occupations
	Percent of the employed population 16 and older employed in construction and extraction occupations
	Percent of the employed population 16 and older employed in installation, maintenance, and repair occupations
	Percent of the employed population 16 and older employed in services
Capital	Average income earned per person (Per capita income) ($)
	Median household income ($)
	Median gross rent ($)
	Median house value ($)
	Percent of households earning $10,000 or less
	Percent of households earning $200,000 or more
	Percent of households receiving food stamps/SNAP
	Percent of population 16 and older living below poverty level
	Percent of housing units with no automobile
	Percent of housing units that are mobile homes
	Percent of population 25 years or older with less than a high school diploma
	Percent of population 5 and older speaking English as a second language with limited English proficiency (those who speak English not very well or not at all)
	Median year structure built