Identifying Disparities in the Relationship between Neighborhood Walkability and Active Transportation Crashes Within South Carolina

Anna Chupak, BS, Shirelle Hallum, MPH, Kelsey Thomas, BA, Eleanor Witherspoon, Erin Looney, BS, Andrew Kaczynski, PhD

Arnold School of Public Health, University of South Carolina

American Public Health Association Annual Meeting

November 14th, 2023

beach lab

Built Environment and Community Health Laboratory

STUDY TEAM

ANDY KACZYNSKI, PhD

Principal Investigator

SHIRELLE HALLUM, MPH

Project Manager

ANNA LOUISE CHUPAK, BS

Graduate Assistant

ERIN LOONEY, BS

Graduate Assistant

KELSEY THOMAS, MPH

Graduate Assistant

ELEANOR WITHERSPOON, BS

Undergraduate Assistant

Background

- Infrastructure supports for walking and bicycling in communities is associated with a range of health benefits:

- Rates of physical activity are lower among people from socioeconomically disadvantaged backgrounds, potentially due to poor infrastructure and other barriers to active transportation

- Little research has evaluated how characteristics of the built environment are associated with pedestrian and bicyclist safety, or how this association may differ by neighborhood disadvantage

Purpose

To examine the relationship between neighborhood walkability and pedestrian and bicyclist crashes, including variations by social vulnerability across census tracts in South Carolina

Aim 1: Examine the relationship between neighborhood walkability & pedestrian crashes

Aim 2: Examine the relationship between neighborhood walkability & bicyclist crashes

Aim 3: Assess how the relationship between walkability & pedestrian crashes vary by social vulnerability

Aim 4: Assess how the relationship between walkability & bicyclist crashes vary by social vulnerability

Setting

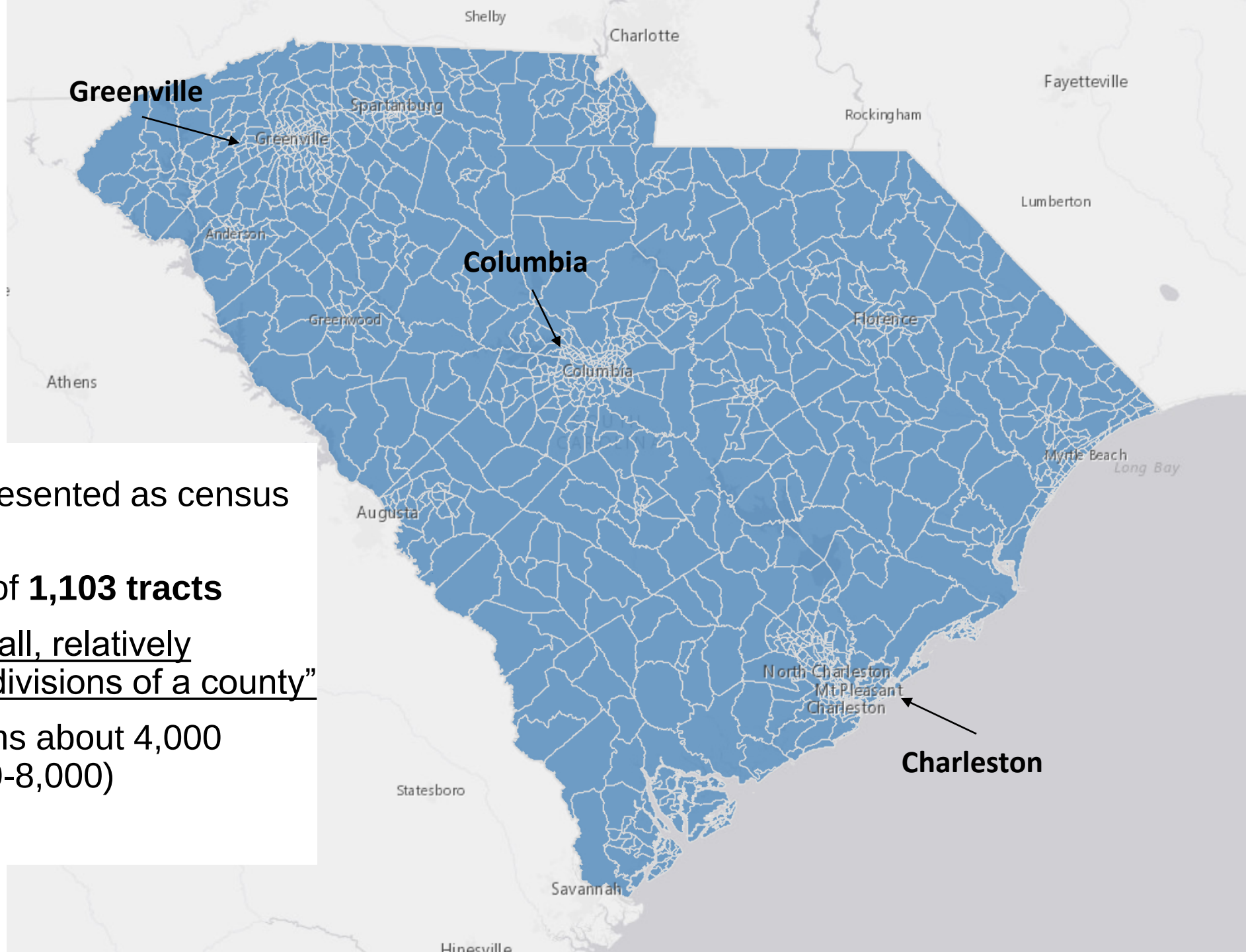
- Southeastern U.S. State of South Carolina (SC)
  - Population = **5,282,634**
  - Area = **30,064.3 square miles**.

- Diverse in race, ethnicity, age, income & education
  - **68.9%** White
  - **26.3%** Black/AA
  - **6.6%** Hispanic/Latino

  - **21.2%** < 18 years-old
  - **19.1%** > 65 years-old

  - Median household income in 2021 = **$58,234**
    - **~14.0%** below the poverty level
    - **88.8%** ≥ a high school education

Setting



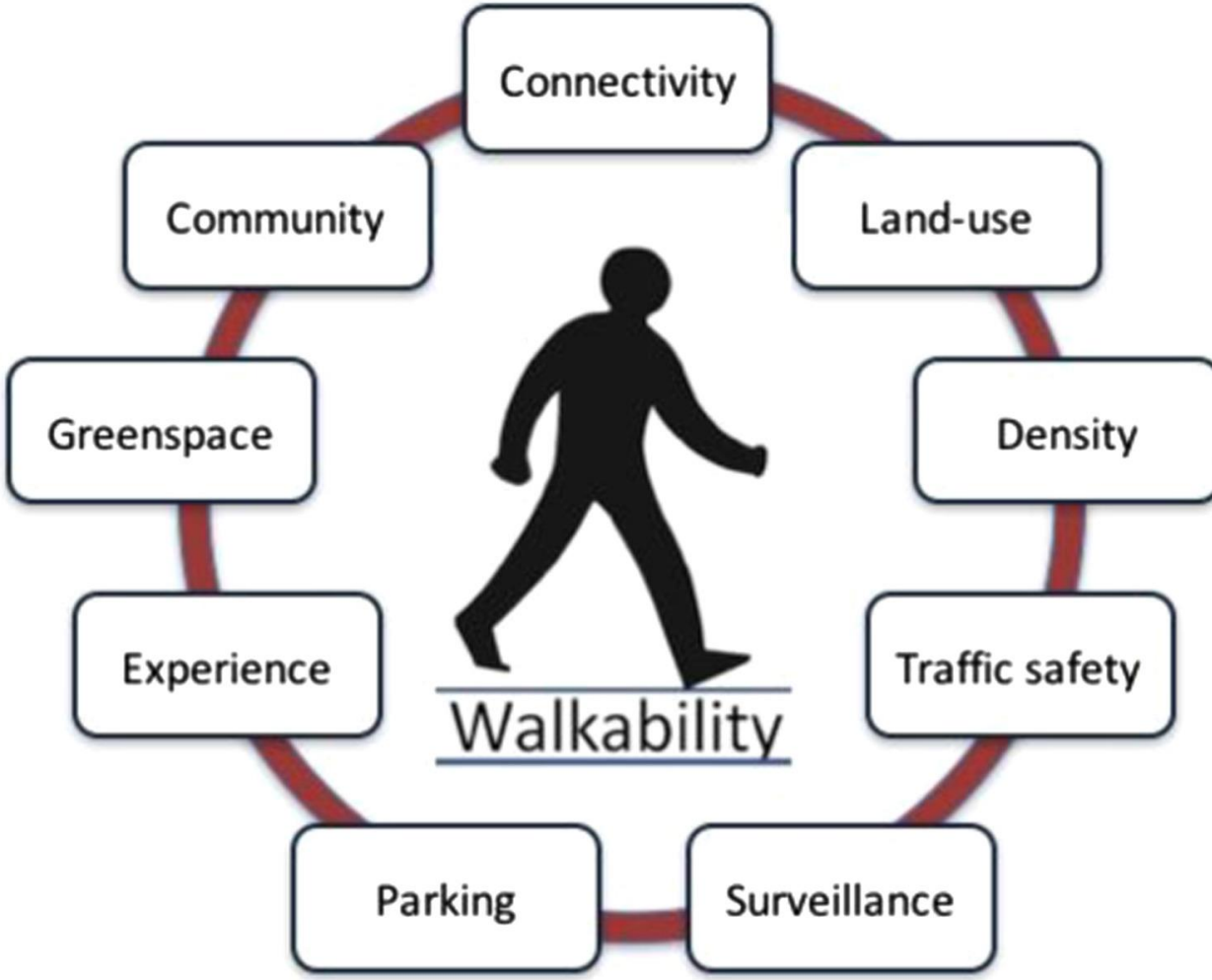
- Neighborhoods were represented as census tracts
- SC encompasses a total of **1,103 tracts**
- U.S. Census Bureau, “small, relatively permanent statistical subdivisions of a county”
- On avg. each tract contains about 4,000 inhabitants (Range=1,200-8,000)

Measures

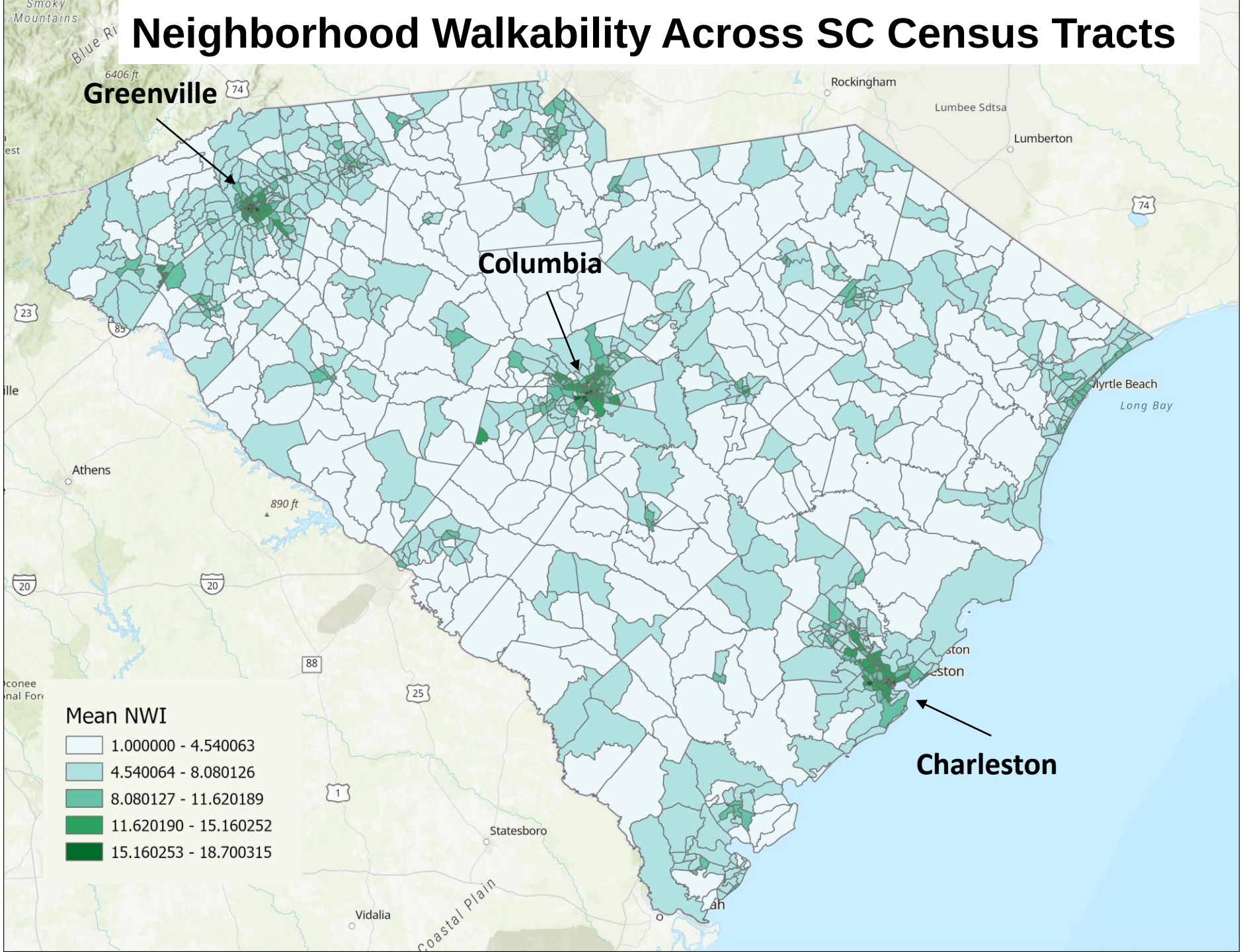
Neighborhood Walkability

- “A place that is easy to walk around, such as to stores, work, and other places”

- Measured by the EPA National Walkability Index (NWI)
    - Systematically compares locations based on their neighborhood supports for walking
        - Includes measures of intersection density, proximity to transit, and land-use diversity
        - Ranks block groups from 1 to 20 (lowest to highest walkability)
        - Census tract NWI = NWI averaged across block groups within tract



Neighborhood Walkability Across SC Census Tracts



Measures

Pedestrian & Cyclist Crashes

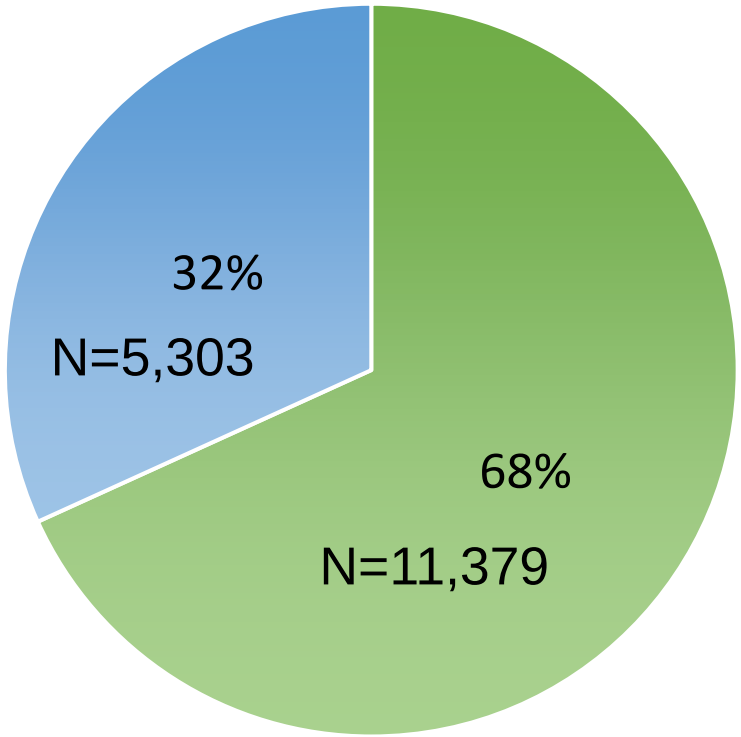
Compiled Crash Data

- Compiled 2011-2021 crash data and imported into ArcGIS
  - Geocoded 10,688 (93.9%) pedestrian crashes
  - Geocoded 4,802 (90.6%) bicyclist crashes

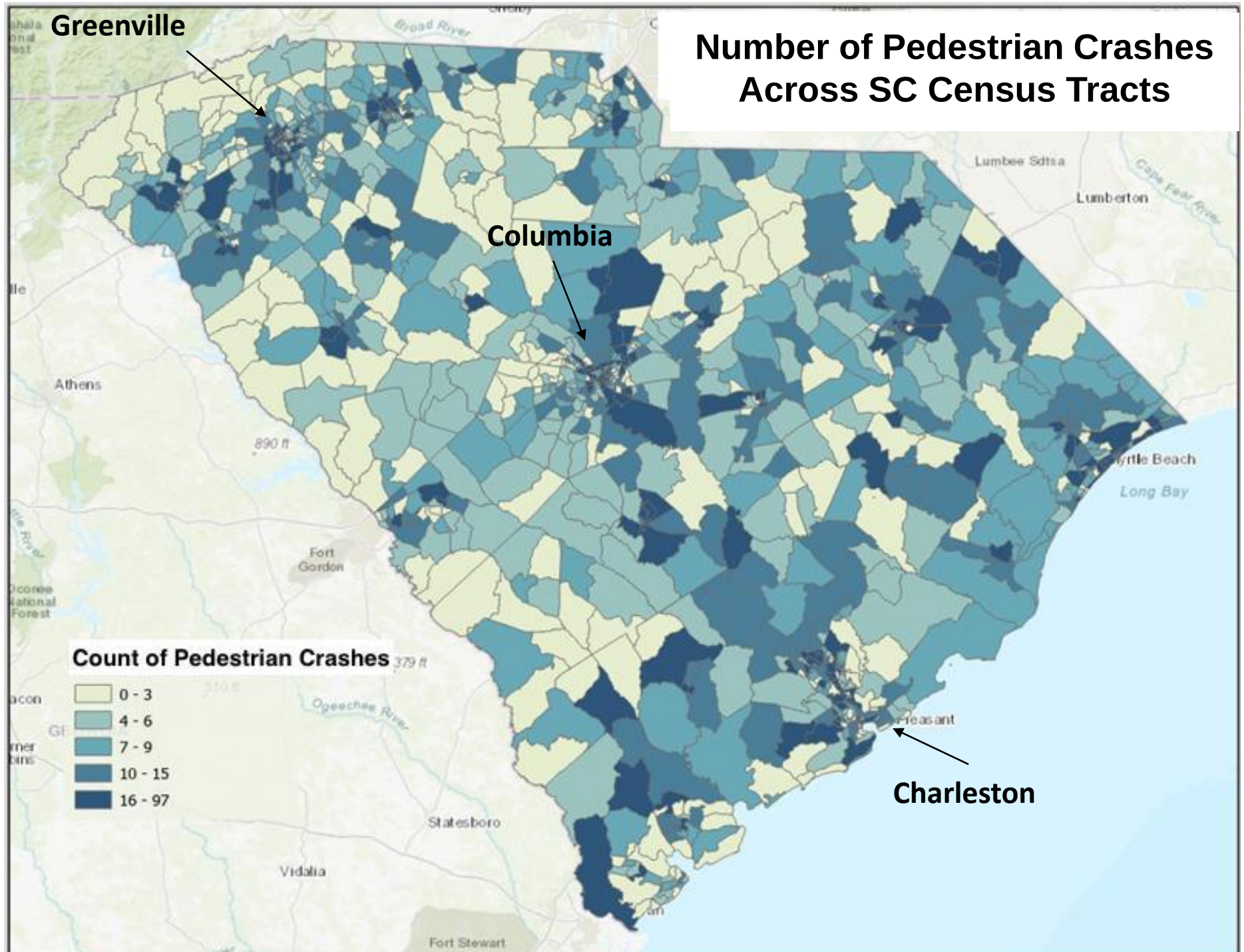
Calculated Crash Scores

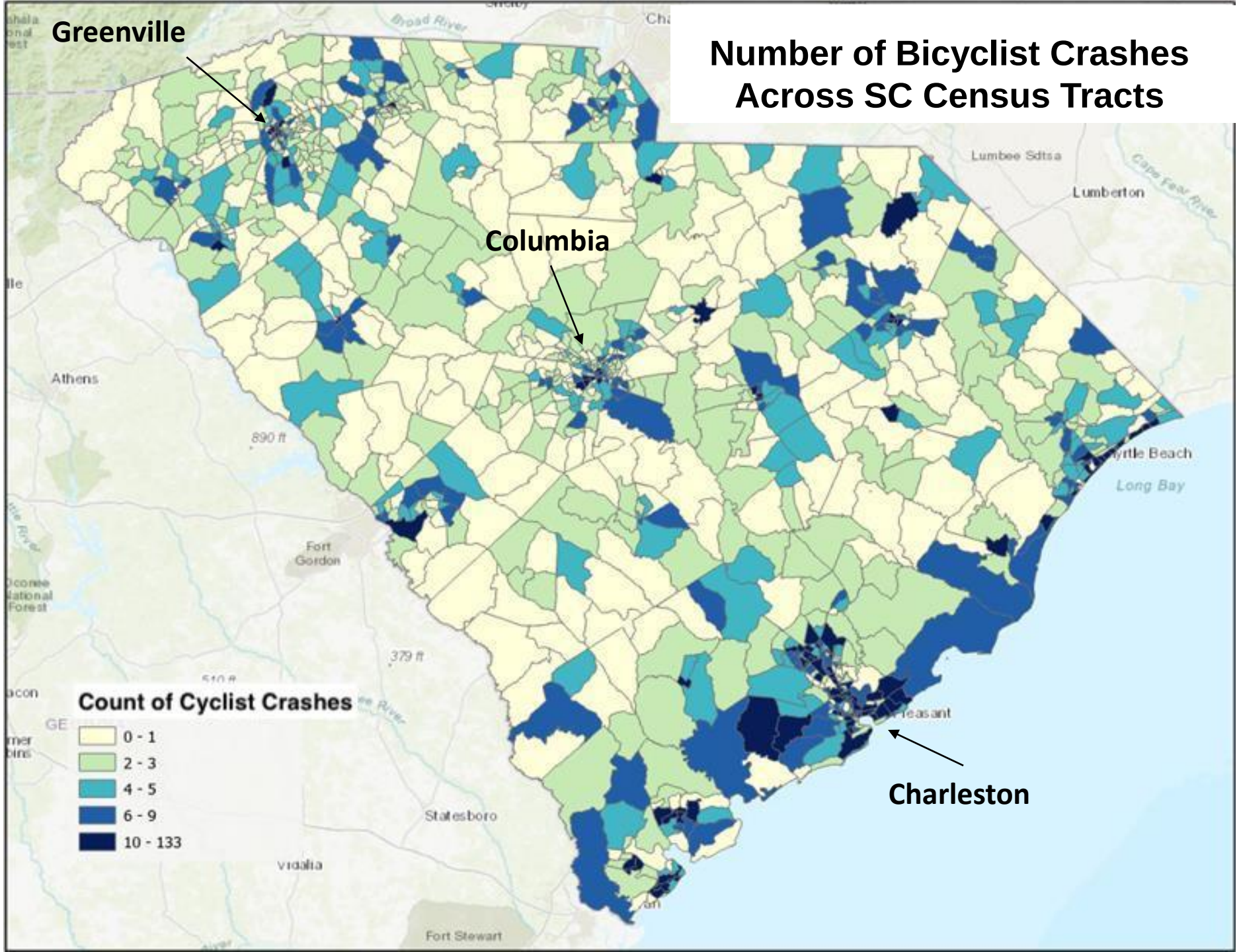
- Used Streetlight data to estimate avg. number of walking & bicycling trips in each census tract per year
- Crash score = total # of crashes in census tract/annual average daily trips

Active Transportation Crashes



STREETLIGHT

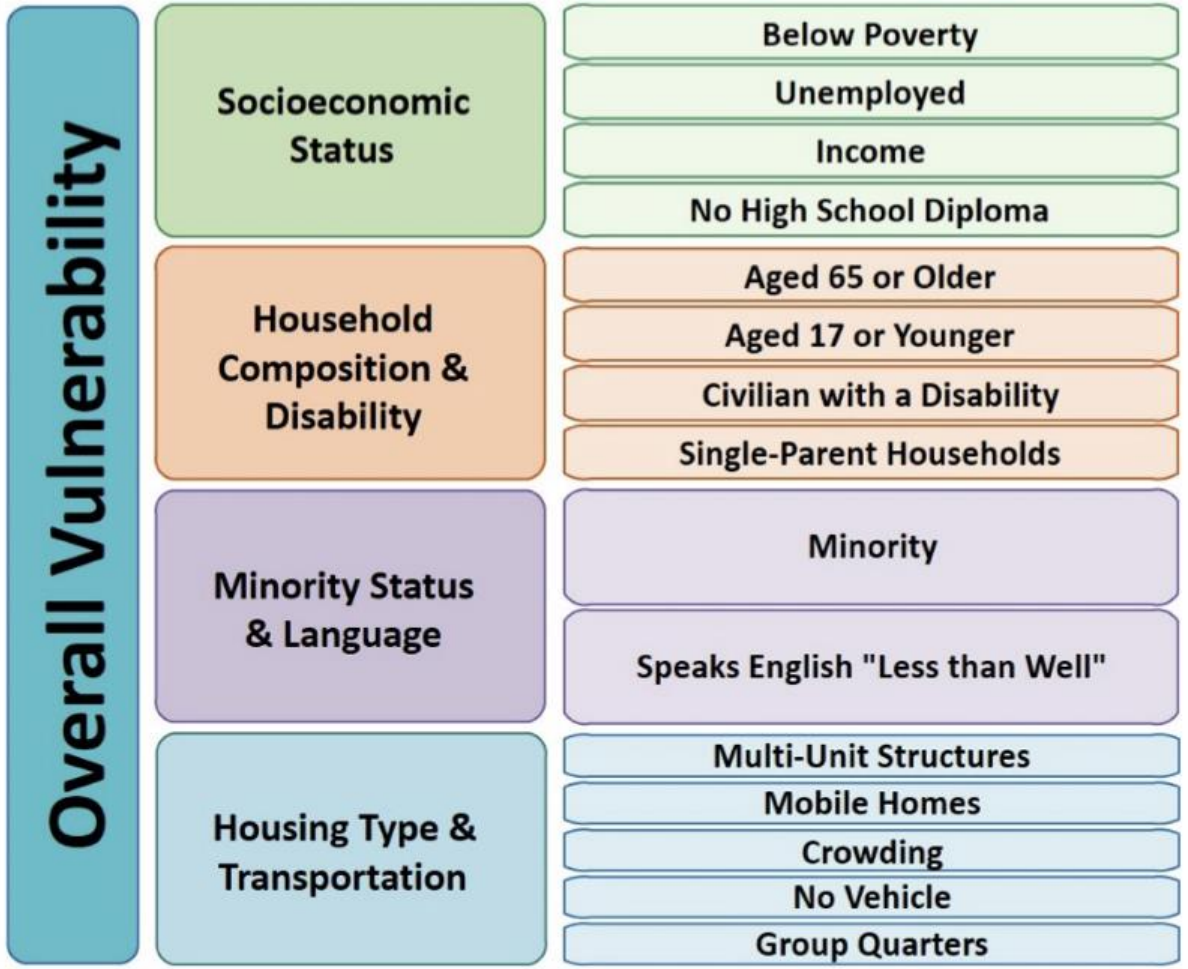

Number of Pedestrian Crashes Across SC Census Tracts
Greenville
Columbia
Charleston
Count of Pedestrian Crashes
0 - 3
4 - 6
7 - 9
10 - 15
16 - 97
Athens
Fort Gordon
Statesboro
Vidalia
Fort Stewart
Lumberton
Lumbee Sdtsa
Cape Fear River
Broad River
Ogeechee River
Long Bay
890 ft
379 ft


Number of Bicyclist Crashes Across SC Census Tracts
Greenville
Columbia
Charleston
Count of Cyclist Crashes
0 - 1
2 - 3
4 - 5
6 - 9
10 - 133
Athens
Lumberton
Lumbee Sdtsa
Cape Fear River
Broad River
Long Bay
Fort Gordon
Fort Stewart
Statesboro
890 ft
379 ft

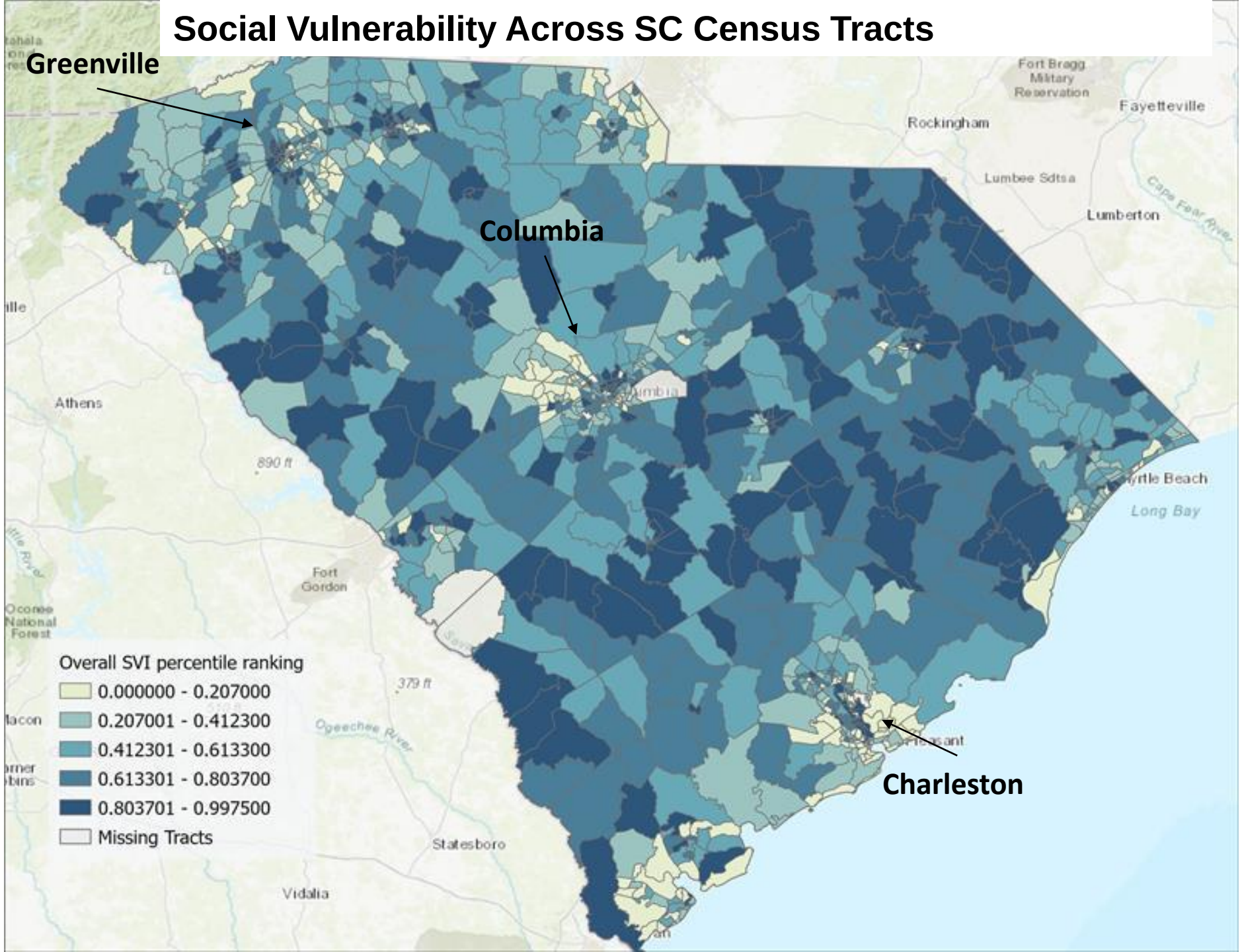
Measures

Social Vulnerability

- Measured by the CDC Social Vulnerability Index (SVI)
- “Resilience of communities when confronted by external stresses on human health, such as natural or human-caused disasters, or disease outbreaks”
- Comprised of 4 dimensions and 15 social factors
- Overall SVI percentile rank = sum of percentile ranking values of the 4 dimensions



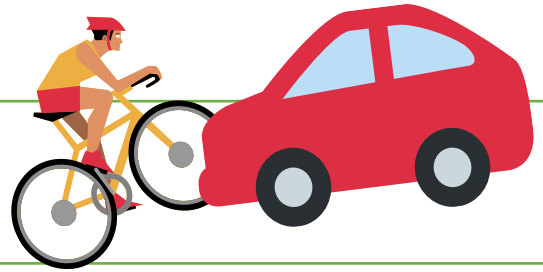
Social Vulnerability Across SC Census Tracts



Analyses

Run Linear Regressions

Analyze the relationships between census tract NWI and crashes per trip, accounting for county-level nesting in SPSS



Include Interaction Term

Include interaction term (NWI x SVI) to determine the relationship between NWI & crashes per trip, varying by SV. Plot simple slopes.

Create Maps in ArcGIS

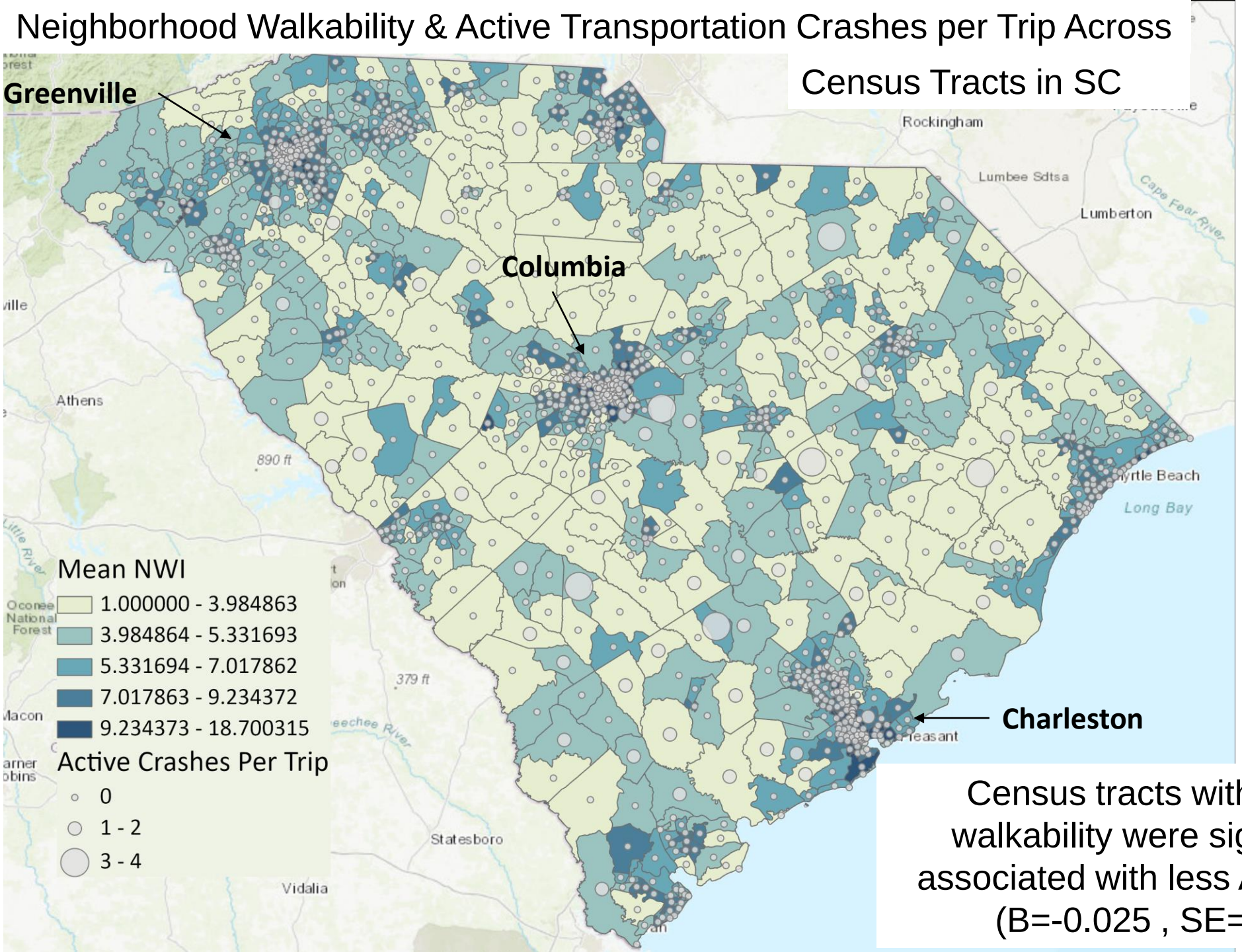
Create 3 maps overlaying NWI with Crashes per Trip

1. NWI & Active Transportation Crashes per Trip
2. NWI & Pedestrian Crashes per Trip
3. NWI & Bicyclist Crashes per Trip

ArcGIS

Aims 1 & 2

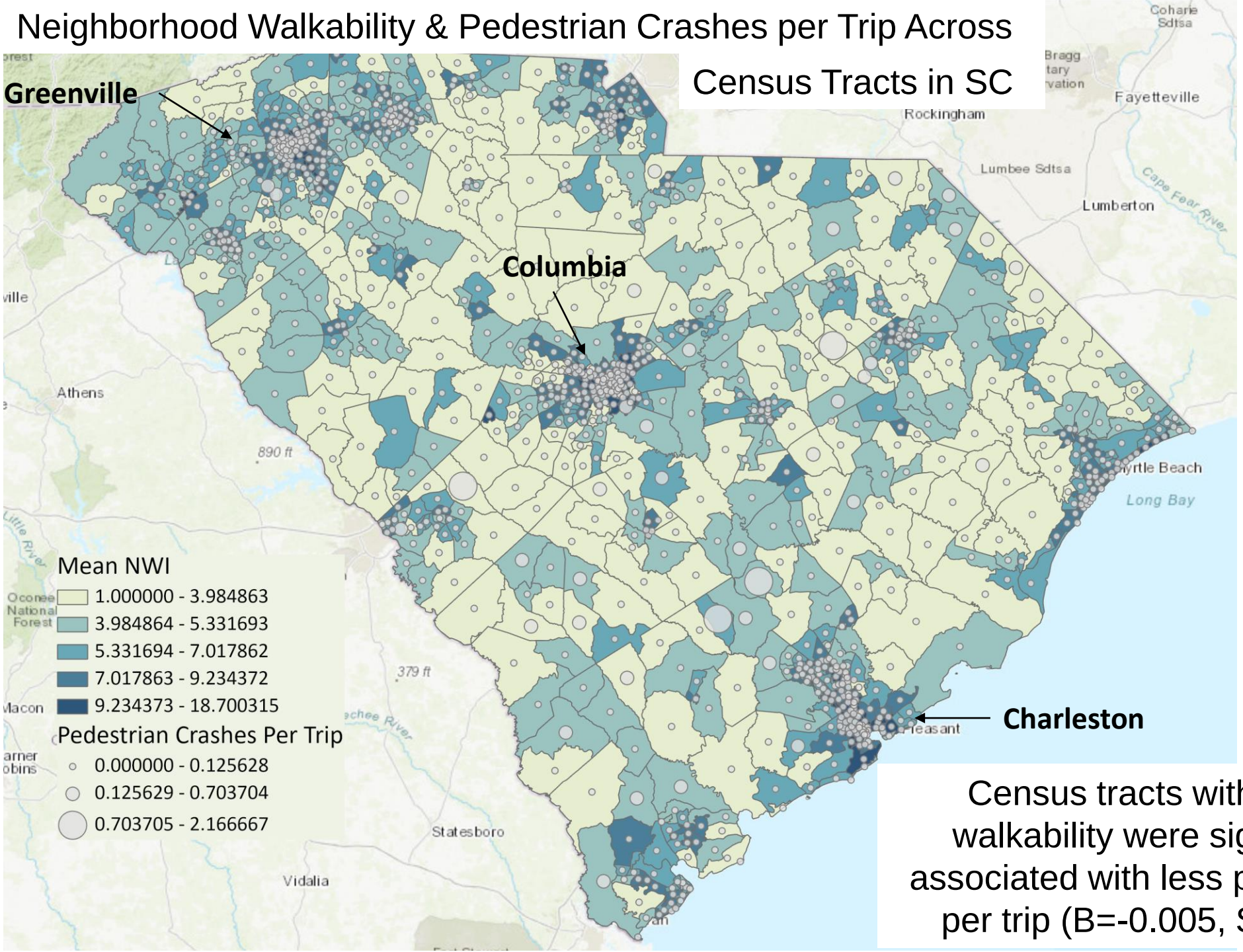
Neighborhood Walkability & Active Transportation Crashes per Trip Across Census Tracts in SC



Census tracts with greater walkability were significantly associated with less ATC per trip (B=-0.025 , SE=0.003)

Aim 1

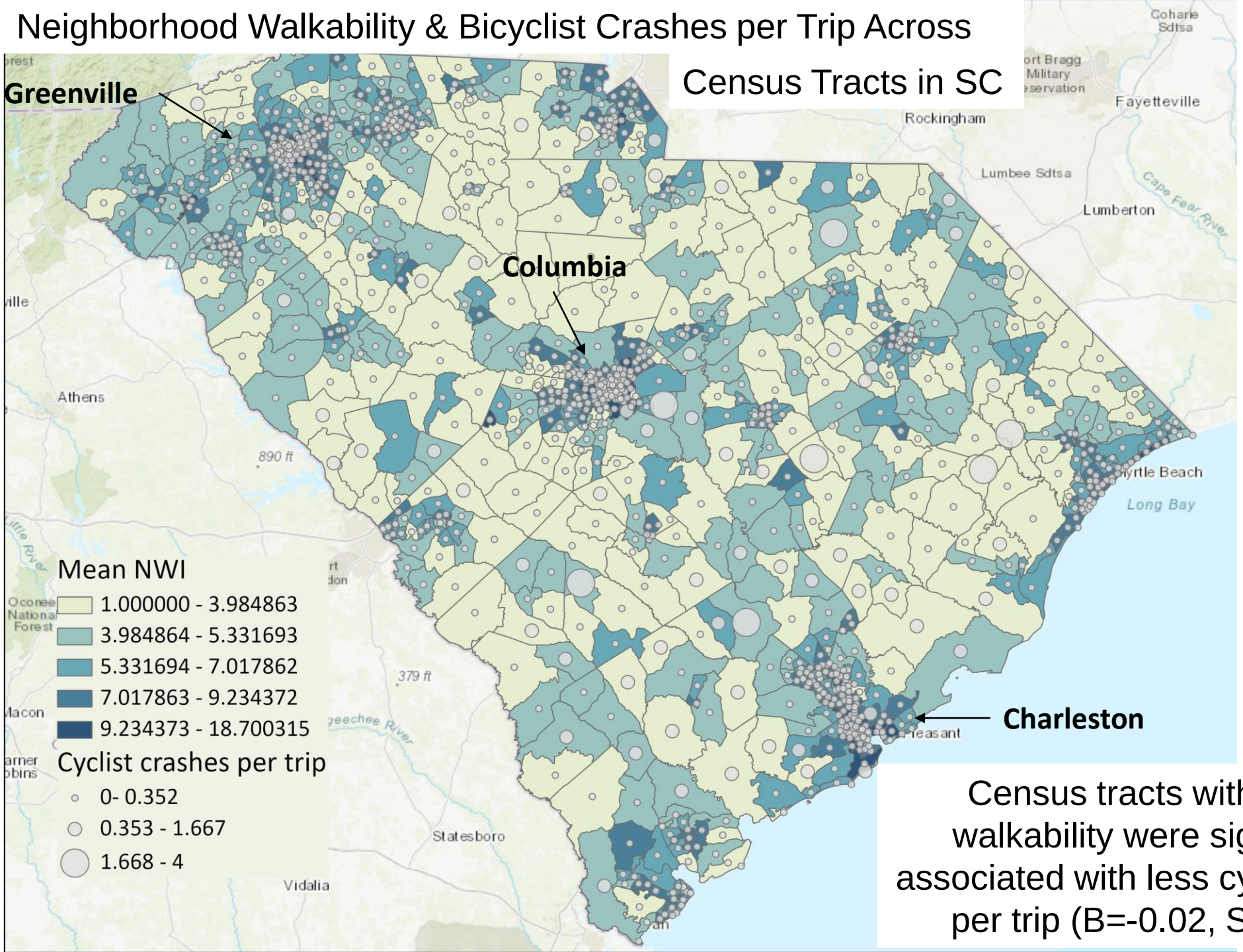
Neighborhood Walkability & Pedestrian Crashes per Trip Across Census Tracts in SC



Census tracts with greater walkability were significantly associated with less ped. crashes per trip (B=-0.005, SE=0.001)

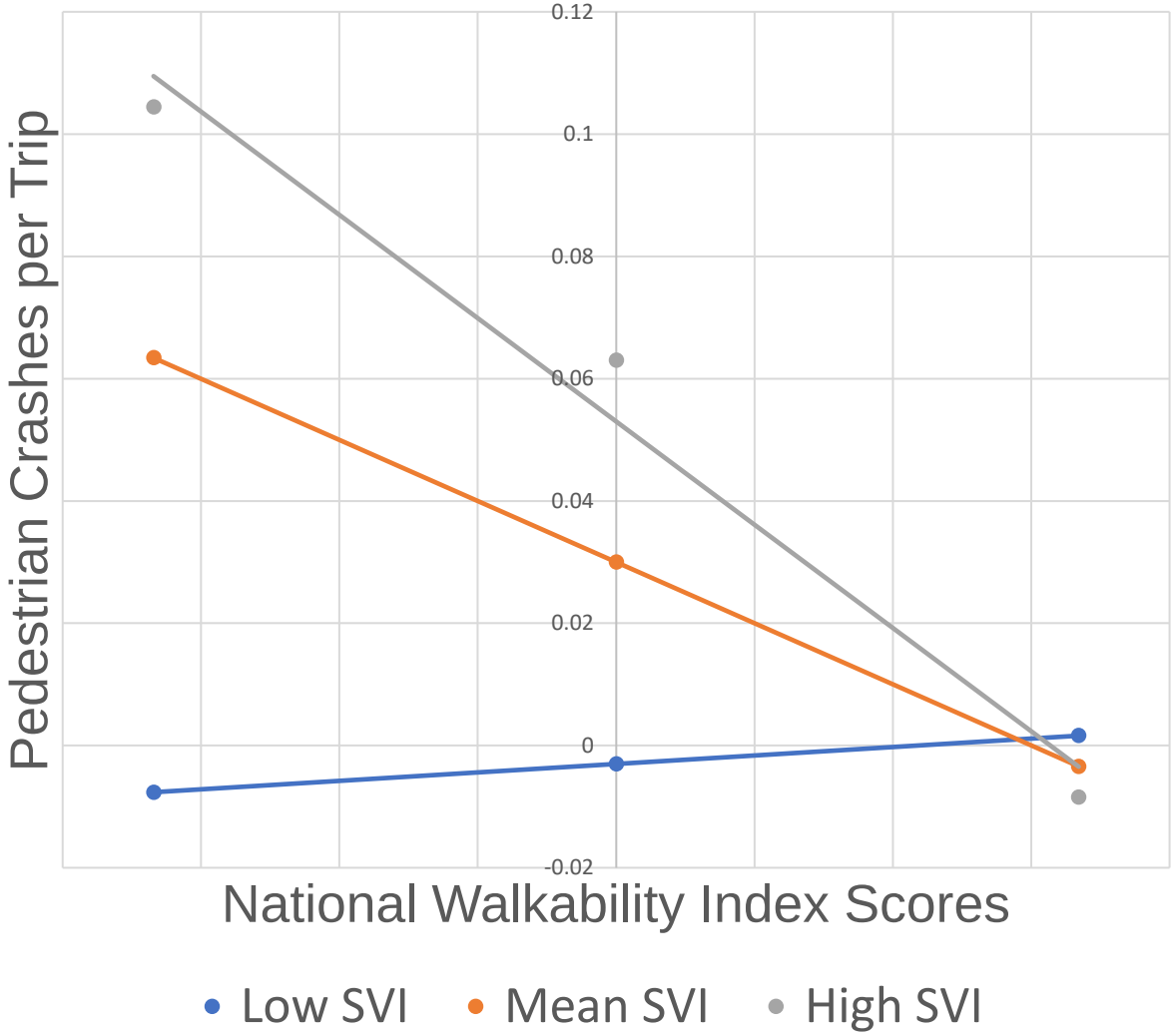
Aim 2

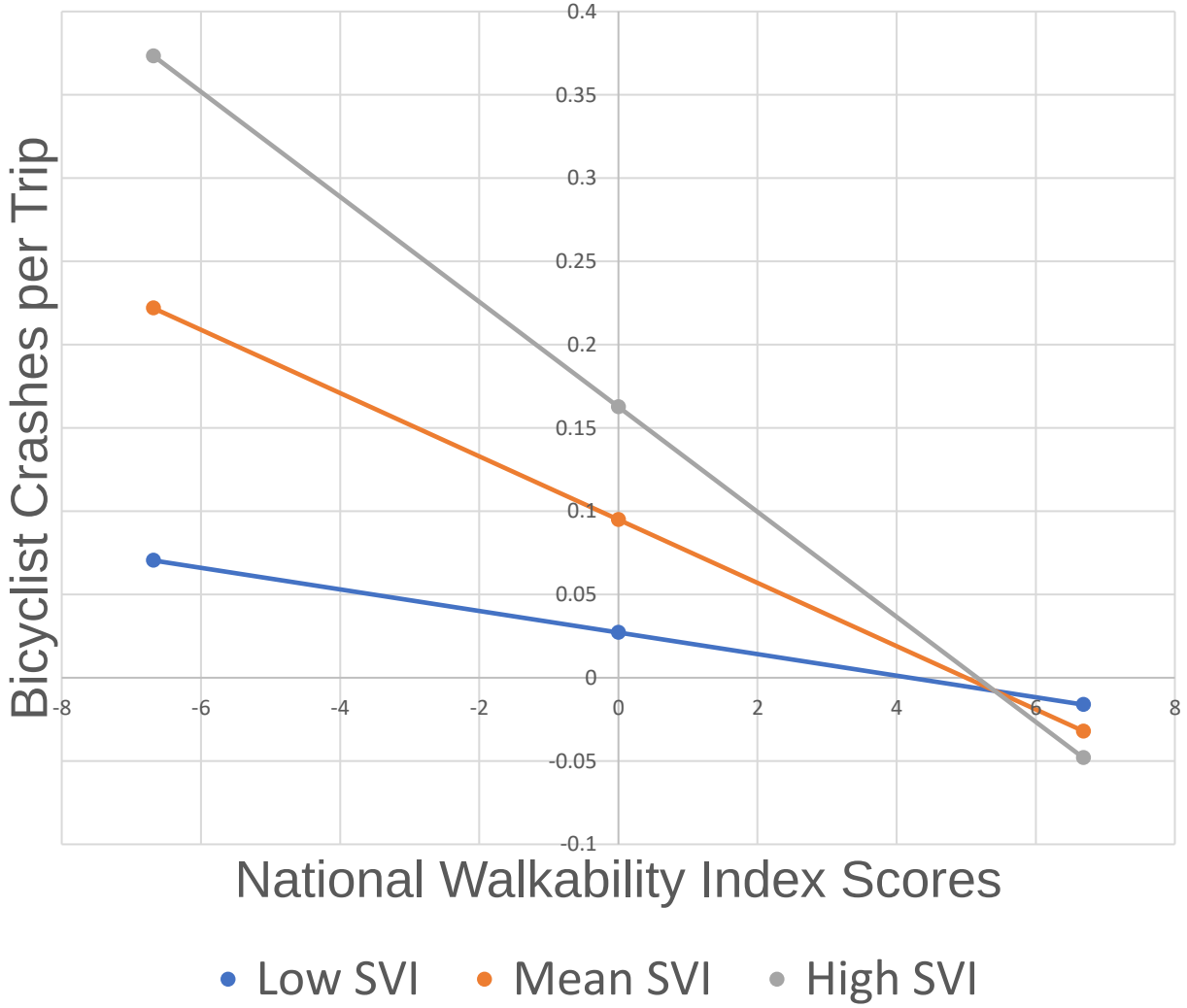
Neighborhood Walkability & Bicyclist Crashes per Trip Across Census Tracts in SC



Census tracts with greater walkability were significantly associated with less cyclist crashes per trip (B=-0.02, SE=0.003)

- Aims 3 & 4: Relationship Between Neighborhood Walkability and Crashes per Trip Varying by Social Vulnerability across Census Tracts in SC





Census tracts with ***greater walkability*** *were* significantly associated with ***less crashes per trip***
And this relationship was ***strongest*** in tracts with ***greater social vulnerability***

Conclusion

Improvement in neighborhood walkability was associated with less crashes per trip, with even stronger relationships among census tracts with greater SV.

Limitations

- Cross-sectional data limits ability to establish causality.
- May not be generalizable to outside SE U.S.
- Neighborhoods may span multiple tracts

Strengths

- Large and diverse sample size
- Compilation of over a decade of crash data
- Used well-established measures from the EPA and CDC

Next Steps

- Create map of relationship between NWI and crash data → mark areas with *low NWI* and *high SV*
- Analyze relationship between *NWI* and *crash severity*, varying by SV

Implications

Future Research

- Examine micro-scale attributes of walkability (e.g., streetlights)
- Conduct a longitudinal data analysis
- Consider individual factors (e.g., race/ethnicity)
- Include other relevant variables related to crash risk (e.g., traffic volume)

Practice

- Help identify tracts in SC in need of infrastructure improvements to address pedestrian & bicyclist safety
- Inform policies promoting walkability
- **Facilitate greater physical activity → reduce chronic diseases → ensure safe and equitable environments for all**

Thank you to the USC Big Data Health Science Center Excellence Initiative Program for their generous support!

Big Data Health Science Center
UNIVERSITY OF SOUTH CAROLINA

Thank you to the BEACH Lab Study Team!

beach lab
Built Environment and Community Health Laboratory

For any questions, contact Anna Chupak:
alchupak@email.sc.edu