Disparities in Pedestrian and Cyclist Crashes by Social Vulnerability across South Carolina

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National Big Data Health Science Conference – February 2, 2024

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Funding Source: University of South Carolina Big Data Health Science Center

Environmental Injustice and Active Transportation

- Neighborhood environments are increasingly recognized as important determinants of population health
- From 2009 to 2020, pedestrian deaths increased **62%, 64,073** people were killed while walking, and **10,343** people were killed while bicycling in the U.S.
- Residents of the Southeast, older adults, people from racial/ethnic minority backgrounds, and people in low-income communities more affected
- Safety risks impact engagement in active transportation and increase physical inactivity (leading to disparities in obesity and chronic disease)
- Environmental injustice and deprivation amplification have serious implications for physical health, social well-being, and mental health

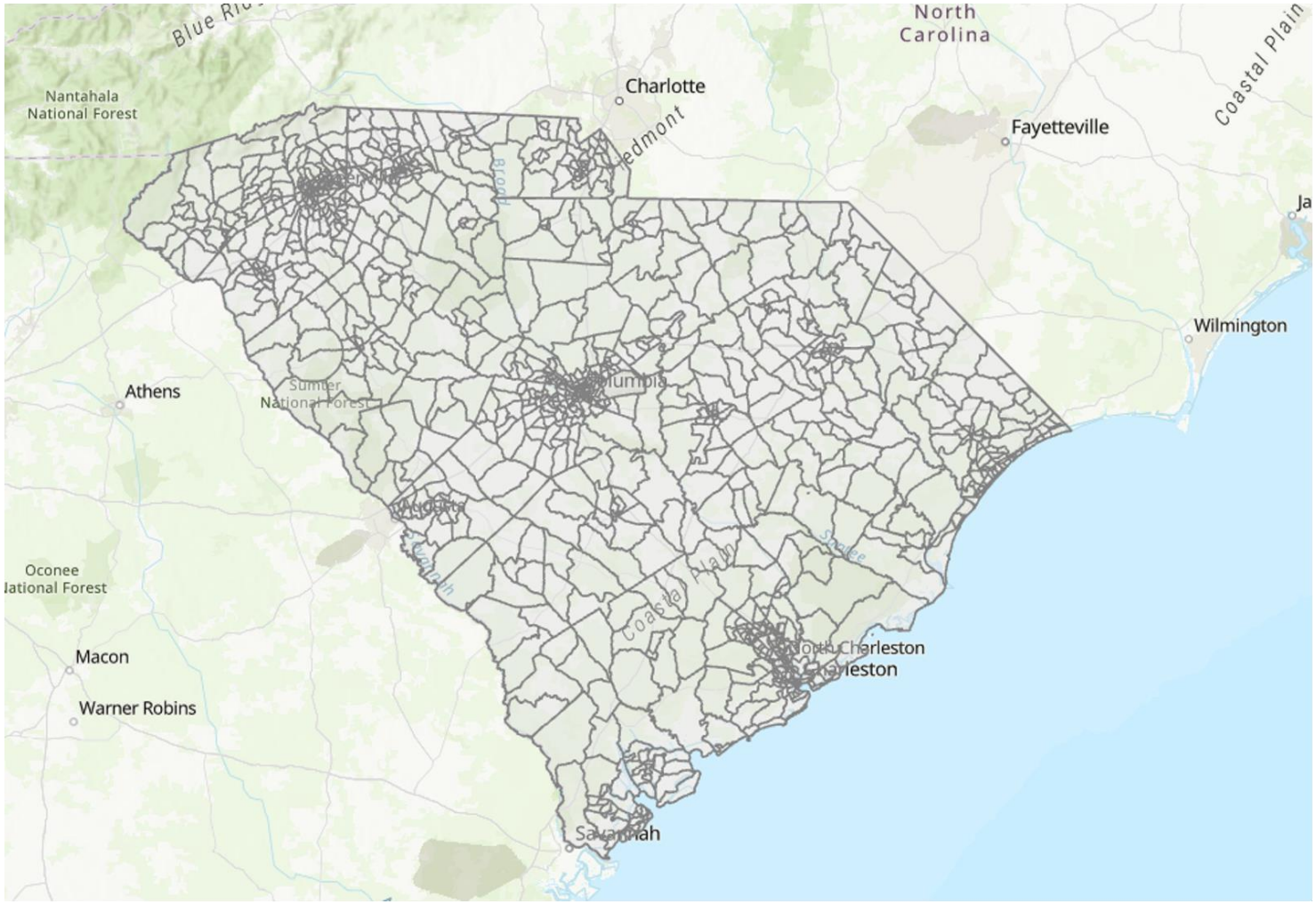
Limitations in Existing Research on Crash Disparities

- Failure to account for the prevalence of active transportation trips
- Lack of focus on the Southeast region of the US where health disparities and active transportation fatalities are egregious
- Analyses dated (most pre-2015 when fatalities began to increase again)
- Consideration of only a single demographic or socioeconomic variable rather than a cumulative/composite indicator of disadvantage

“ ARE ACTIVE TRANSPORTATION CRASHES MORE LIKELY TO OCCUR IN SOCIALLY VULNERABLE NEIGHBORHOODS?

Study Setting

- 1103 census tracts in SC – 889 urban (80.9%) and 213 rural (19.3%)



Social Vulnerability Index

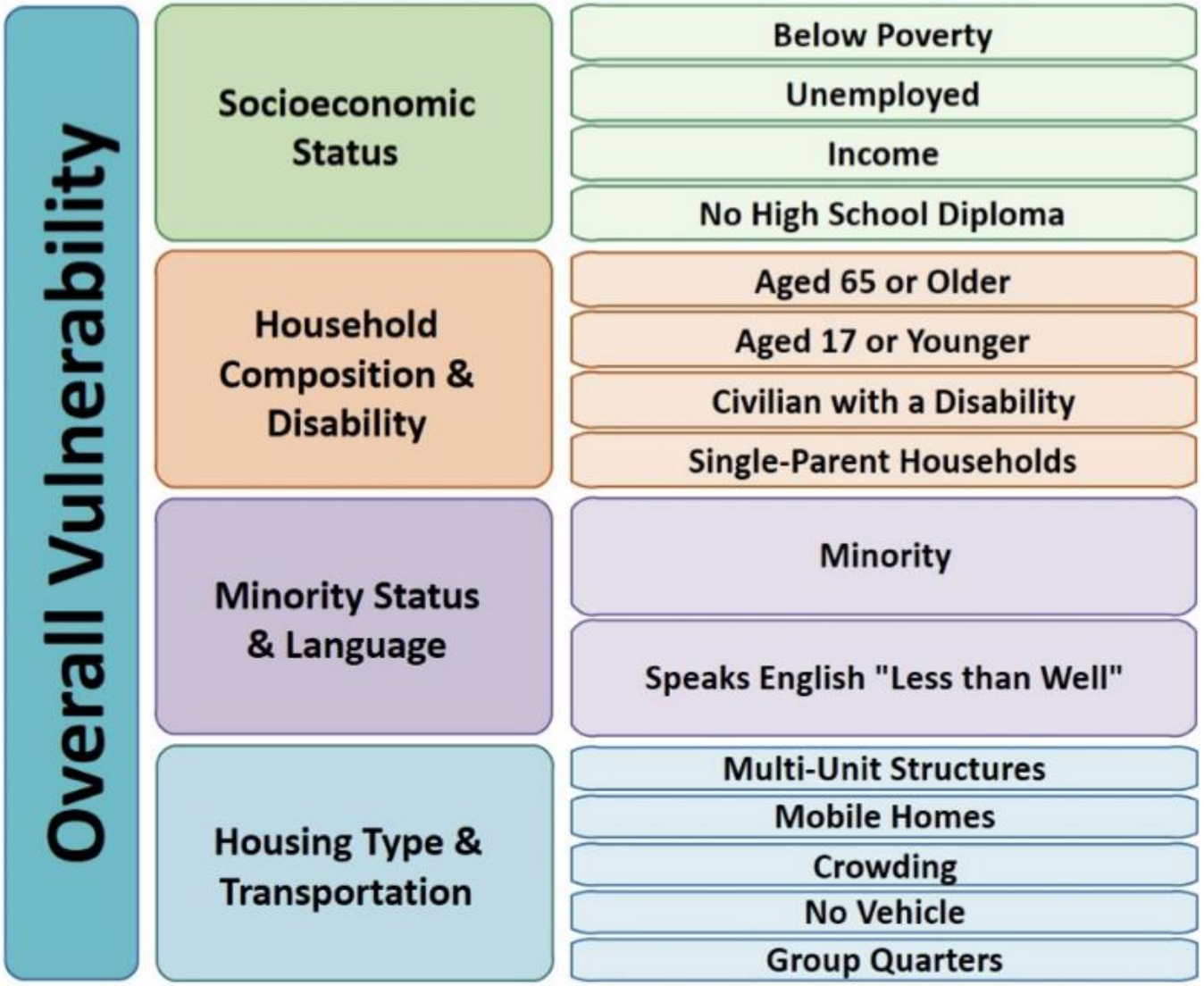
- Statistical tool used to rank the susceptibility of communities to various hazards, disasters, or adverse events resulting from social, economic & environmental factors.

- Source: CDC Agency for Toxic Substances & Disease Registry

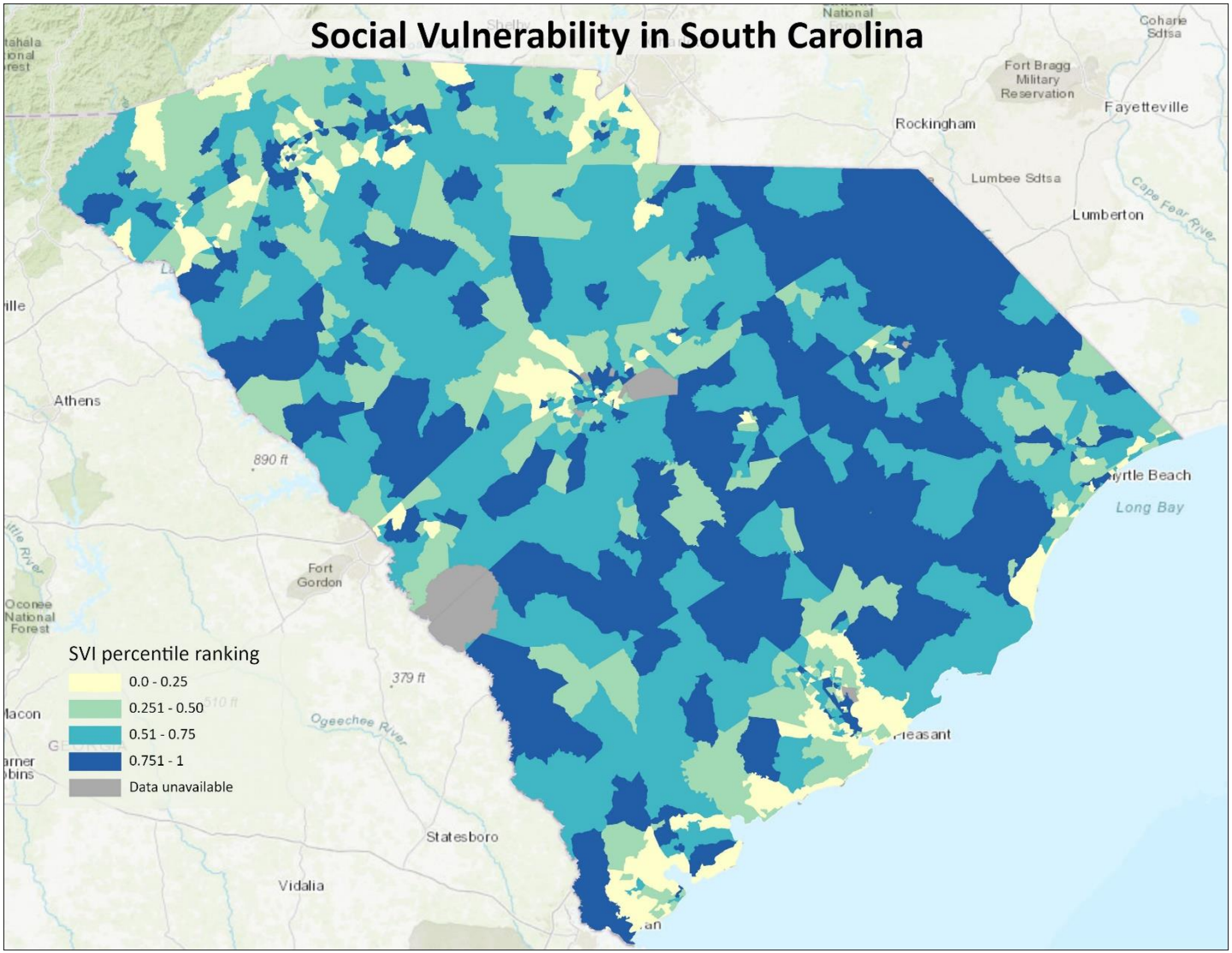
- 15 Variables & 4 Dimensions
  - Socioeconomic Status
  - Household Composition & Disability
  - Minority Status & Language
  - Housing Type & Transportation



Social Vulnerability Index Dimensions and Variables



Overall Social Vulnerability by Census Tract in SC



Pedestrian and Cyclist Crashes

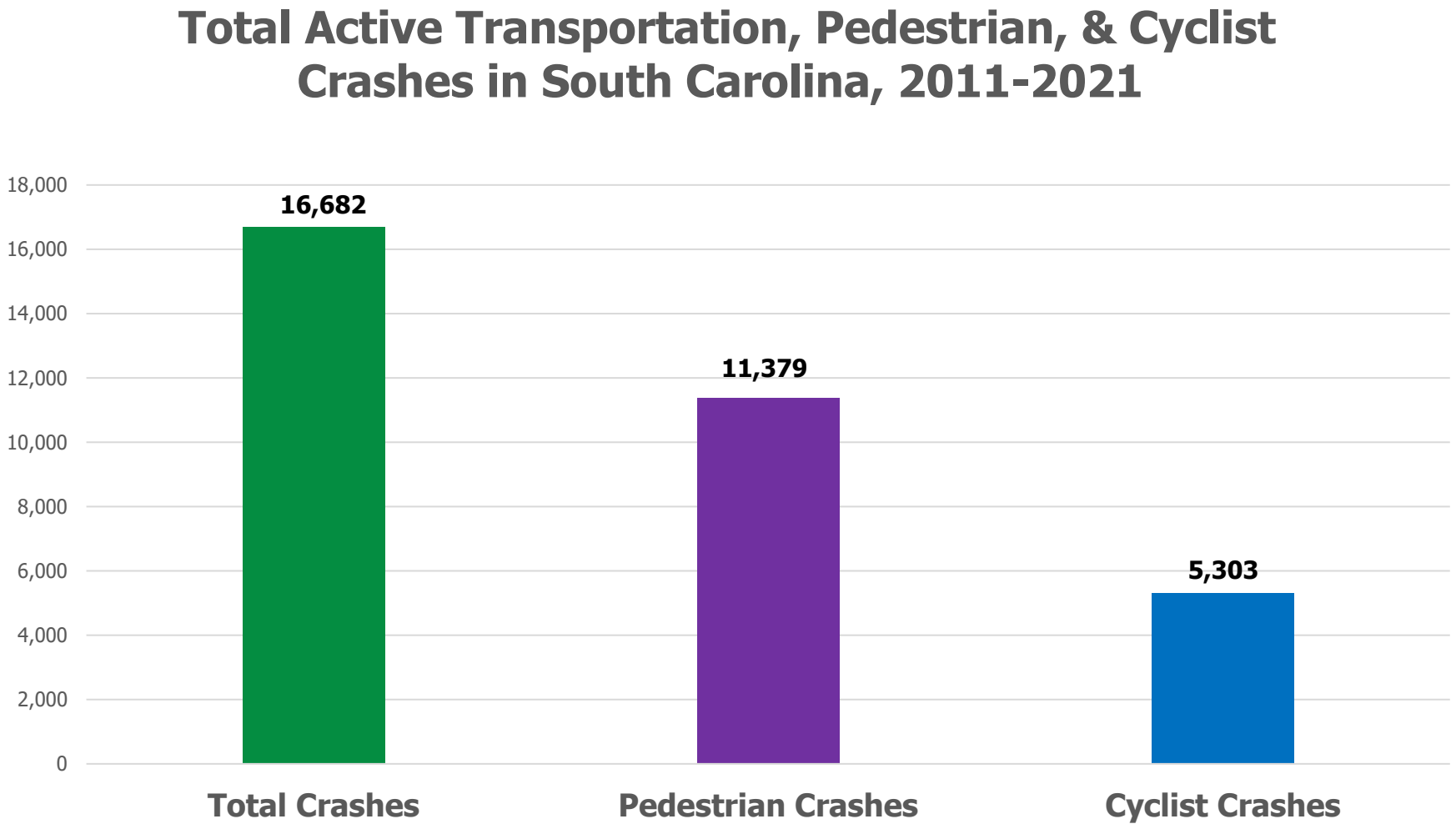
- Data for all crashes involving a pedestrian or cyclist obtained from SCDOT for 2011-2021
- Each crash geocoded and assigned to a census tract
- Each crash also assigned an 'equivalent property damage only' (EPDO) value based on the severity of death (436), injury (13), or damage (1)

SCDOT

Tract Crash Scores

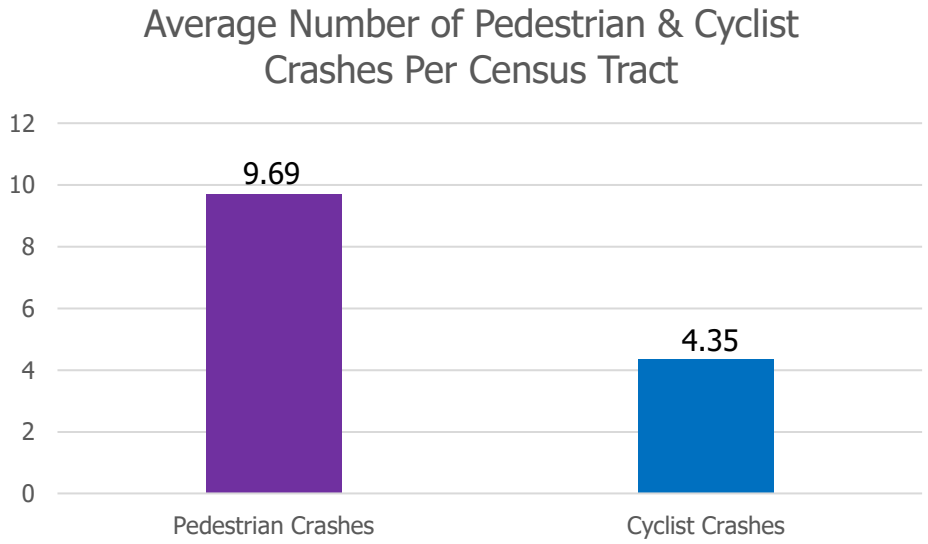
- More active transport trips = greater chance of ped & bike crashes
- Streetlight data used to estimate the average number of walking and cycling trips in each census tract per year
- Created four crash scores for each tract:
  - Prevalence of pedestrian crashes per trip
  - Prevalence of cyclist crashes per trip
  - Pedestrian crash severity per trip
  - Cyclist crash severity per trip

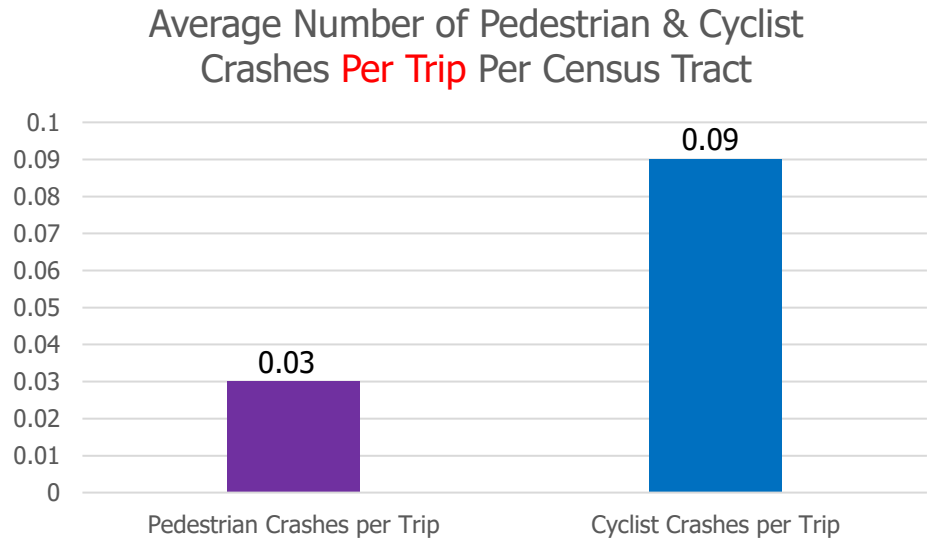
Pedestrian and Cyclist Crash Statistics in SC



Pedestrian and Cyclist Crash Statistics in SC

- Number of pedestrian crashes per tract ranged from 0 to 97 over the decade
- Number of cyclist crashes per tract ranged from 0 to 133
- On average, more overall pedestrian crashes per tract
- But on average, more cyclist crashes per tract per trip





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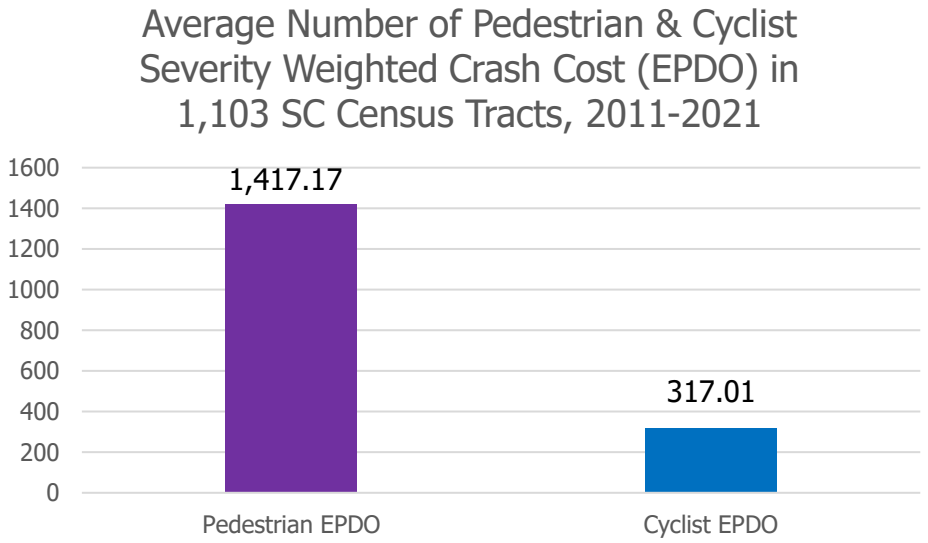
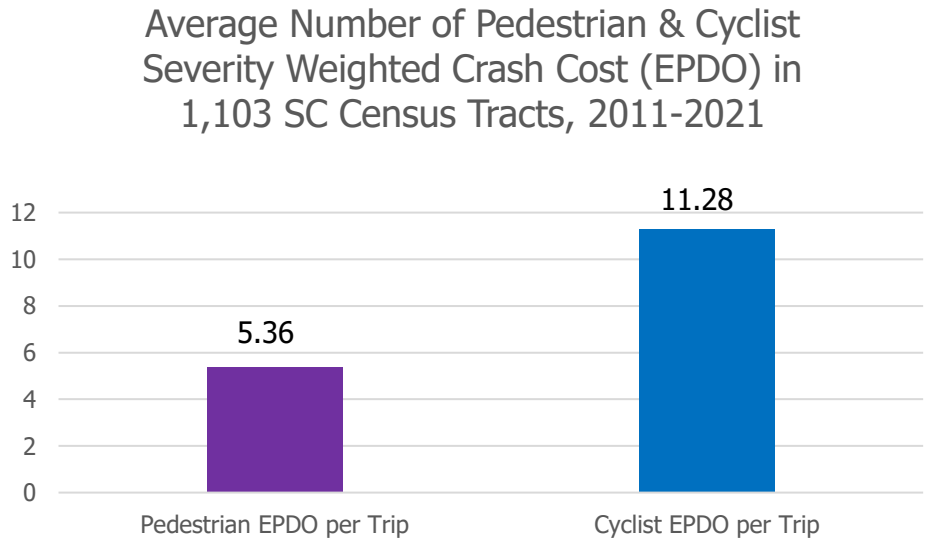
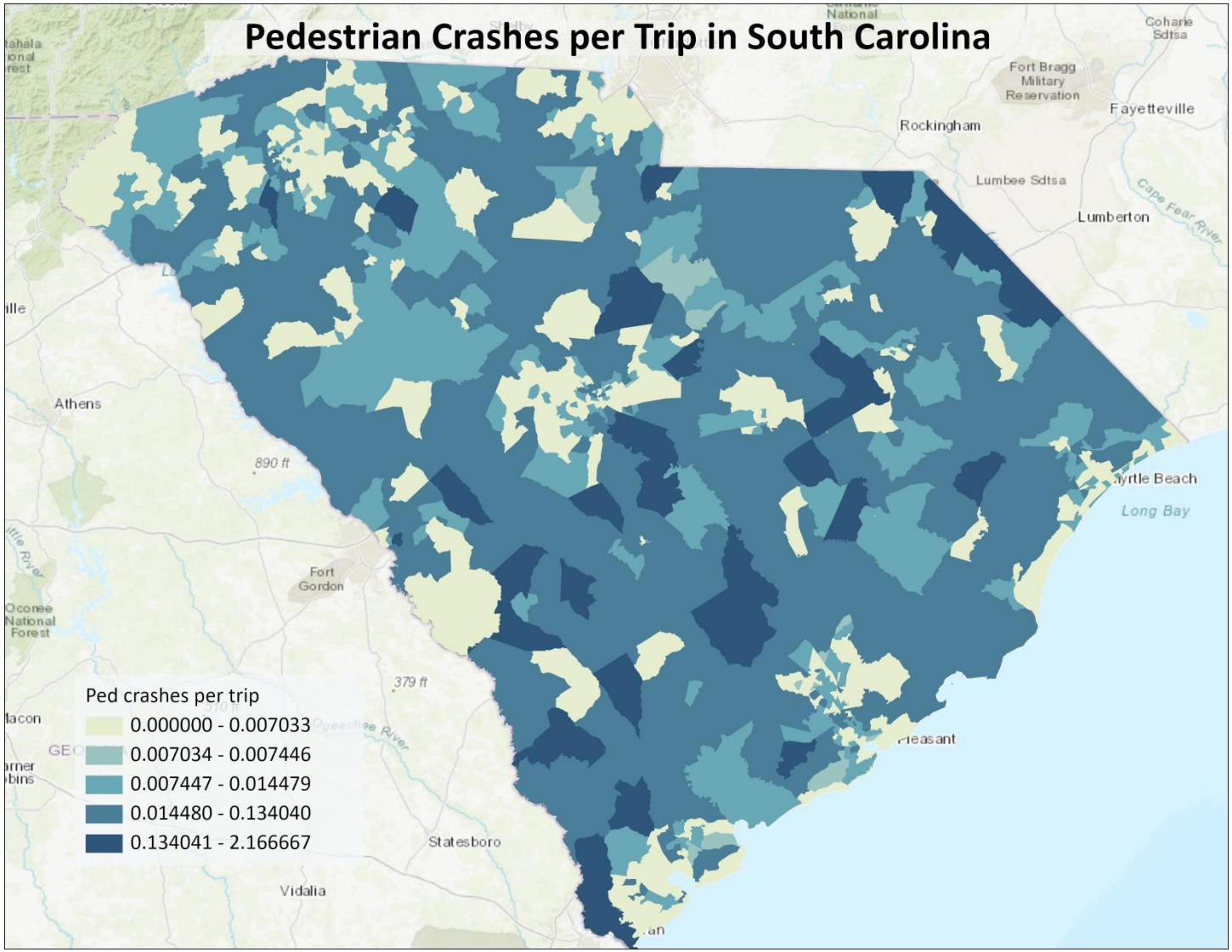
Pedestrian and Cyclist Crash Severity Statistics in SC

- Total pedestrian EPDO per tract ranged from 0 to 13396 over the decade
- Total cyclist EPDO per tract ranged from 0 to 7798
- On average, more total pedestrian EPDO per tract
- But on average, more cyclist EPDO per tract per trip

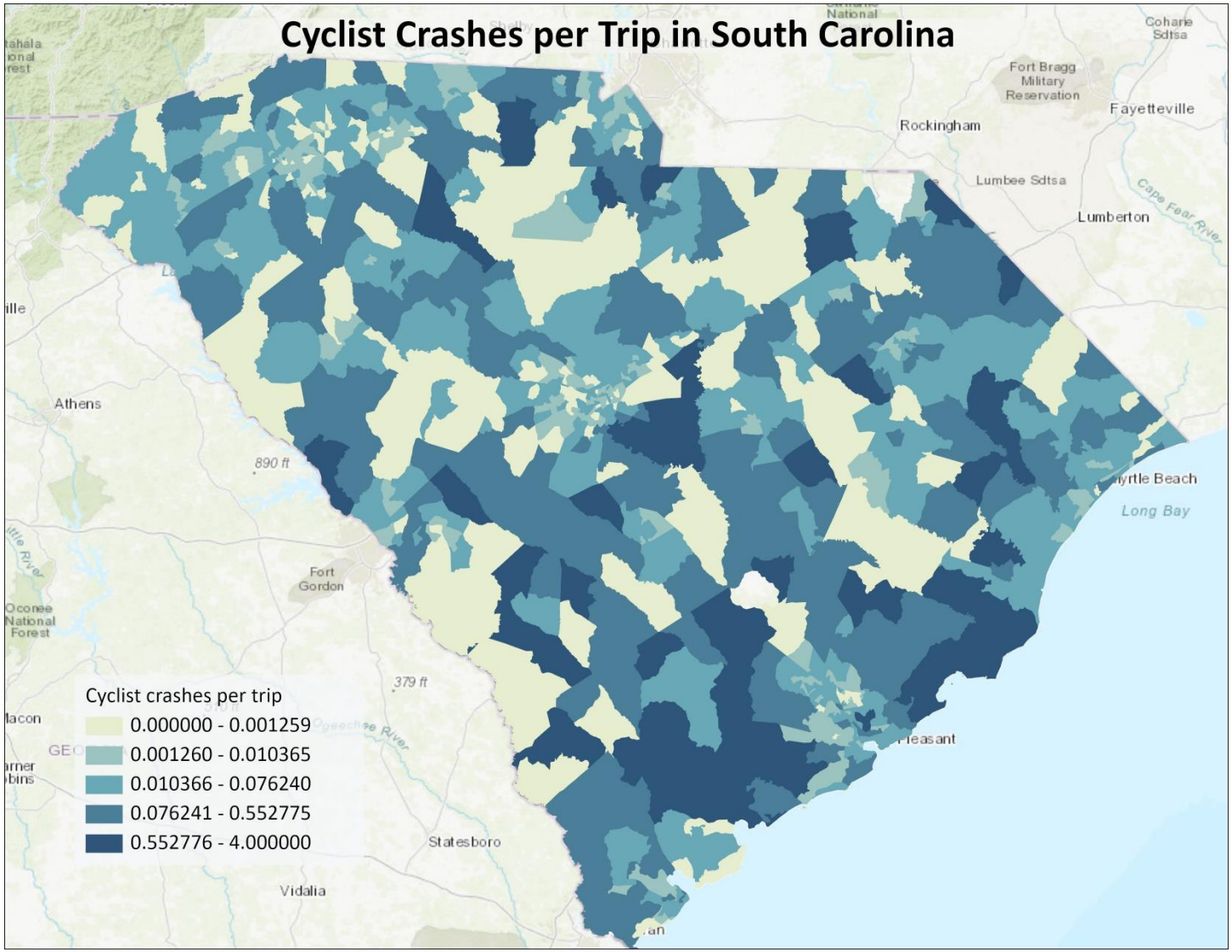




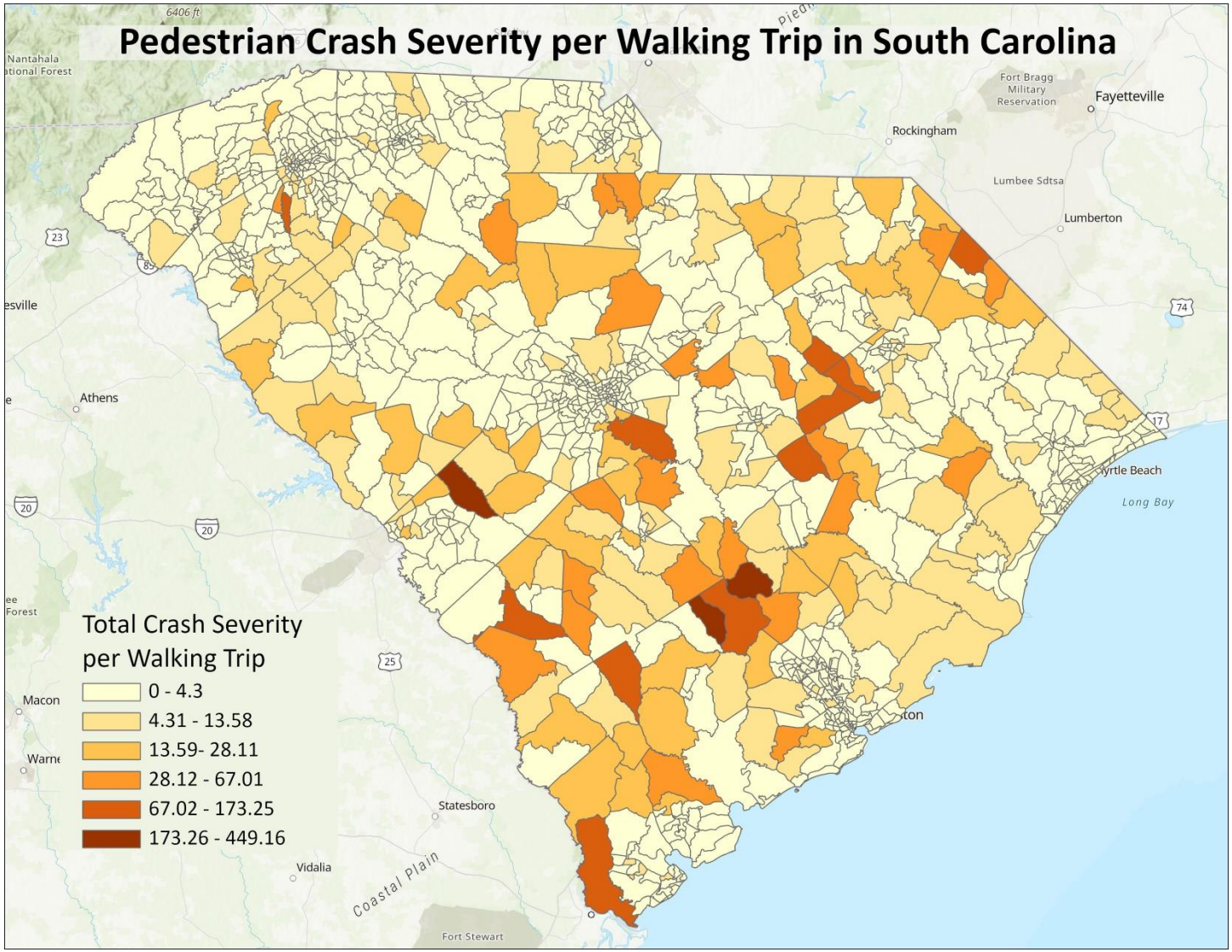
Pedestrian Crashes per Trip across SC Census Tracts



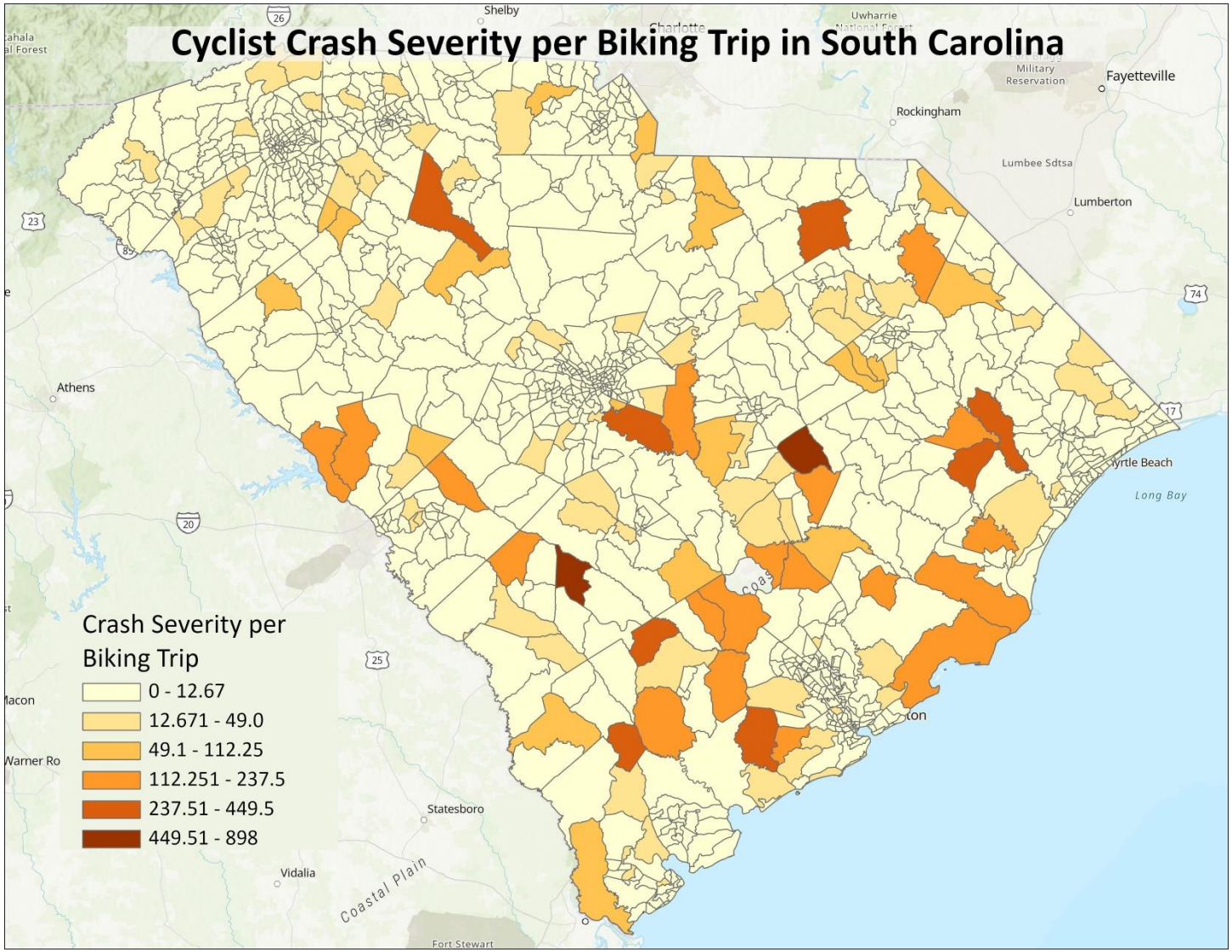
Cyclist Crashes per Trip across SC Census Tracts



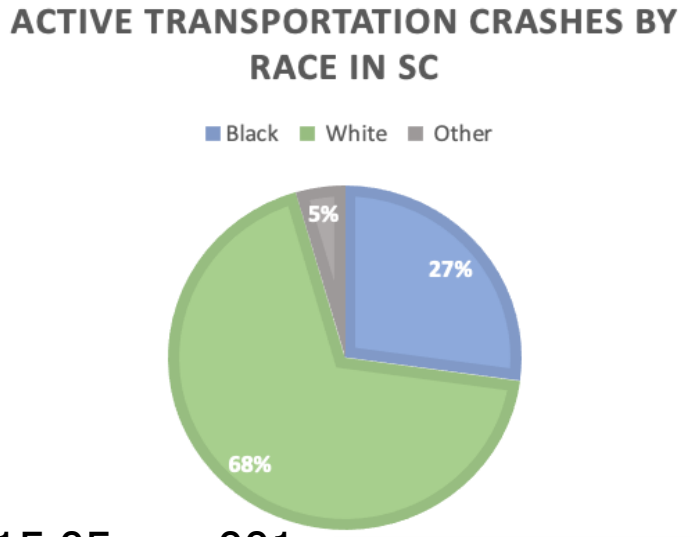
Pedestrian Crash Severity per Trip across SC Tracts



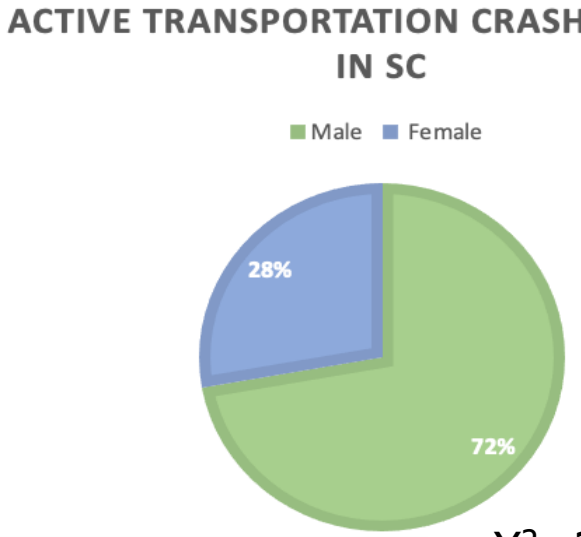
Cyclist Crash Severity per Trip across SC Tracts



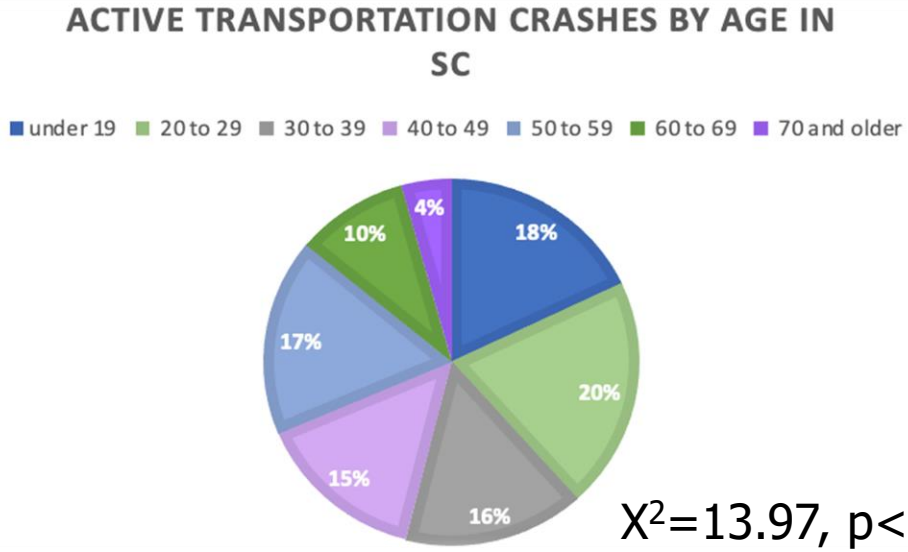
Active Transportation Crashes in SC by Race, Sex, & Age



$X^2=15.05$, $p<.001$

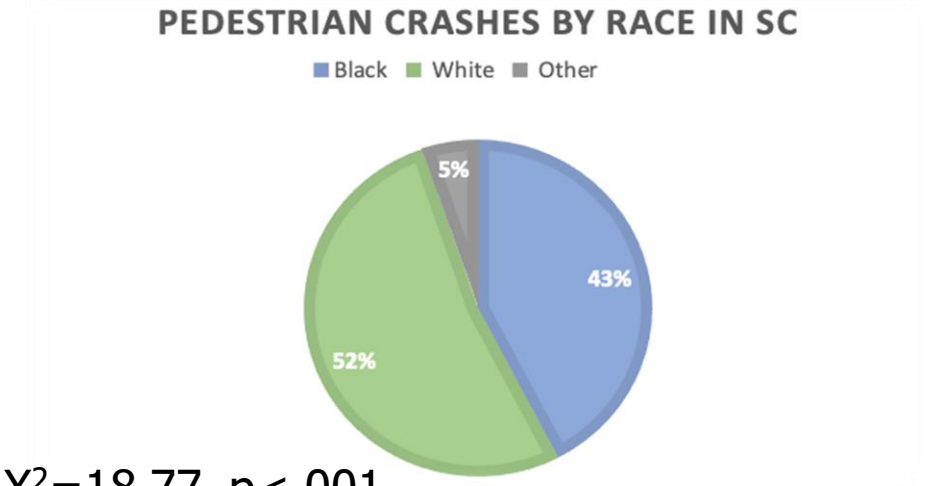


$X^2=21.17$, $p<.001$

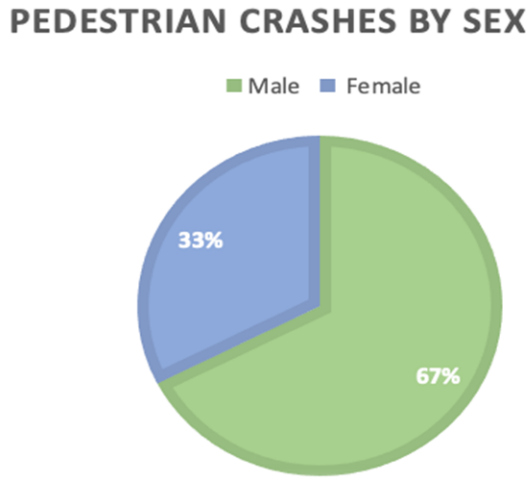


$X^2=13.97$, $p<.05$

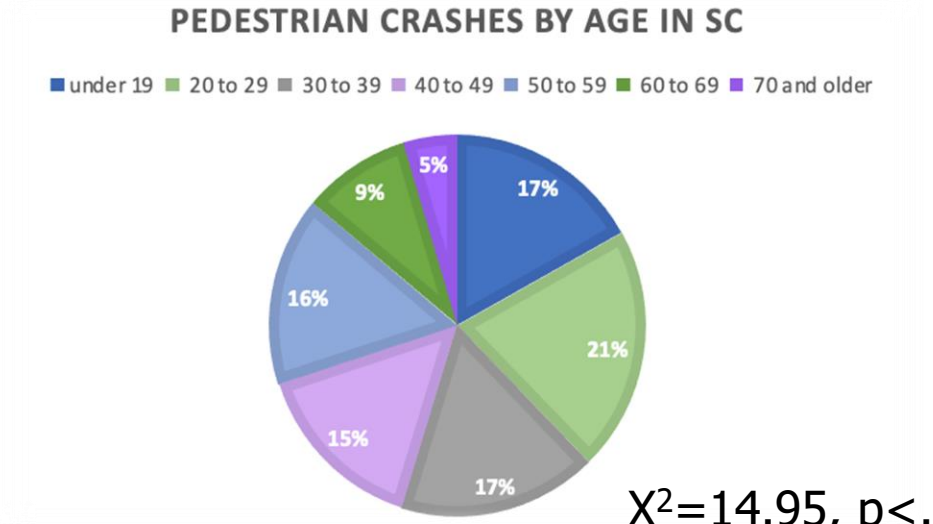
Pedestrian Crashes in South Carolina by Race, Sex, & Age



$X^2=18.77$, $p<.001$

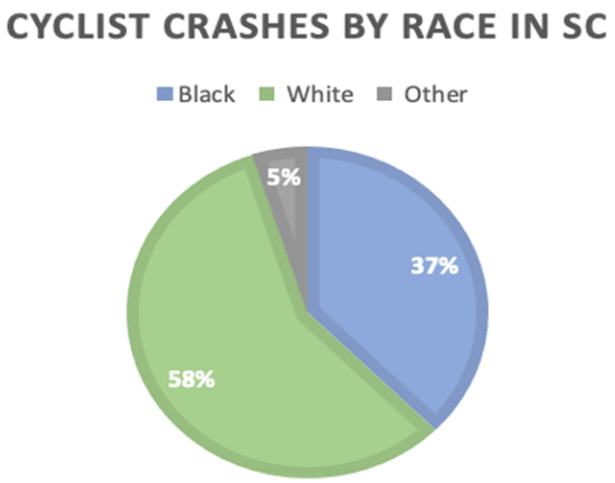


$X^2=14.45$, $p<.001$

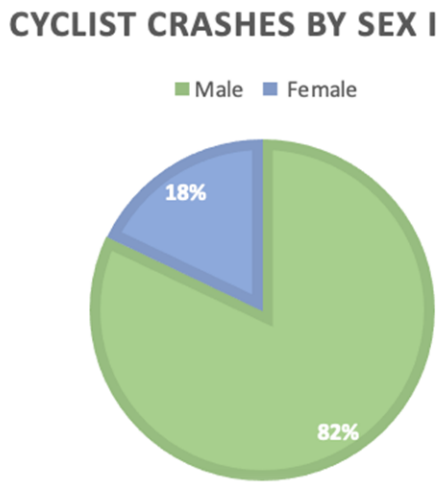


$X^2=14.95$, $p<.05$

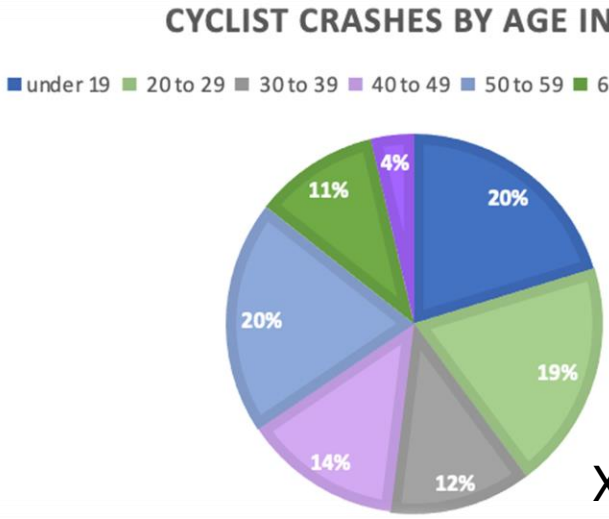
Cyclist Crashes in South Carolina by Race, Sex, & Age



$X^2=6.43$, $p<.05$



$X^2=43.57$, $p<.001$



$X^2=13.26$, $p<.05$

Social Vulnerability and Pedestrian Crashes in SC

- Average crash frequency and severity were not related to SVI in rural areas for either pedestrian or cyclist crashes
- In urban census tracts, level of social vulnerability was positively and significantly related to the number of pedestrian crashes per trip (B=.048, SE=.012, p<.001)
- In urban census tracts, level of social vulnerability was positively and significantly related to the amount/ level of pedestrian crash severity per trip (B=9.02, SE=2.52, p<.001)

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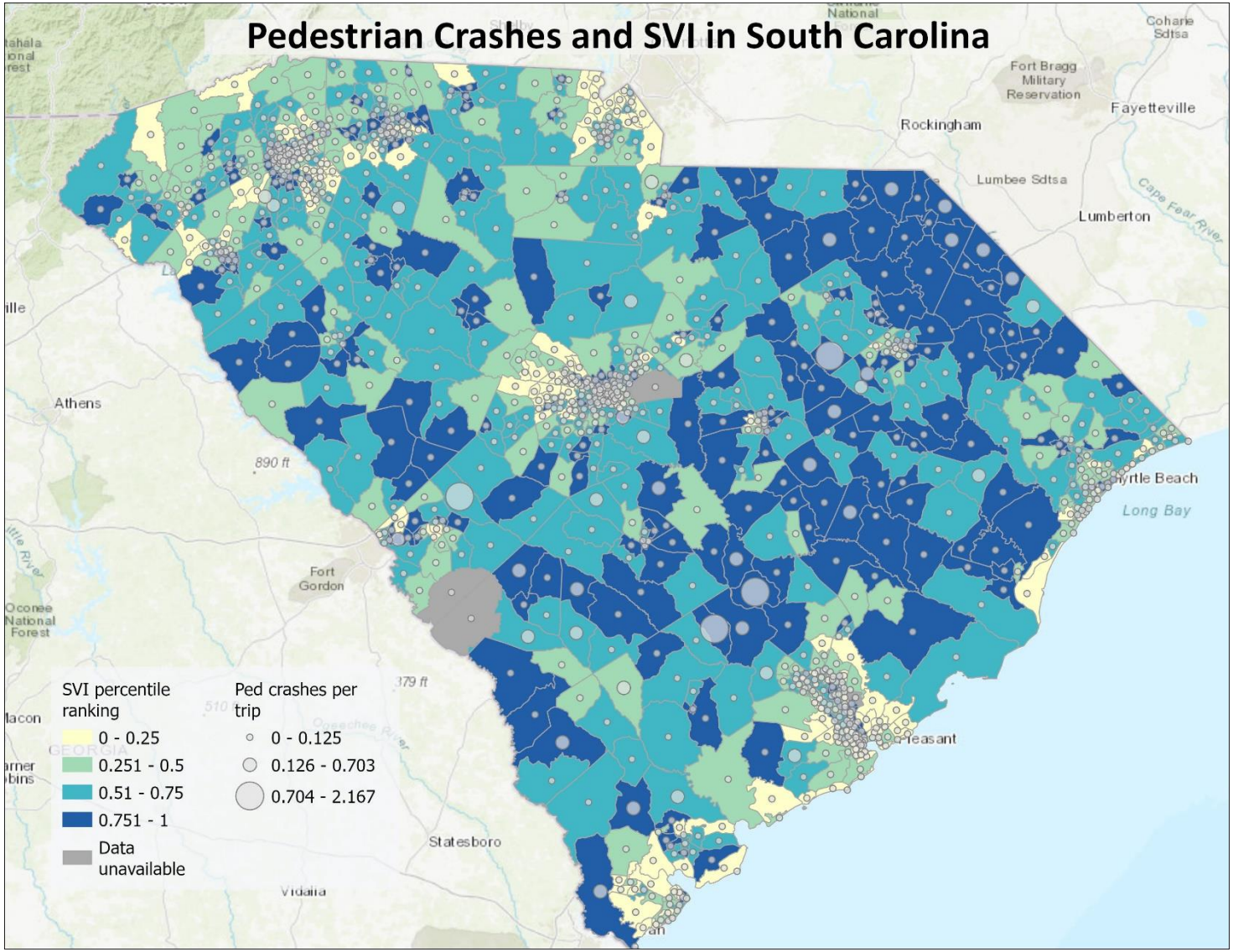

Social Vulnerability and Cyclist Crashes in SC

- In urban census tracts, level of social vulnerability was positively and significantly related to the number of cyclist crashes per trip (B=.093, SE=.029, p<.01)

- In urban census tracts, level of social vulnerability was positively and significantly related to the amount/level of cyclist crash severity per trip (B=16.73, SE=5.48, p<.01)

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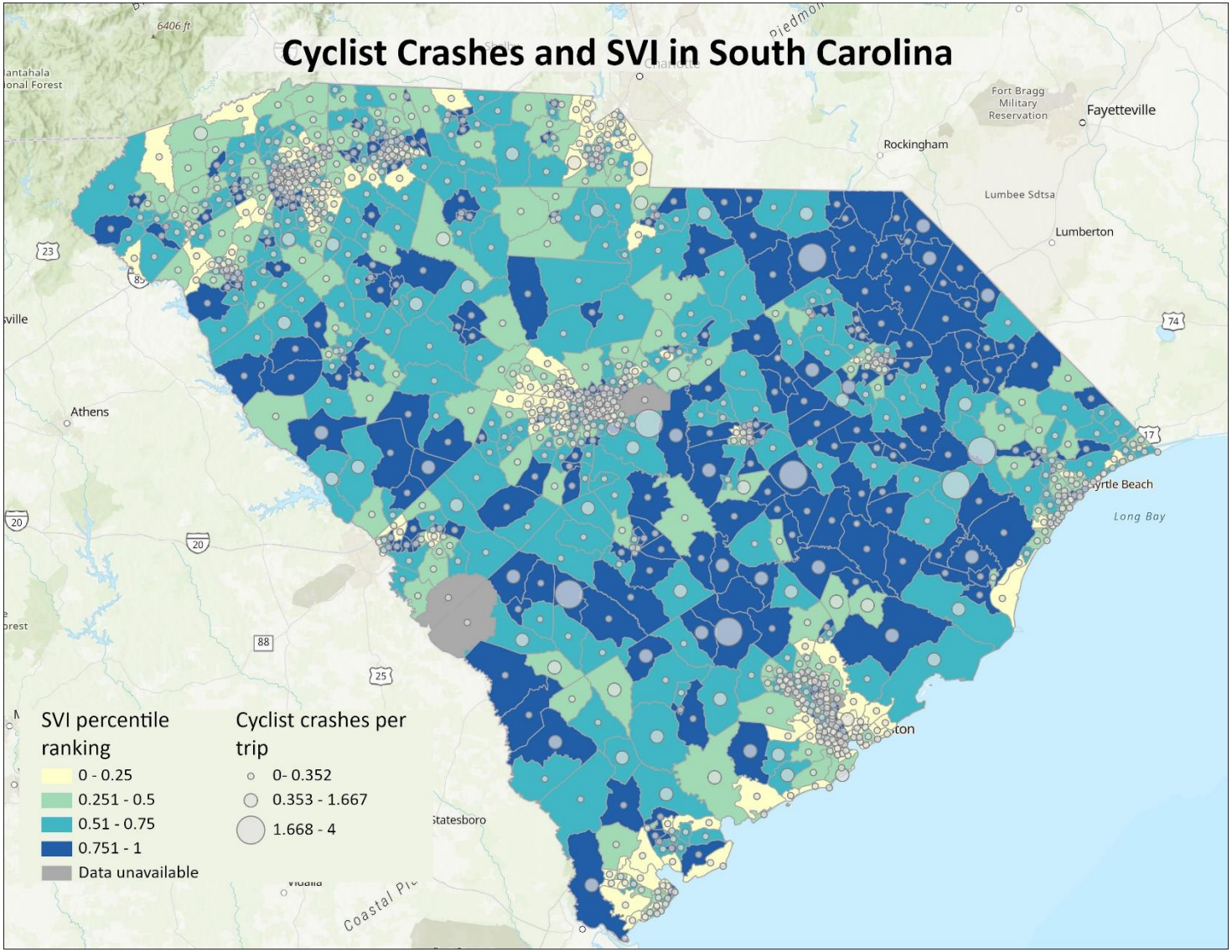
Social Vulnerability and Cyclist Crashes in SC



Summary

- Greater SVI = More pedestrian and cyclist crashes and severity
- Consistent with other past research in Texas
- People from lower income backgrounds/areas more likely to:
  - be located among high traffic and hazardous arterial roads
  - walk and cycle for utilitarian purposes
- Important to highlight and address the differential impact of crashes on diverse populations/neighborhoods

Strengths and Limitations

- Compilation and geocoding of over a decade of detailed pedestrian and cyclist crash data and adjustments for active transportation prevalence
- Cross-sectional analysis precludes definitive causal connections between SVI and crash outcomes
- Need to also consider individual-level factors of the pedestrian/cyclist and other aspects of the built environment
- Findings limited to census tracts in one state and may not be generalizable

Implications for Future Research and Practice

- How do crash disparities differ by the 4 dimensions of social vulnerability?
- Longitudinal analyses of how crashes and crash disparities are improving or worsening over time
- Examination of historical and policy factors contributing to disparities
- Consideration of protective factors that may mitigate crash disparities in rural areas where no differences were found
- Need for geographically and demographically targeted interventions and policies to address crash disparities across SC

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