

# Alone and Resilient? Examining Power Outage Effects by Community Type

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## Abstract

Understanding how people are affected by power outages is becoming more critical with the increased likelihood of electric grid disruptions. However, previous research focuses little on the societal impacts of power outages, specifically how a person's or household's demographics influence outage experiences. While the demographic background of a person matters, where someone lives also influences a household's power outage experience. Prior studies examined the differences between outage duration and living in an urban or rural area and have found between rural and urban areas. This research examines how people in rural, suburban, and urban areas were affected by power outages caused by Winter Storm Elliott in 2022 using two ten-county areas around Buffalo, NY, and Raleigh, NC, as case study sites. Data collection involved a Qualtrics quota sample with 2,063 participants, of which 1,226 experienced a power outage. The research hypothesized that those who live in rural areas experienced longer power outages, greater unhappiness, had lower social capital, and used fewer adaptations than those in urban or suburban areas. Results suggest that location may be less influential than previously thought when considering adverse power outage effects and rural households being more resilient during these events.

## Introduction

While the demographic background of a person matters, where someone lives also influences a household's power outage experience. People that live in rural areas are also more likely to experience more prolonged power outages than those living in urban areas (Call, 2010; Gros et al., 2012; Román et al., 2019). Rural households are typically considered more vulnerable to hazards as they typically have higher poverty rates, more older adults, and are geographically and spatially isolated (Cutter, Burton, & Emrich, 2010; Glasgow, 2000; Horney et al., 2017). Rural areas also tend to receive less attention from utility providers regarding improving and hardening infrastructure and often are a lower priority with restoration (Mitsova et al., 2018; Mitsova et al., 2019; Mukherjee, Nateghi, & Hastak, 2018). Some studies outside of the U.S. found that rural households cope relatively well during prolonged power outages, but the economic costs are a higher concern (Heidenstrøm & Hansen, 2020; Wethal, 2020). Examining how people in urban, suburban, and rural areas is a critical avenue of research investigates the effects people experience in different geographic locations caused by power outages.

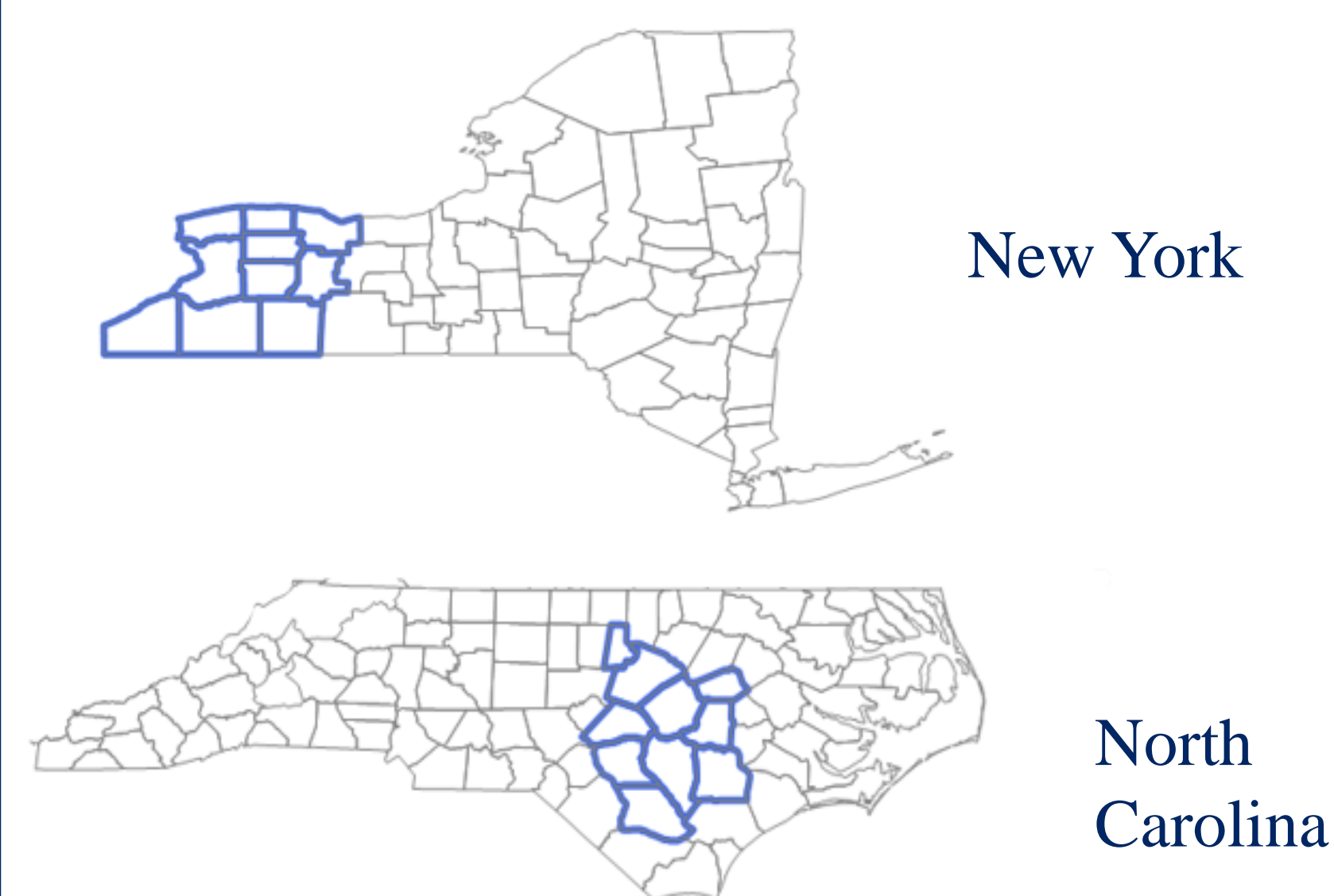
## Hypotheses

1. Those who live in rural areas experienced longer power outages than those in urban or suburban areas.
2. People who live in rural areas experienced greater unhappiness during the power outage than those who live in urban and suburban areas.
3. Those who live in urban areas used more adaptations than those who live in rural areas.
4. Those who live in rural areas reported having lower social capital during the power outage.

## Methods



Panel survey  
n = 2,063  
1,226 experienced a power outage



## Survey Structure

Demographics

Power Outage Frequency and Duration

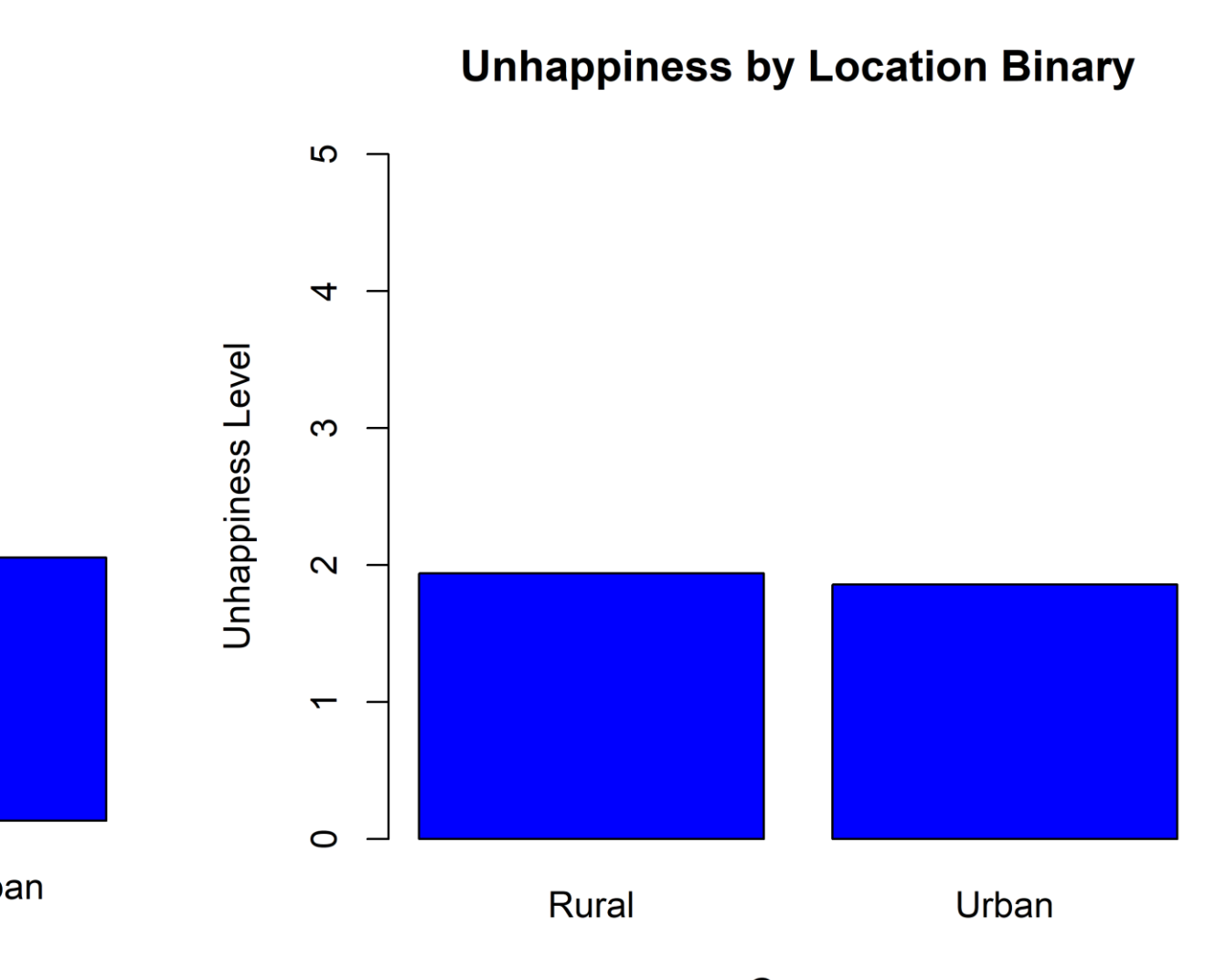
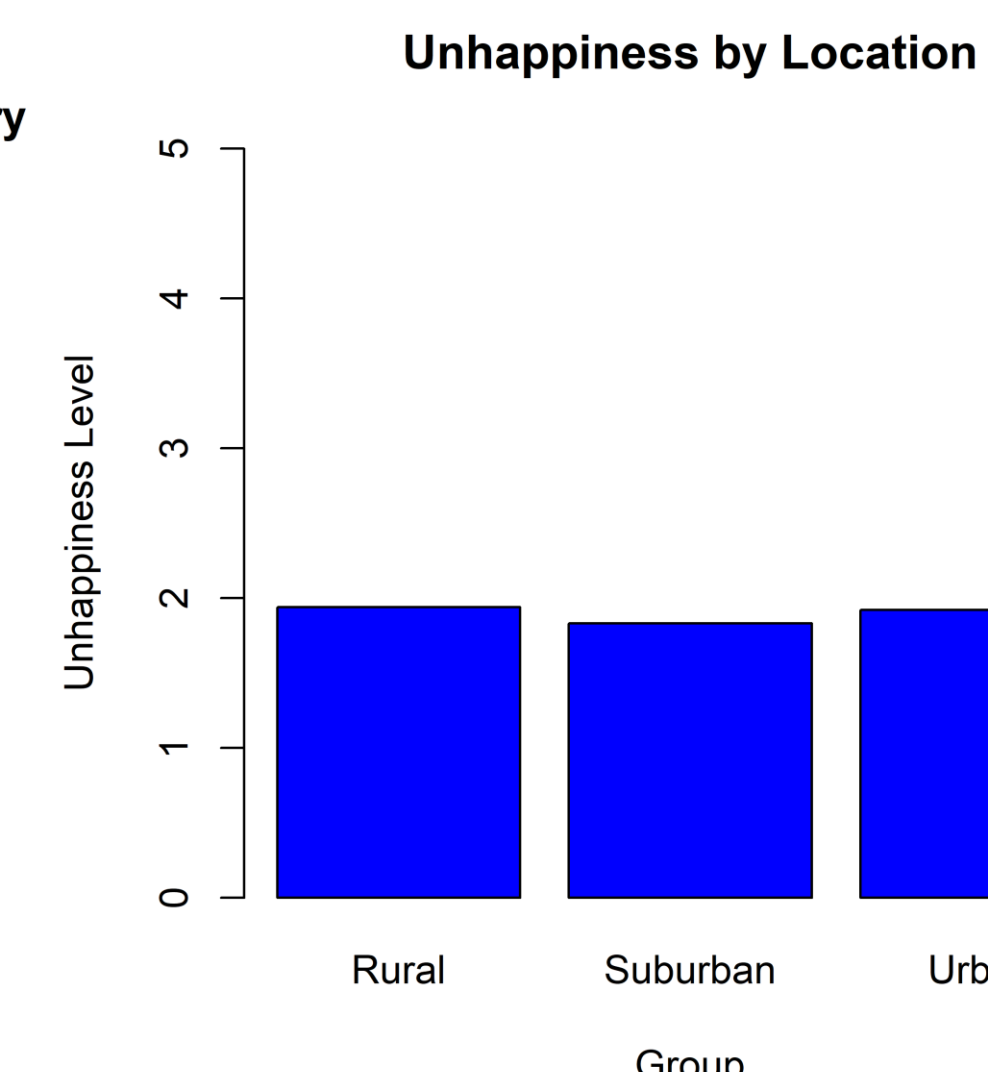
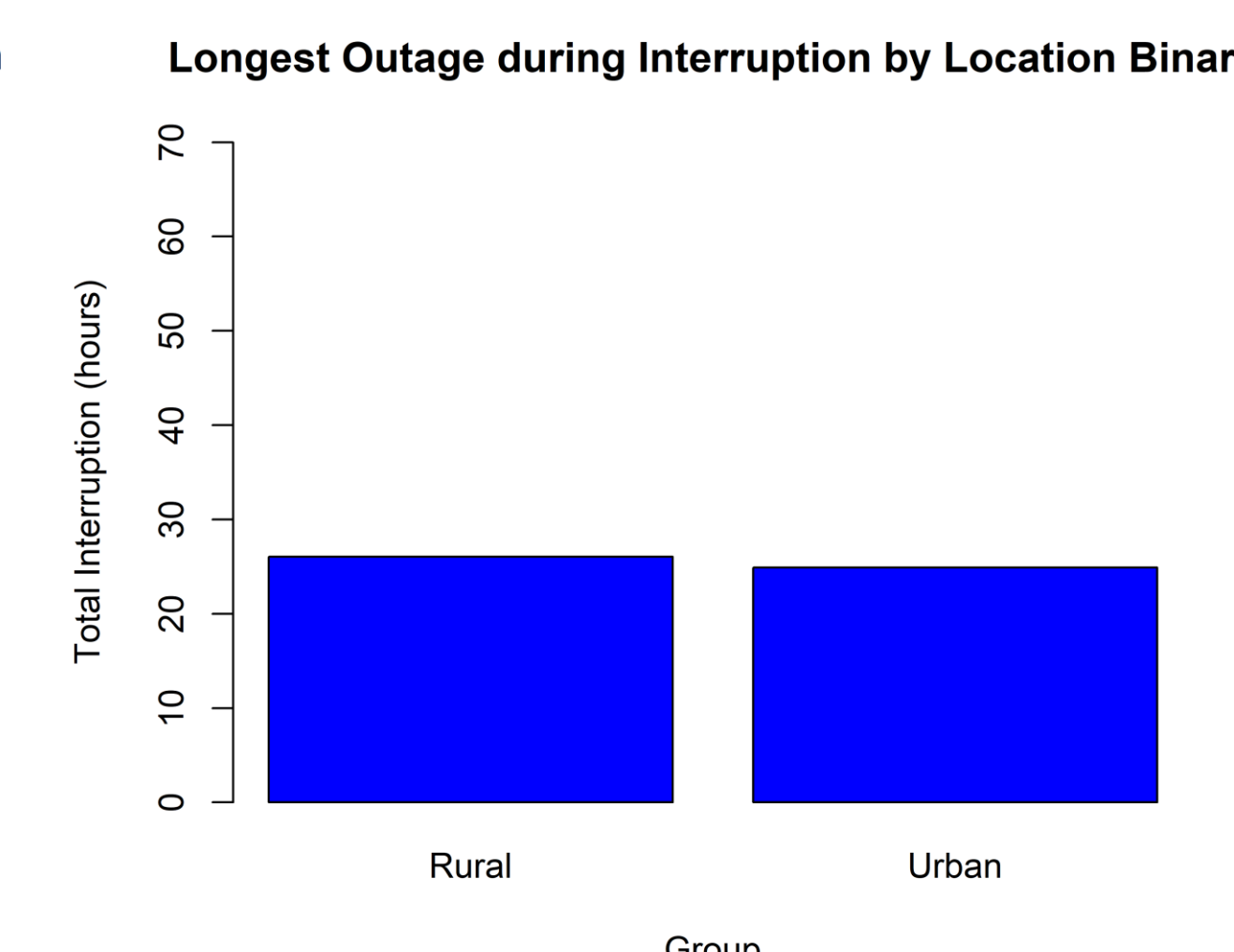
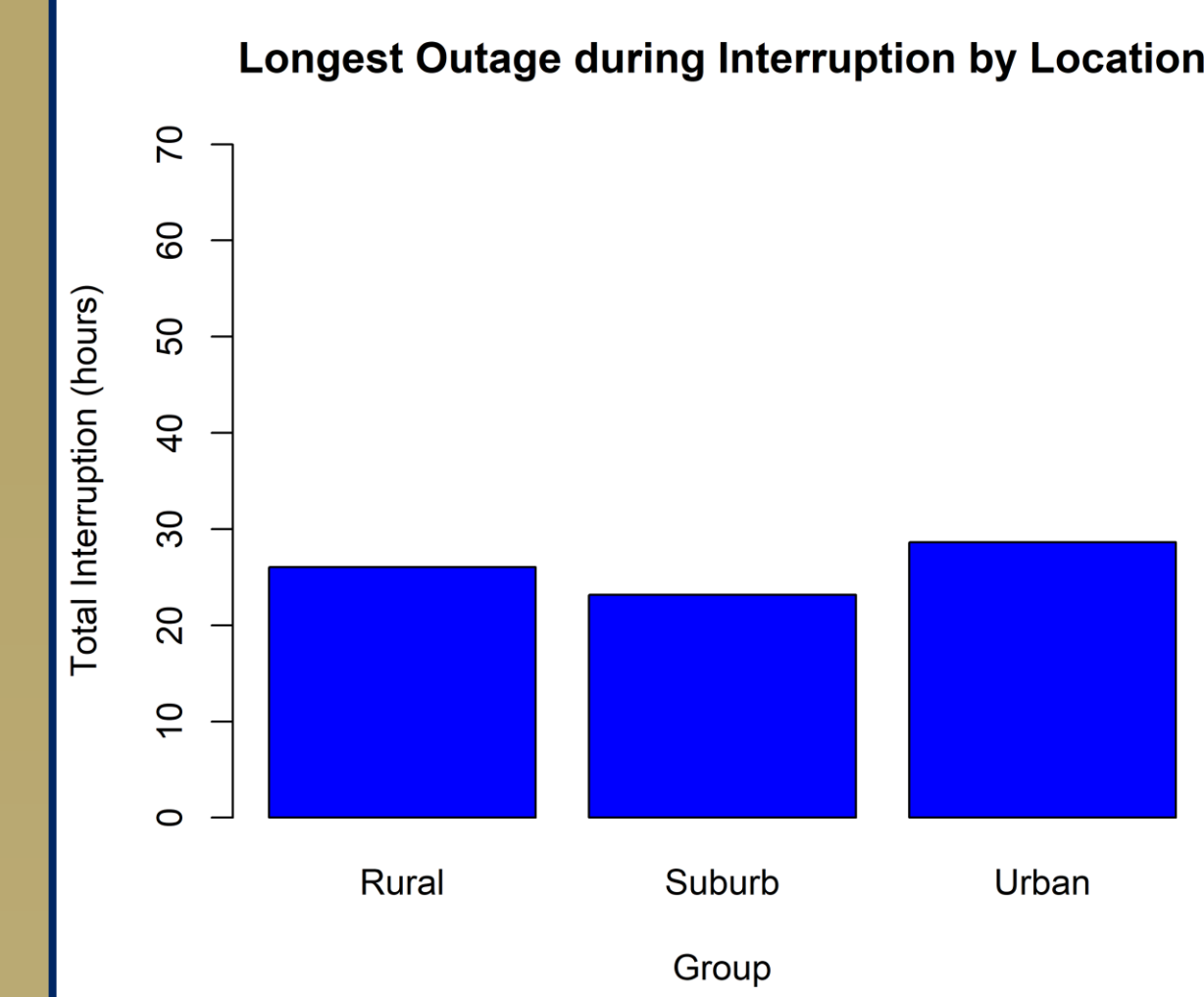
Preparedness, Risk Perception, Social Capital, Adaptation use

Preparedness, Risk Perception, Unhappiness, Social Capital, Adaptation use

Hypothetical adaptation use during power outages of varying lengths

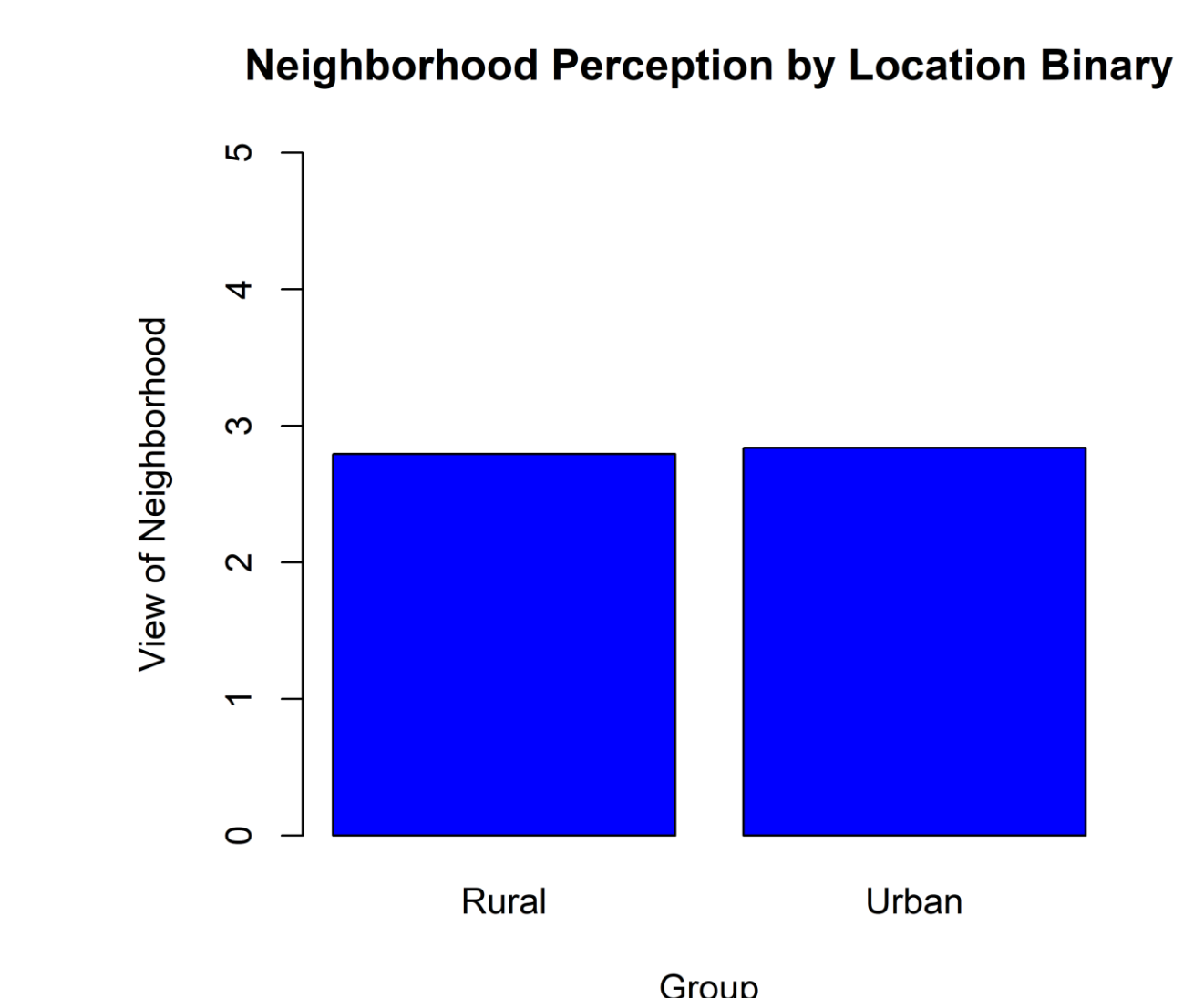
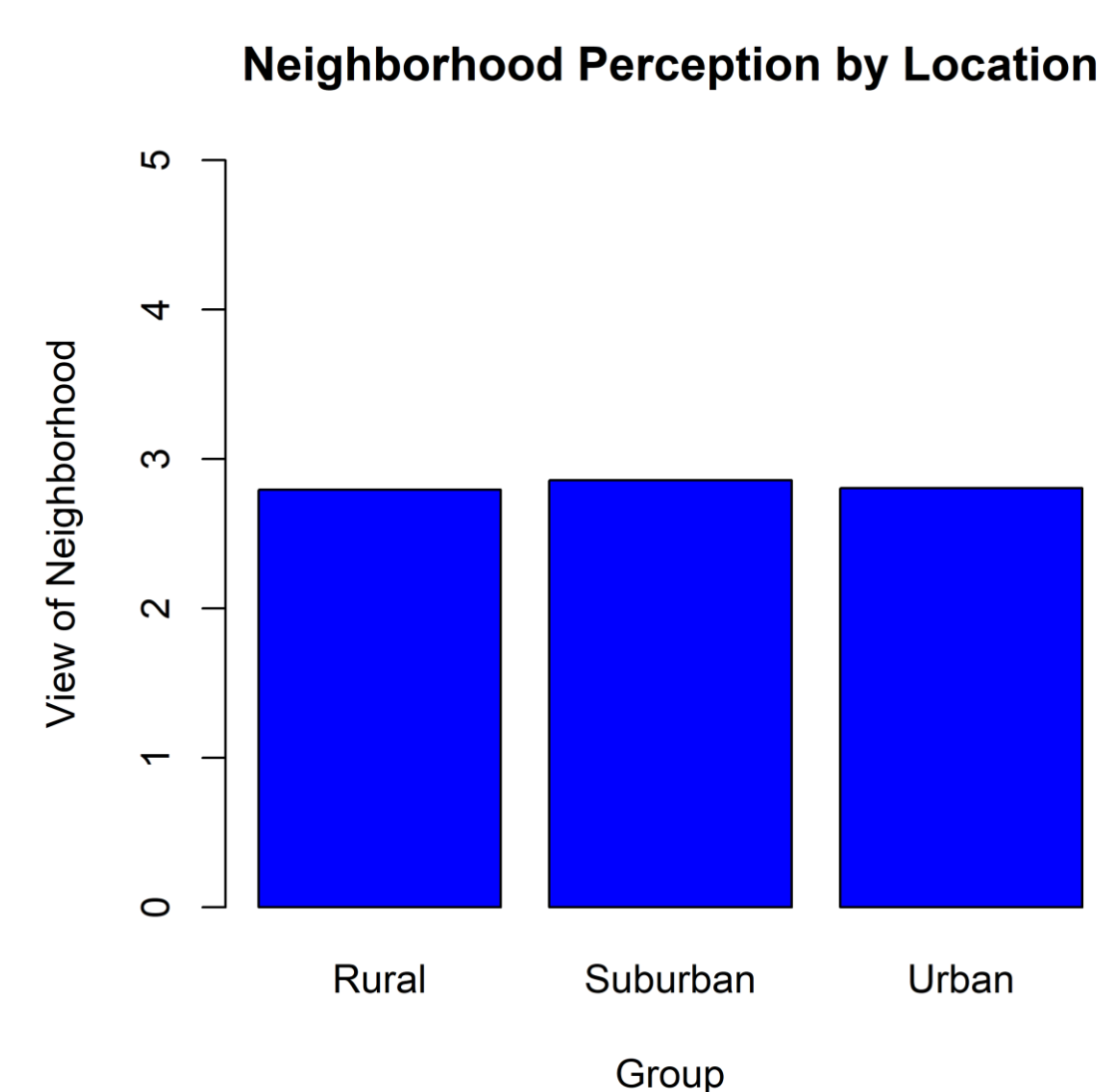
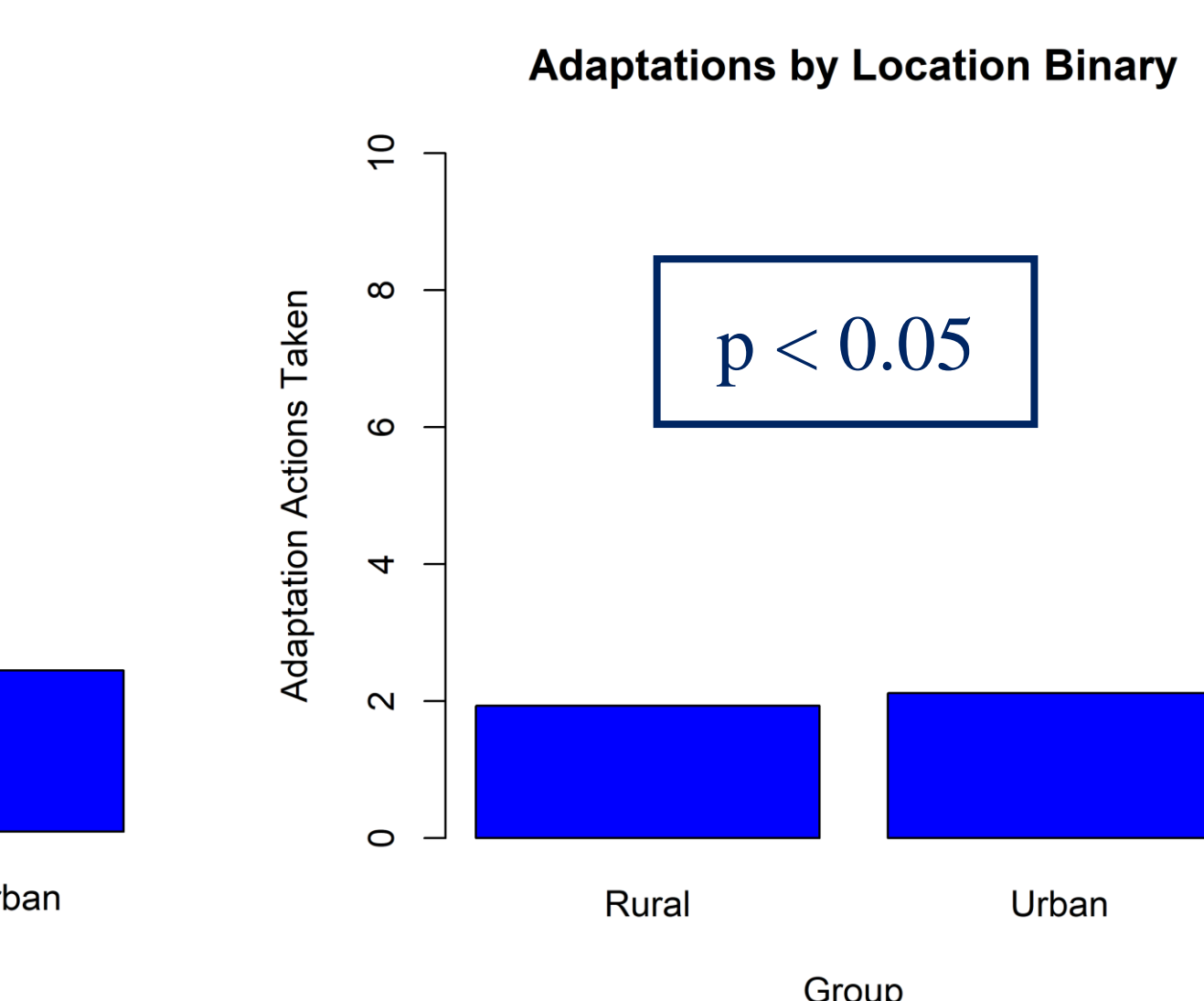
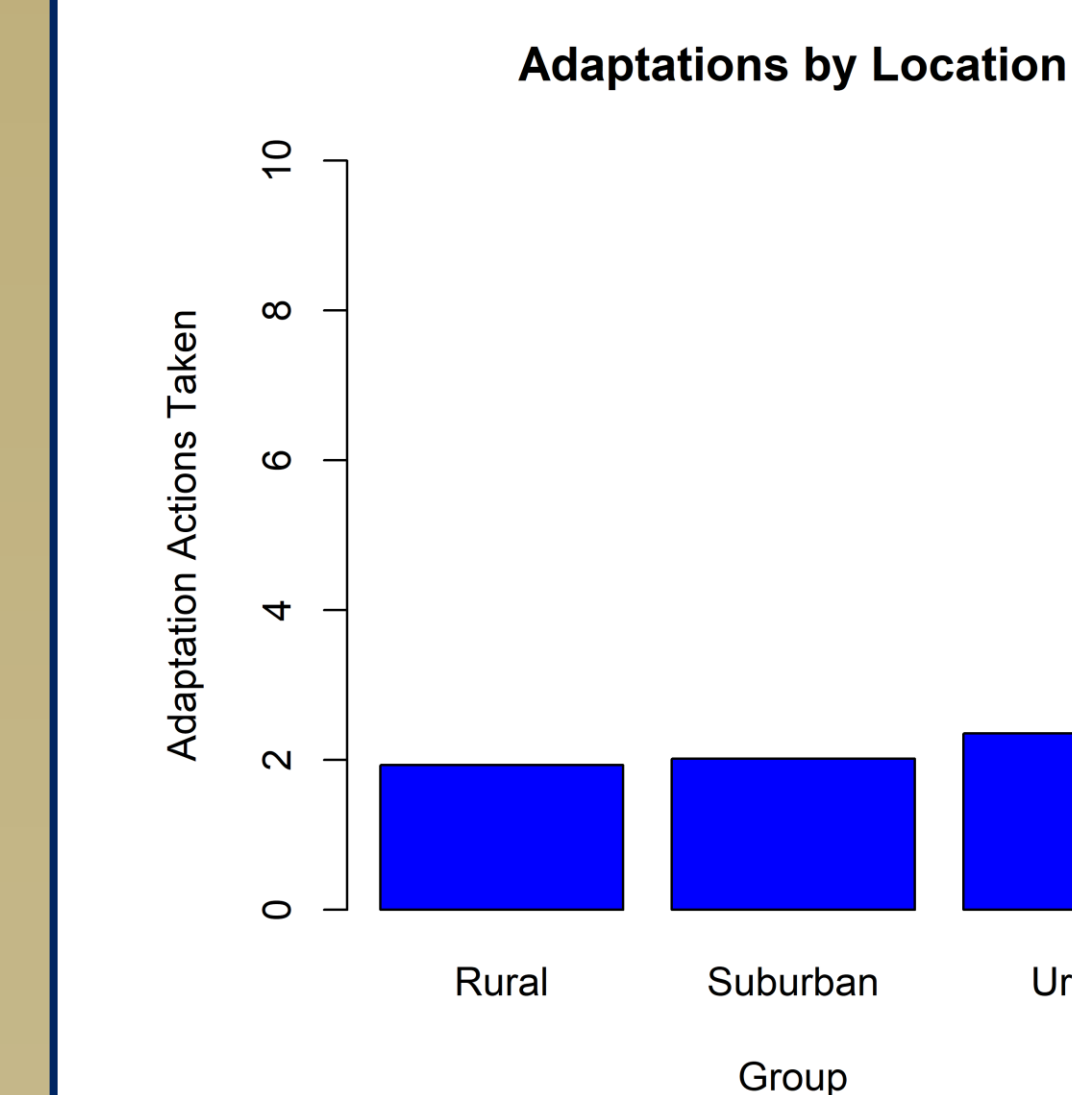
Demographics

## Results



**Figures 1-2.** Examining the difference between the longest outage during the total interruption by each community type asked in the survey (left) and by area requested from Qualtrics (right). Neither test was statistically significant.

**Figures 3-4.** Examining the difference between unhappiness levels experienced during a power outage by each community type asked in the survey (left) and by area requested from Qualtrics (right). Neither test was statistically significant.



**Figures 5-6.** Examining the difference between the number of adaptations used during a power outage by each community type asked in the survey (left) and by area requested from Qualtrics (right). The test with the location variable in a binary variable was statistically significant.

**Figures 7-8.** Examining the difference between the perception of participants' neighborhoods by each community type asked in the survey (left) and by area requested from Qualtrics (right). Neither test was statistically significant.

## Conclusions

- Location was not as strong as a variable as anticipated.
- Findings indicate there is not a statistical difference between outage durations, unhappiness, and neighborhood perception.
  - H1, H2, and H4 were not supported.
- Some significance emerged with adaptation use but only after making the location variable binary.
  - H3 was only partially supported.
- Additional research is needed to solidify the empirical basis needed to draw stronger conclusions.

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