

Outcome Disparities Following Ballistic Fractures with Soft Tissue Injury

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Introduction

- Gunshot fractures are a common and expensive traumatic injury in many major cities.
- Over 40% of gunshot wound patient present with more than one orthopedic injury with nearly 20% requiring immediate orthopedic surgical intervention. Common sites of injury for GSWs include the femur and the tibia, both of which are at risk for several serious orthopedic complications such as infection, reoperation, and non-union.
- The healing process of bone is biologically complex with many factors contributing to its success such as the interaction between muscle and bone.
- Previous studies have explored the similarities between GSW fractures and open fractures due to the shared damage to surrounding soft tissues and its potential implications in the healing process.
- Socioeconomic disadvantage in our patient population may contribute to higher rates of surgical complications such as infection and nonunion.
- The cumulative effects of soft-tissue disruption, decreases in muscle-bone interactions, and nutrient deficiencies driven by socioeconomic disparities may lead to increased negative outcomes following ballistic injuries with skeletal fracture.

Objective and Significance

This study aims to:

- Describe fracture healing outcomes following bone fractures sustained due to ballistic injuries
- Examine the impacts of social determinants of health (SDOH) effects on orthopedic outcomes such as nonunion, loss of follow-up, infection, and reoperation.

We hypothesize that social disadvantage would be associated with adverse fracture outcomes.

Methods

- Electronic medical records were reviewed for adult orthopaedic surgery patients treated at University Medical Center (UMC) who have sustained a bone fracture related to ballistic trauma from April 2023 to March 2026.
- Data extracted includes demographics (age, sex, ethnicity), health characteristics, injury characteristics, Area Deprivation Index (ADI), treatments, and outcomes.
- ADI is a composite measure of social disadvantage and is calculated by national percentile and state decile. **Higher ADIs represent greater social disadvantage.**
- Regression analysis was used to test for association between ADI and clinical outcomes while controlling for subject demographics using Stata/SE 19.

Results

- Preliminary analysis included 32 patients with femur fractures from ballistic trauma.
- Mean distance from the subjects' homes and UMC was 54 miles (range 2.7-504 miles)

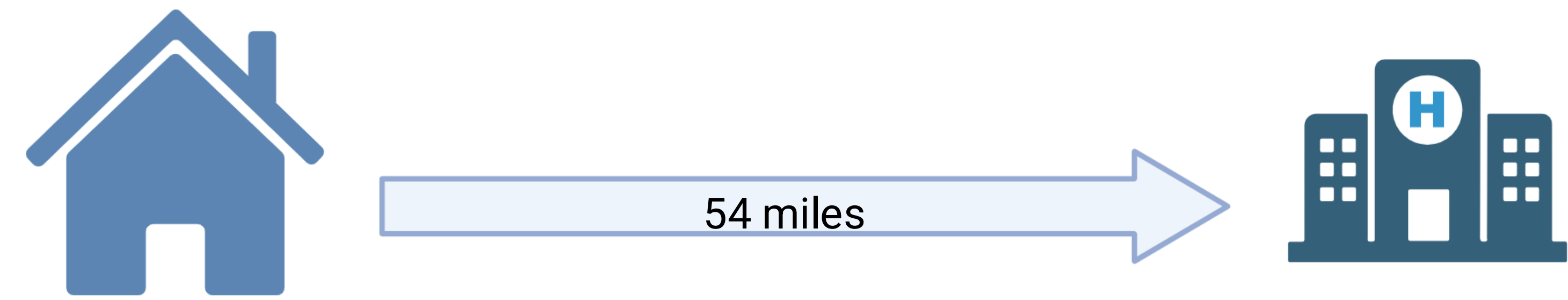
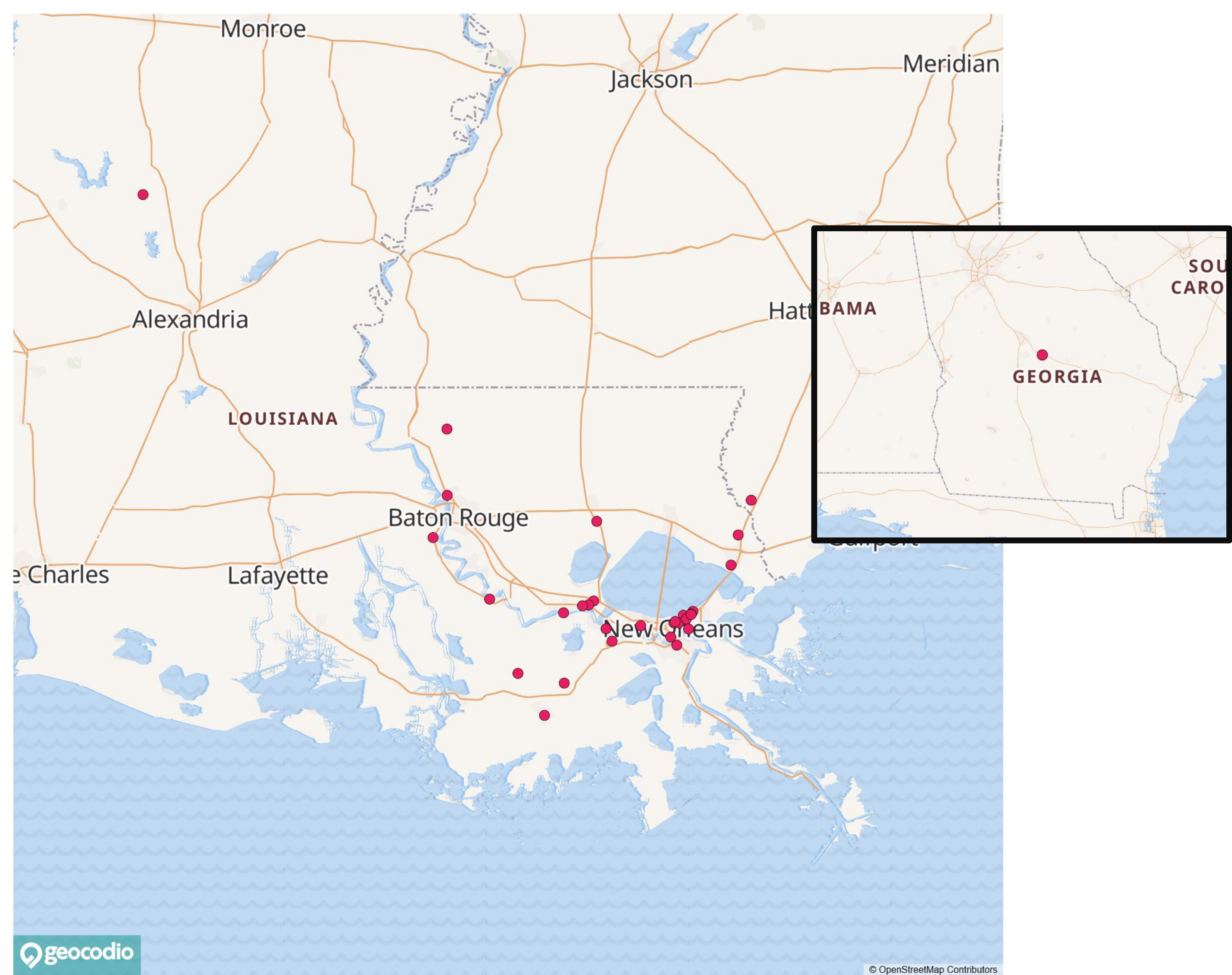


Figure 1: Map of catchment area based on home addresses of subjects treated at UMC following ballistic related femur fracture (below)



- The mean ADI national percentile was 76.4 ± 9.3 (range 58-96).
- **Increasing ADI was positively associated with more likely loss of follow up ($\beta = 18.2$ [95% CI 2.0-34.4]; $p = .037$).**
- Distance from home to UMC was not associated with loss of follow up.

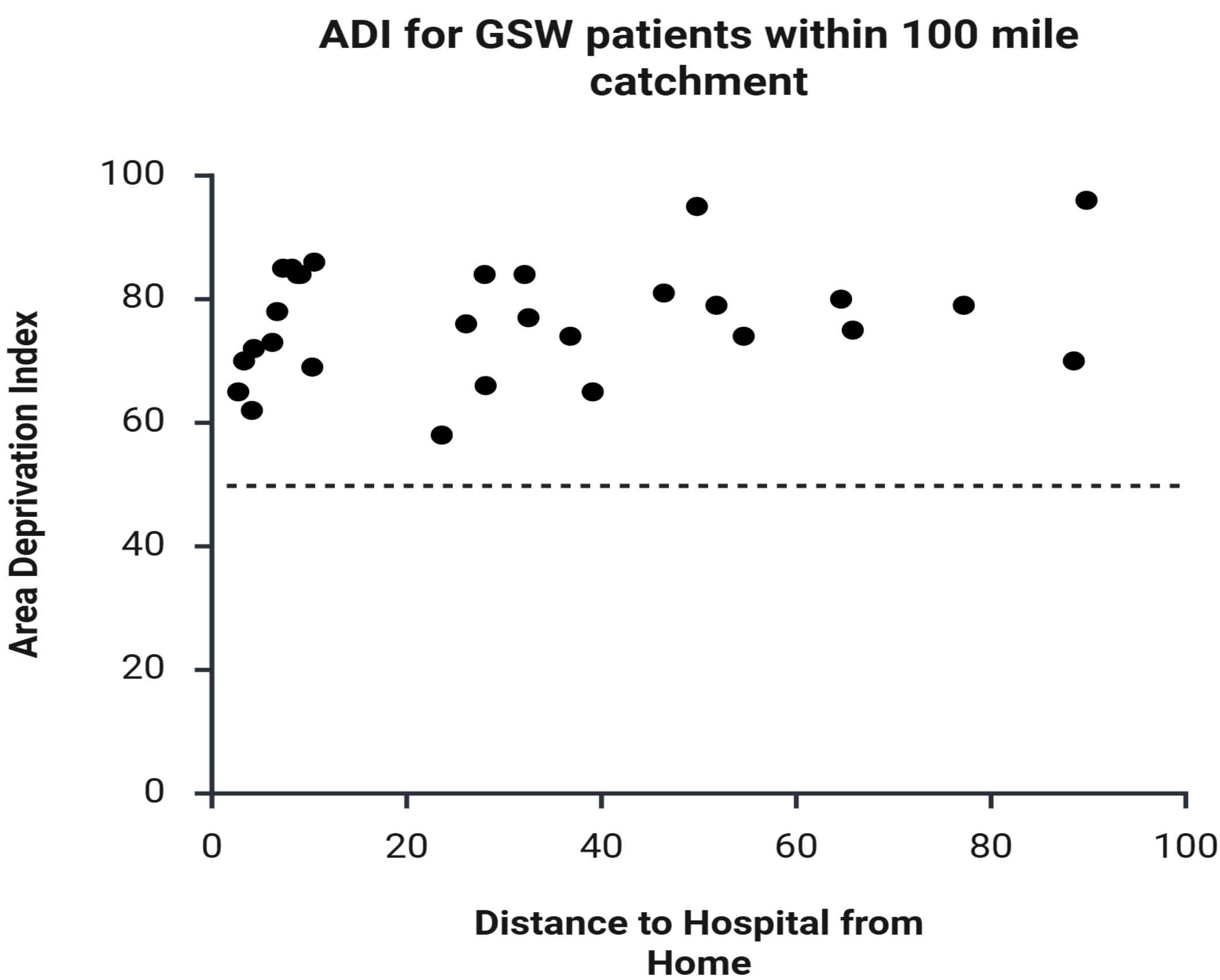


Figure 2: Plot of ADIs for subjects who lived within 100 miles of UMC catchment area. (left) Notable observation is that no patients had an ADI at or below 50% national percentile (dash line) emphasizing high level of socio-economic deprivation of patient population

Results

- Mean age was 34 years (range 17-76 years)
- 81% of the subjects were male
- 81% of subjects were African American
- 72% of subjects received free care or were covered by Medicaid
- 75% of subjects did not return to clinic per instructions and were considered lost to follow up prior to complete healing (typical clinical course of 1 year)
- Complications related to soft tissue infection and bone healing requiring reoperation occurred in four patients
- Loss to follow up may have affected the ability of the study to accurately capture short- and long-term complications of ballistic fracture injuries.

Discussion and Limitations

- The preliminary results highlight the large catchment area for which UMC provides acute traumatic orthopedic care and a patient population with high social disadvantage.
- **ADI was positively associated with loss to follow up while patient residence to hospital distance was not. This suggests that social disadvantage affected patients' access to care to a greater degree than potentially large physical distances.**
- Limitations to this study include a potential inability to adequately capture negative surgical outcomes in patients due to loss of follow up. Preliminary data indicated a low rate of infection and non-union; however, this may be due to the high rate of loss of follow.
- Further work on this study will seek to understand other factors impacting patient outcomes following ballistic fracture injuries such as nutrition and other socioeconomic variables.

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