

USING TRAVEL-TIME TO ESSENTIAL SERVICES TO IDENTIFY VULNERABLE AND FRAGILE COMMUNITIES

Utkuhan Genc

Ph.D. Student, Industrial Engineering | Purdue University

ugenc@purdue.edu

Background / Motivation

- Transportation networks are a critical element of flood risk resilience in terms of providing **timely access** to essential services
- Changing climate will impact coastal communities, where residents could experience up to **643 min of added commute time per year** in 2060 in current sea level rise (SLR) trajectories due to **reduced speeds** on inundated roads (Hauer et al., 2021)
- Existing transportation network in **Louisiana** has the **second highest risk** among all US coastal communities in terms of both **isolation** and inundation in low SLR scenario, third in middle and high SLR scenarios (Logan et al., 2023)
- People living in coastal communities across Louisiana mentioned the **increased drive time to essential services** as an important outcome of flood risk



Figure 1. Aerial picture of Louisiana road inundation
Source: Houston Chronicle

Background / Motivation

- With changing climate, population dynamics are changing in coastal communities:
 - Population ↓ → Services closing either because of the damage from tropical cyclones or decreased business activity → Drive time ↑
 - Population ↑ → Strained capacity in existing facilities, and potential increased drive time for new residents of a region

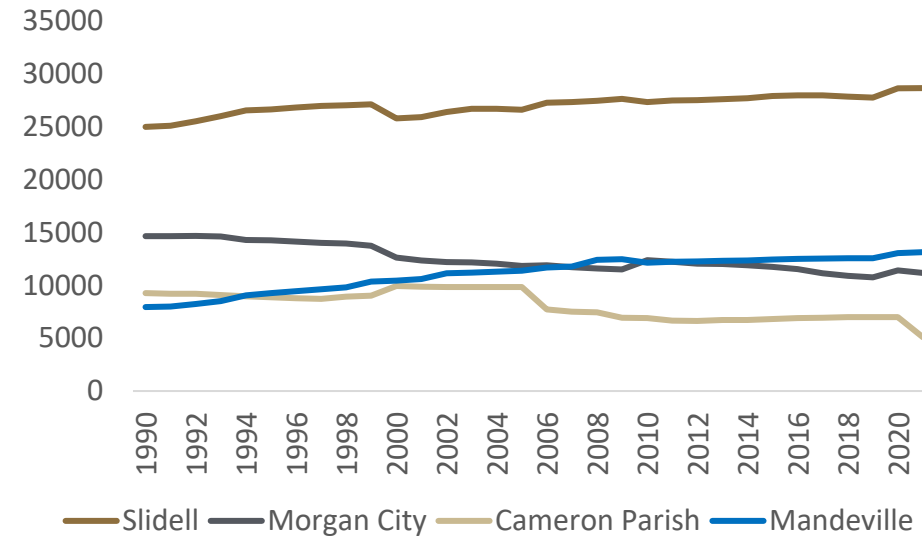
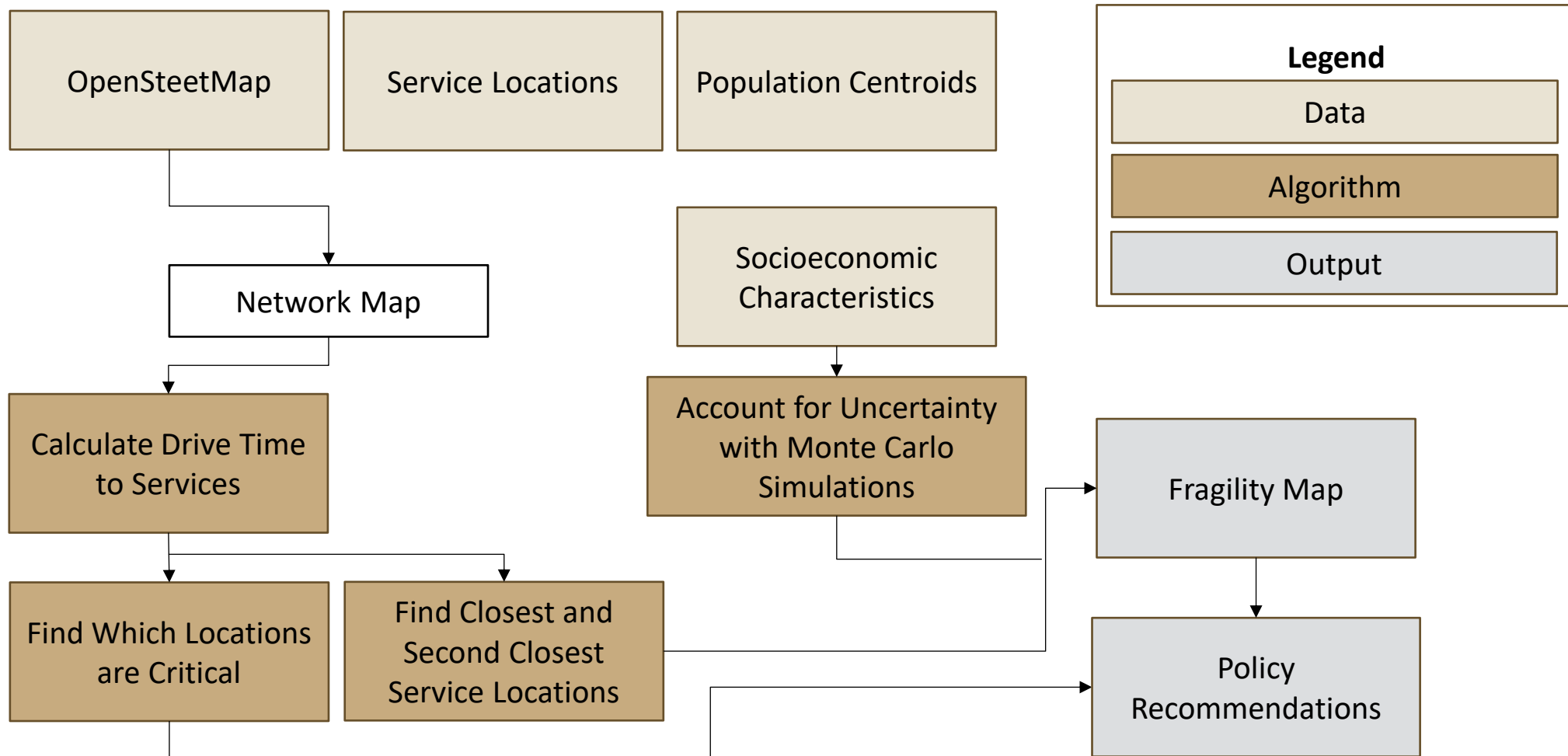


Figure 2. Population change over years

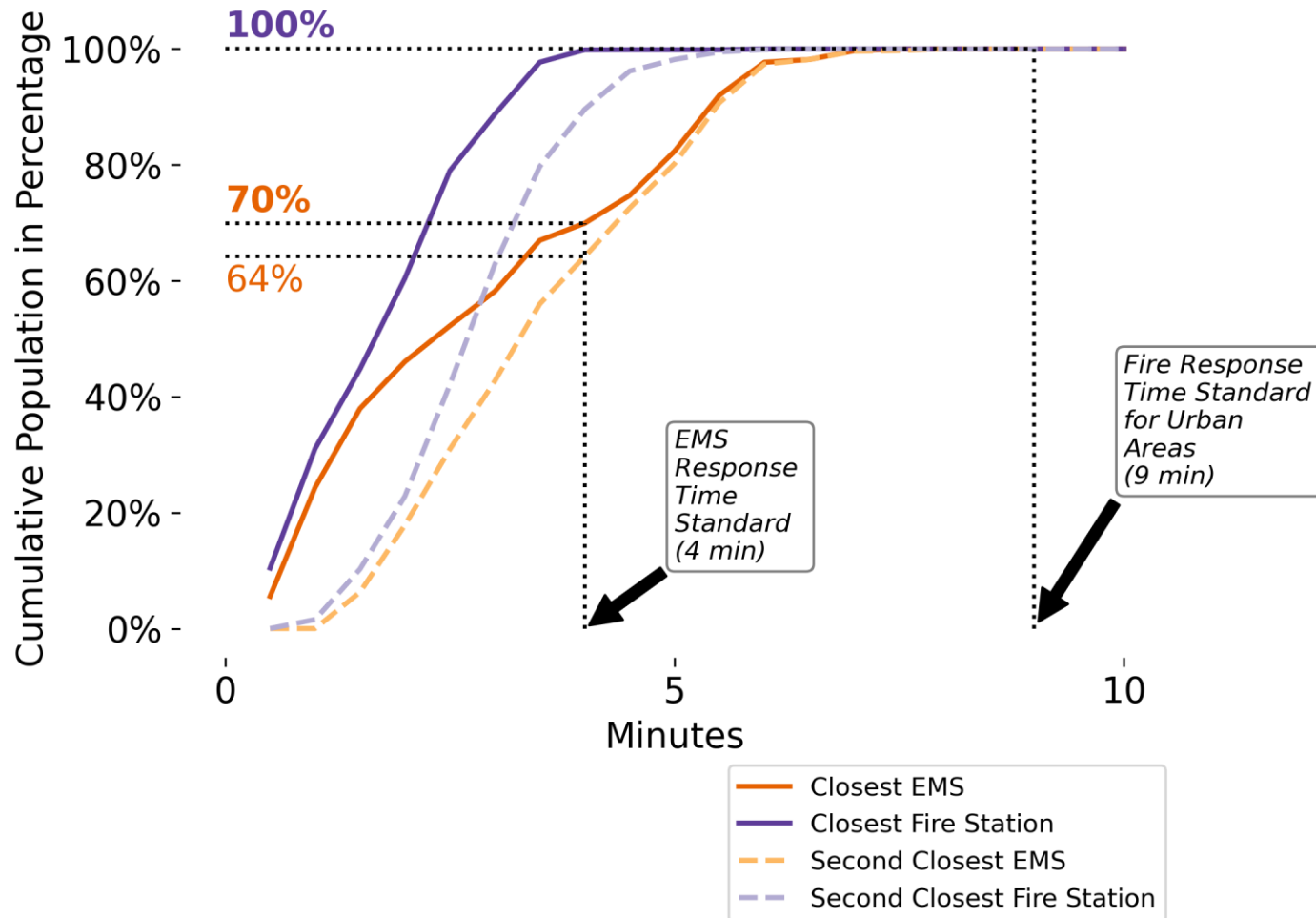
Research Questions

- How to quantify the fragility of the access to essential services using transportation networks as it relates to resilience?
- Which facilities are critical in terms of access?
- Are there any sociodemographic differences in terms of access to essential services?

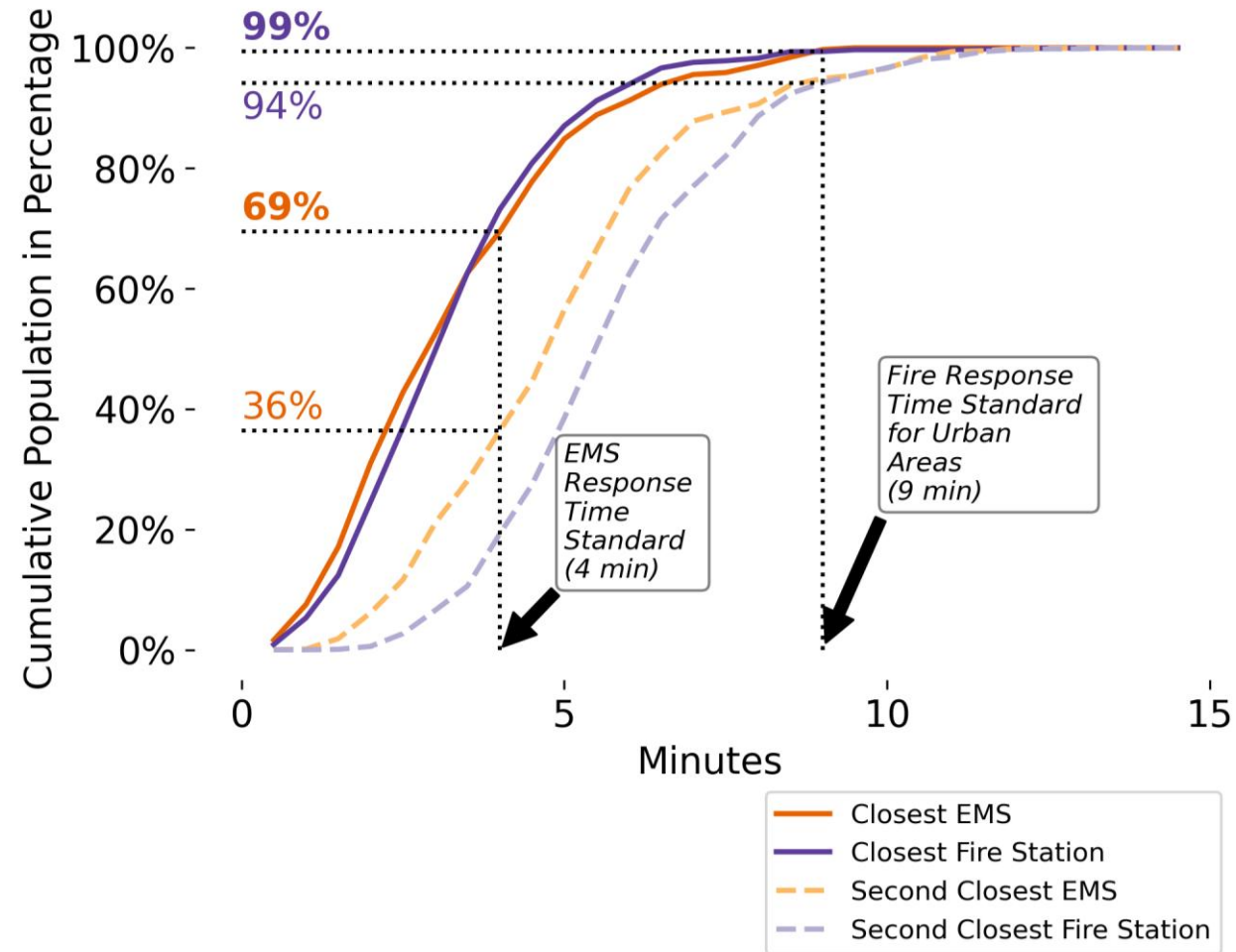
Methods



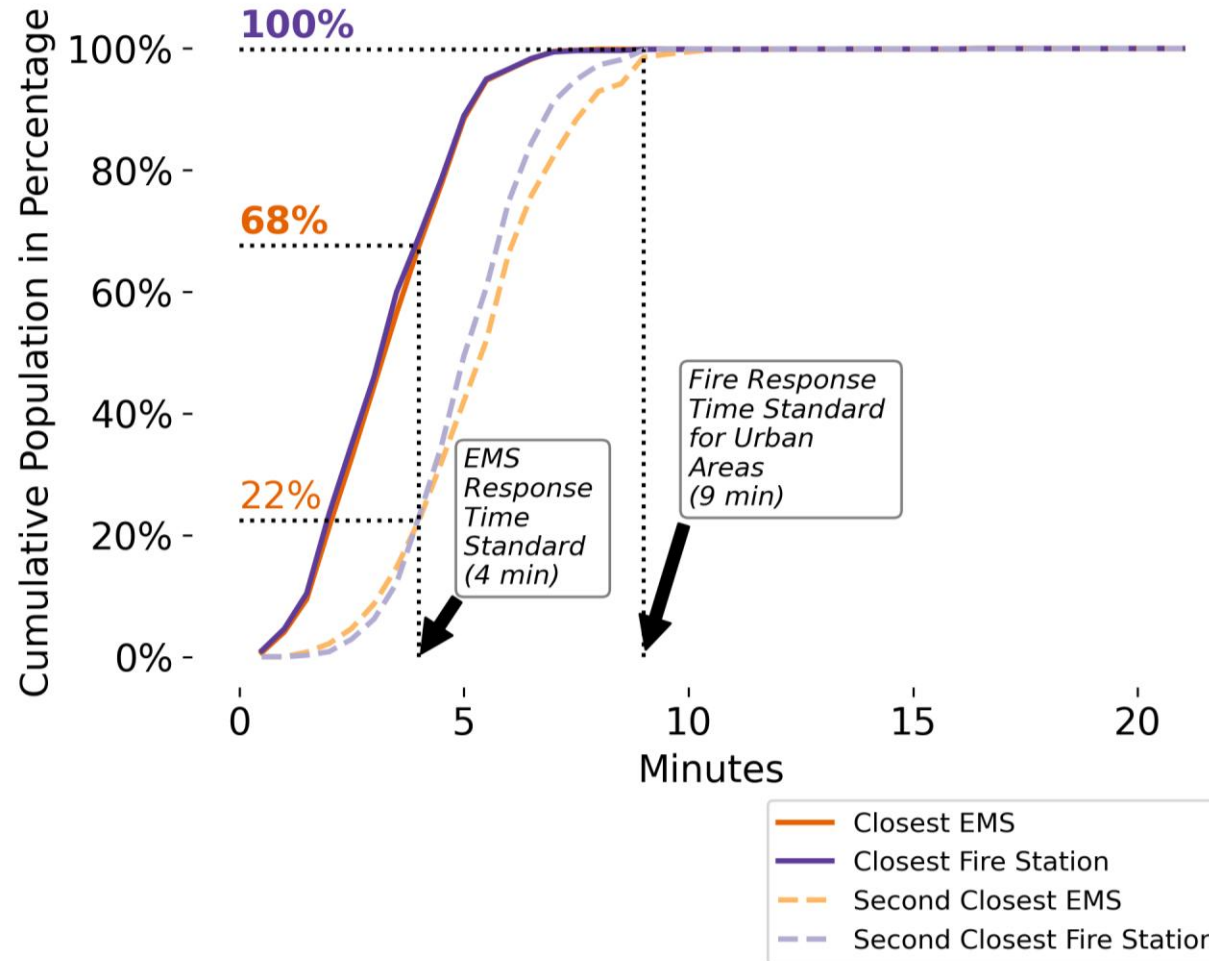
Emergency Services Access (Morgan City)



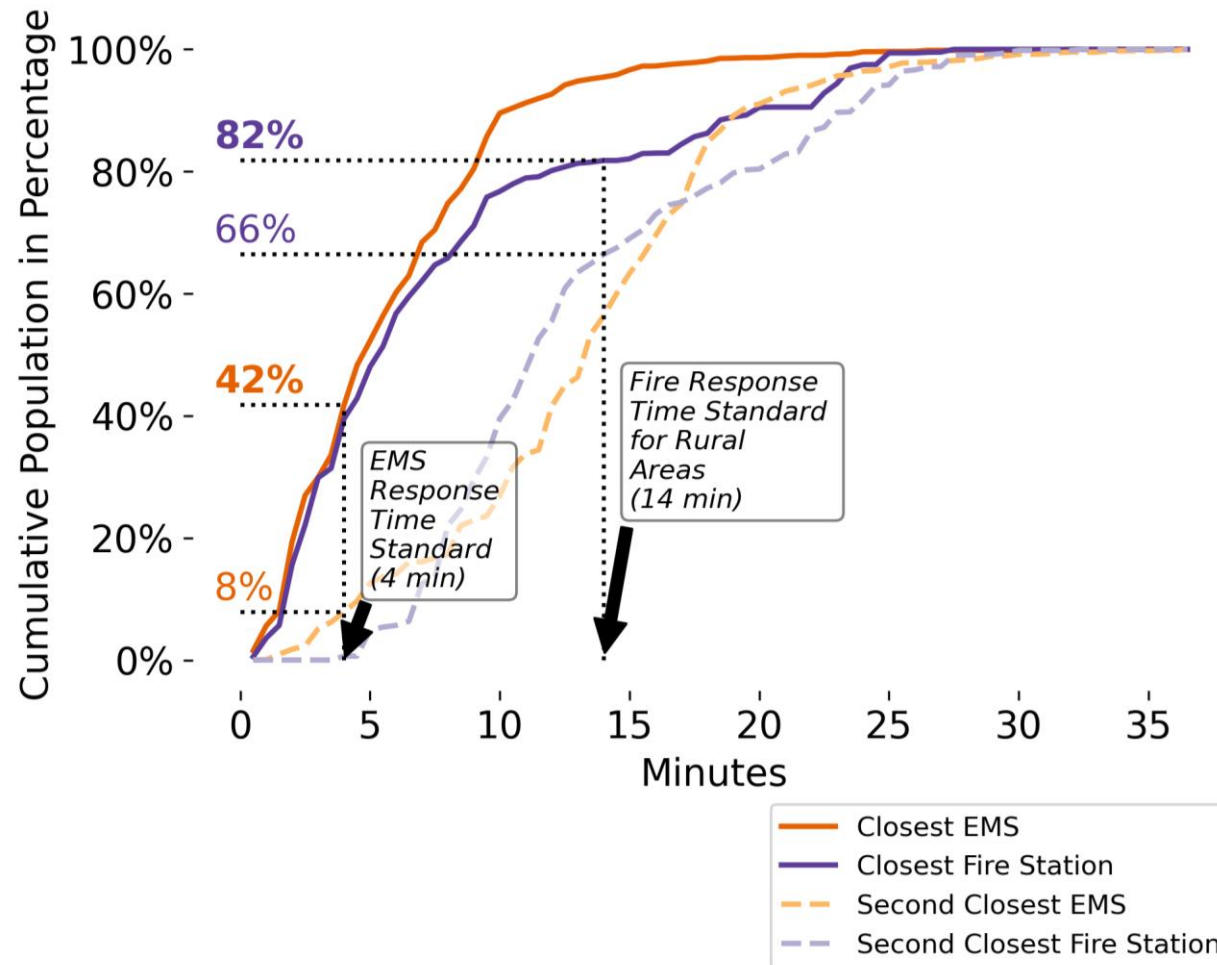
Emergency Services Access (Slidell)



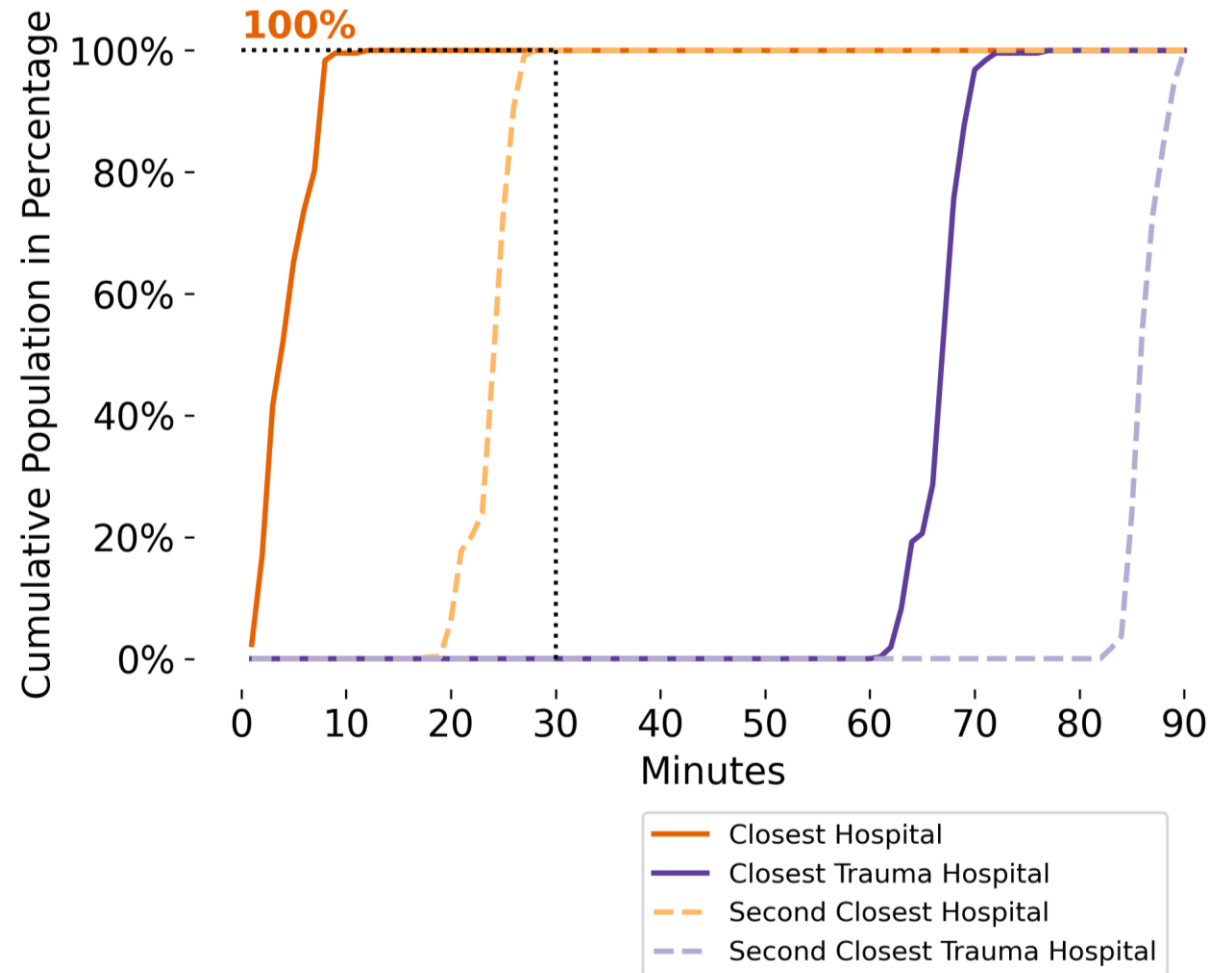
Emergency Services Access (Mandeville)



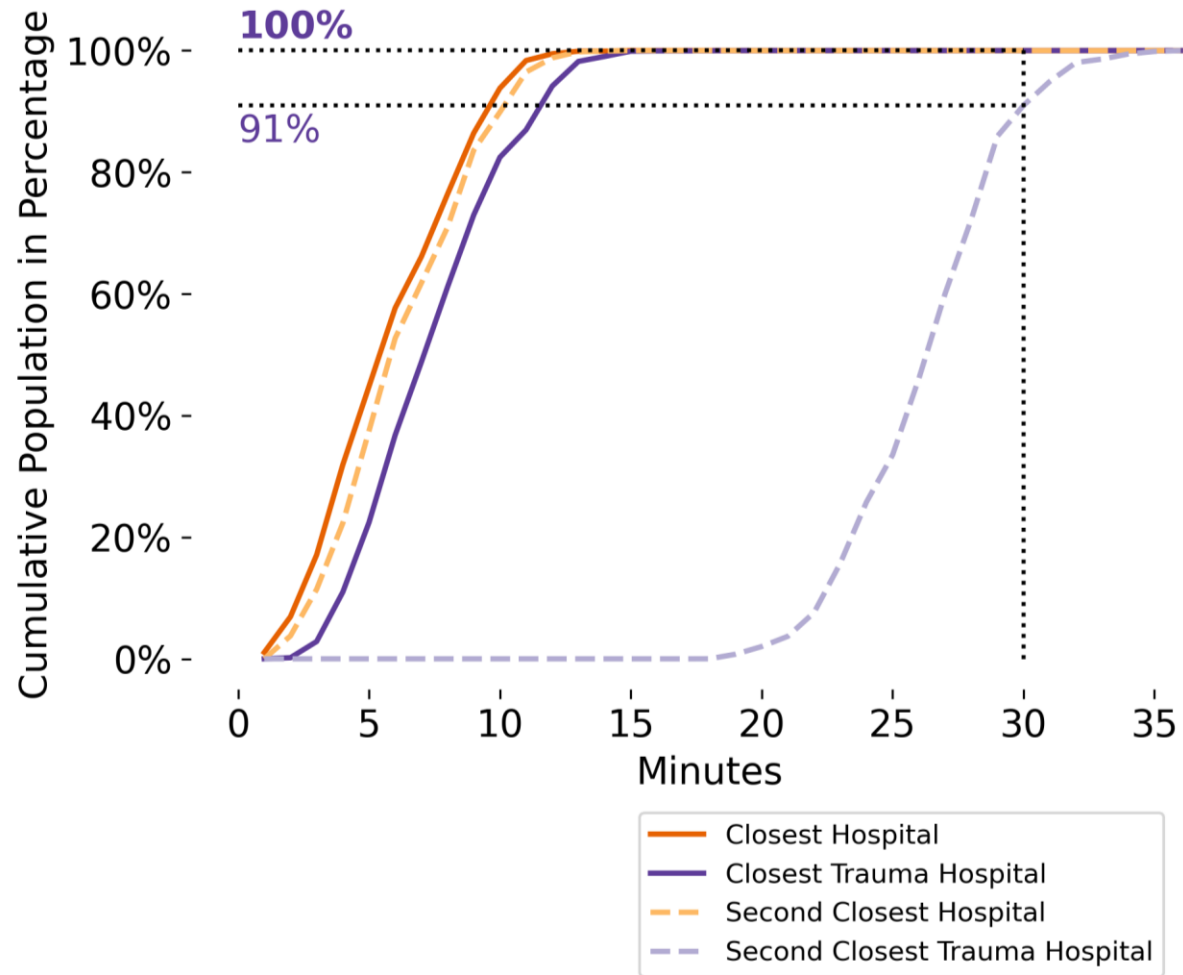
Emergency Services Access (Cameron Parish)



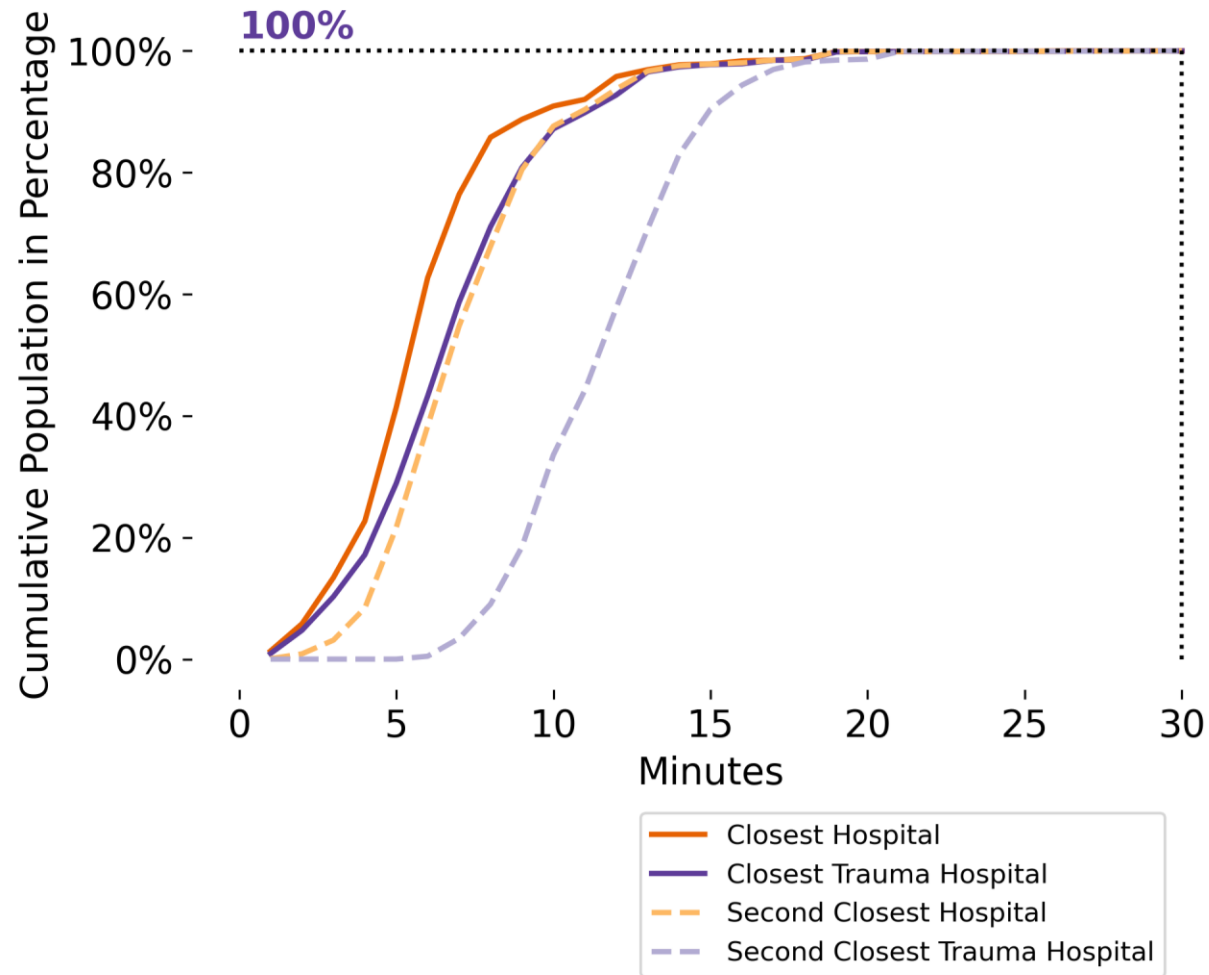
Hospital Access (Morgan City)



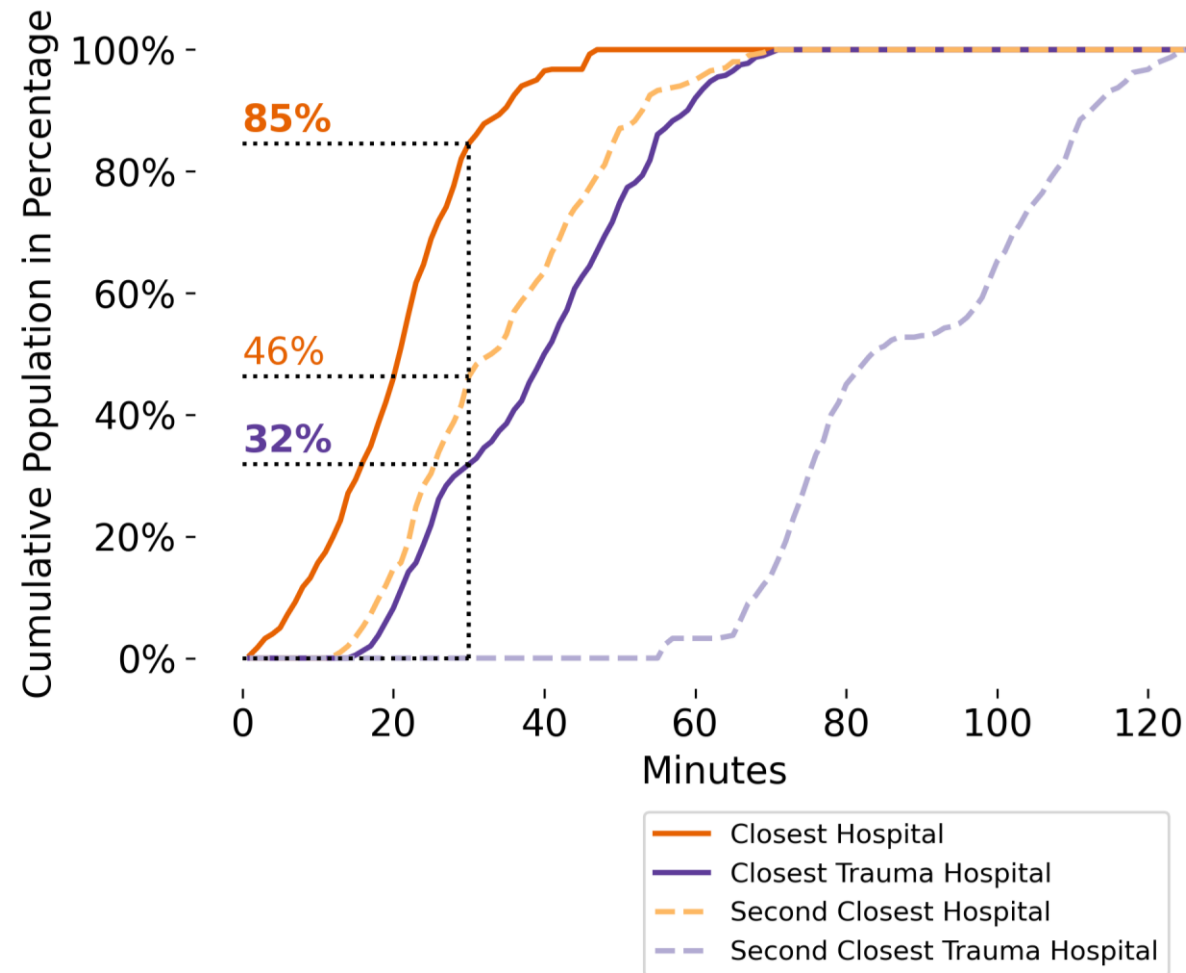
Hospital Access (Slidell)



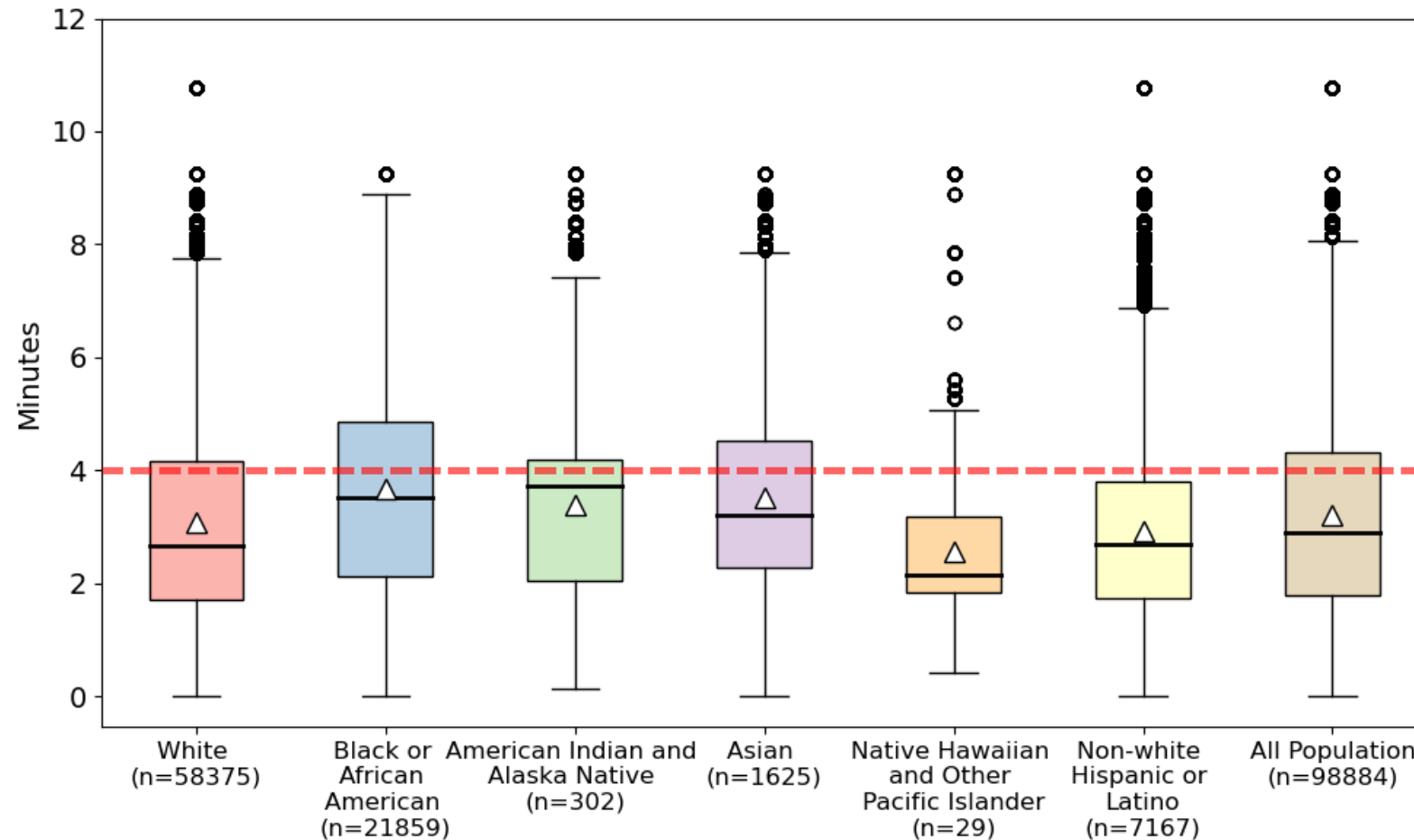
Hospital Access (Mandeville)



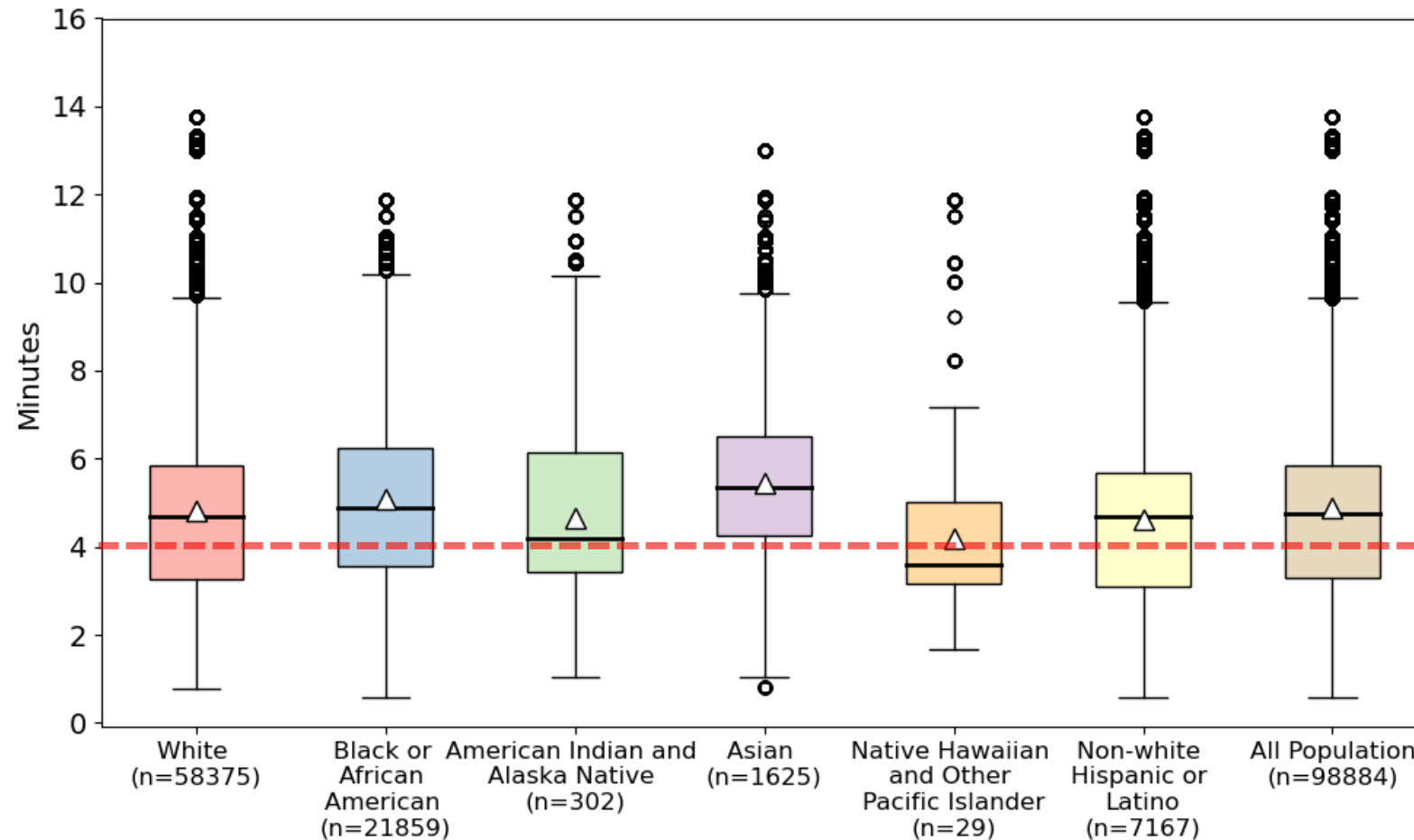
Hospital Access (Cameron Parish)



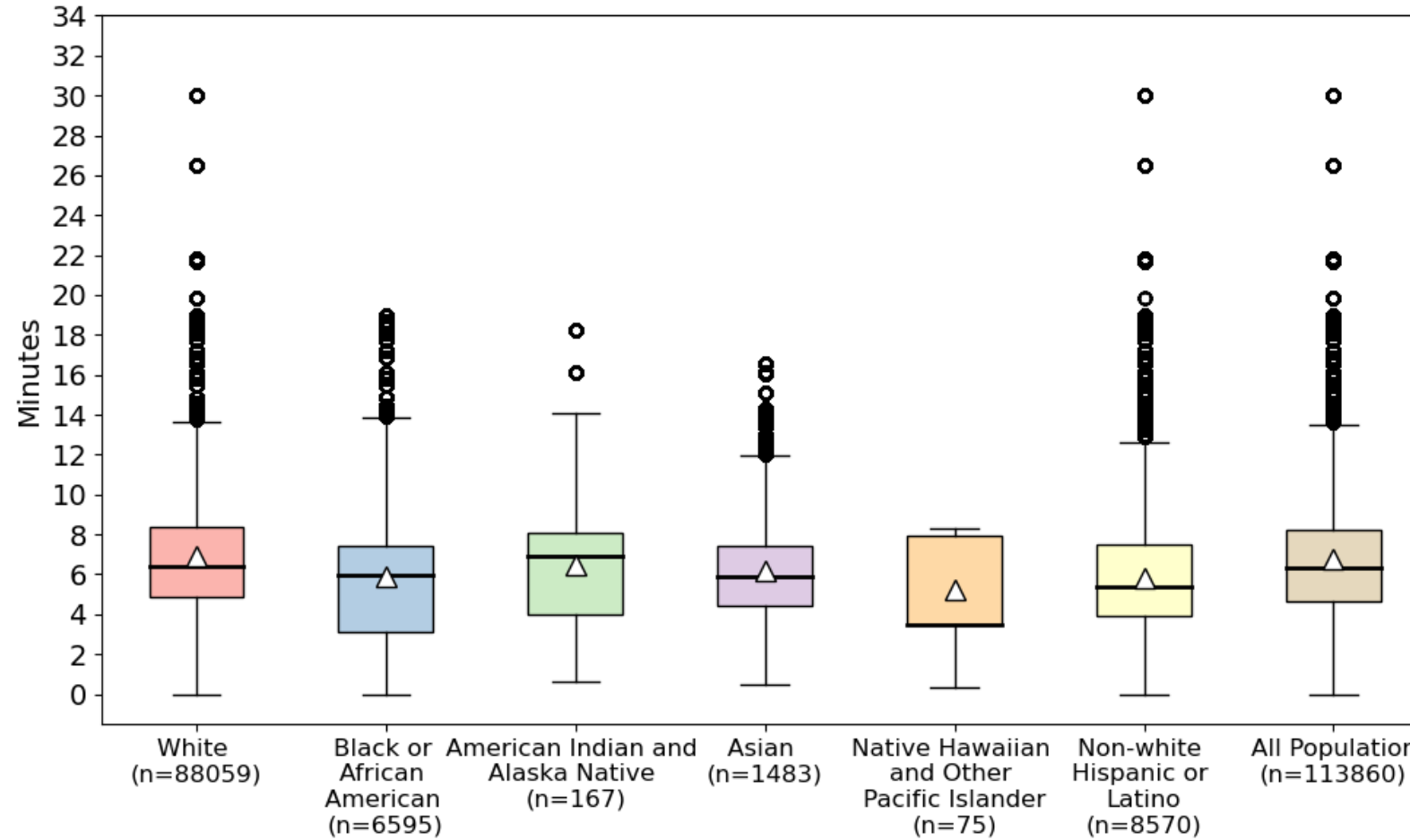
EMS Access and Equity (Slidell): Closest



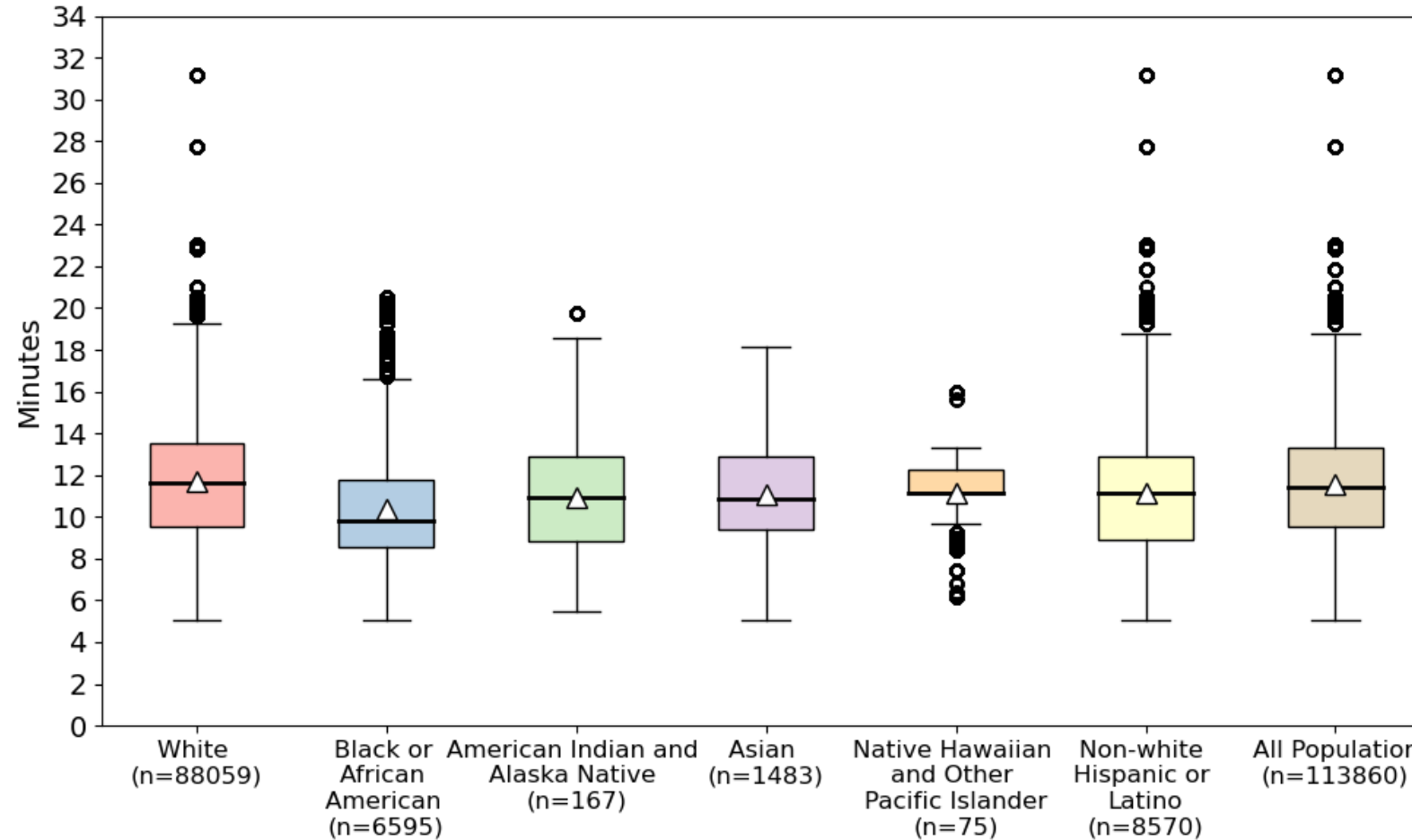
EMS Access and Equity (Slidell): Second Closest



Trauma Hospital Access and Equity (Mandeville): Closest



Trauma Hospital Access and Equity (Mandeville): Second Closest



Conclusion

- When looking at EMS and trauma hospital access, defining access with the closest locations **does not** tell the entire story about resilience.
 - Larger percentage of people do not have any alternative facility within critical time threshold
- Areas with **population decline** (i.e. Cameron Parish and Morgan City) are **more fragile** in terms of trauma hospital access
- When looking at differences in access to first and second closest locations racially, we see some differences.
 - **Asian** population's access to EMS becomes **the worst** when looking at **second closest EMS facility** even if it had one of the **better outcomes** when looking at the **closest facility**
 - **Black or African American** population have **more outliers** when looking at second closest **trauma hospital**, while White and Asian population groups seem more cohesive access in secondary alternative.

Implications

- Looking at the secondary, tertiary, etc. locations for essential service access could indicate fragility. Areas where population decline is happening (i.e. Cameron Parish) show high fragility for population decline-induced business closures and lack of road access due to flooding.
- Since certain racial groups are less likely to own car, differences in access can be exacerbated, which highlights the importance of understanding fragility through equity perspective

Future work

- Different sociodemographic characteristics have different needs so expanding the equity analysis with income, age, and if a household has a children or not could highlight inequities felt by these groups regarding the services, they need the most.
- Defining a general resilience index from marginal time differences and number of alternatives to understand regional differences.
- Expanding the analysis into entire coastal areas.

Acknowledgements

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THANK YOU!

Utkuhan Genc
ugenc@purdue.edu