USING EQUITABLE ACCESS TO ESSENTIAL SERVICES AS GUIDANCE FOR INVESTMENTS IN COASTAL ADAPTATION

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Measures of Risk Based On Capabilities

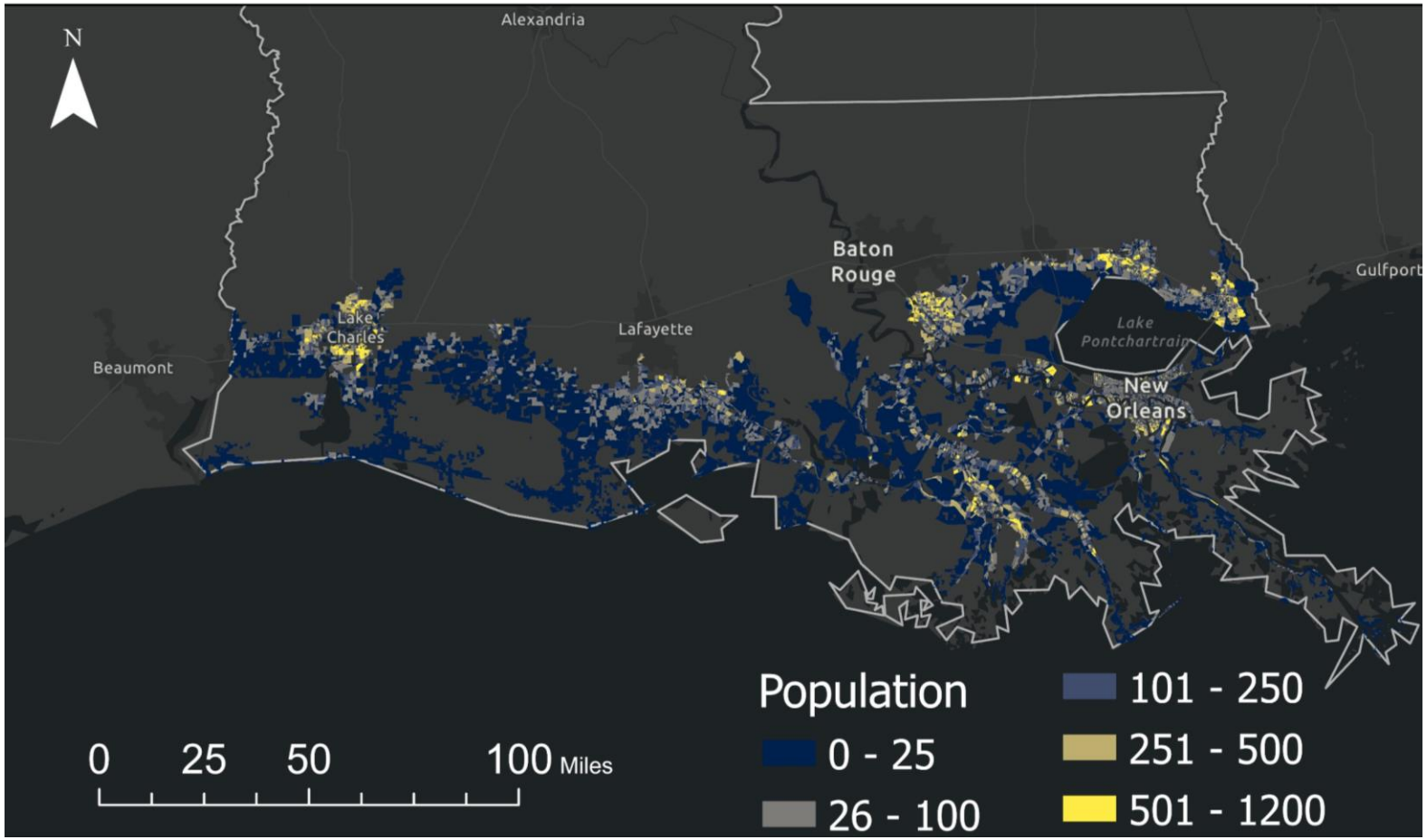
What are the impacts of disruptions to essential services?

- Flood risk is increasing in most coastal communities
- Population decline in rural areas also contributes to closures


Image Source: (Bittle, 2023)

How convenient are alternatives if a household's best option is shut down?

Empirical Setting – CLARA Cells with Population



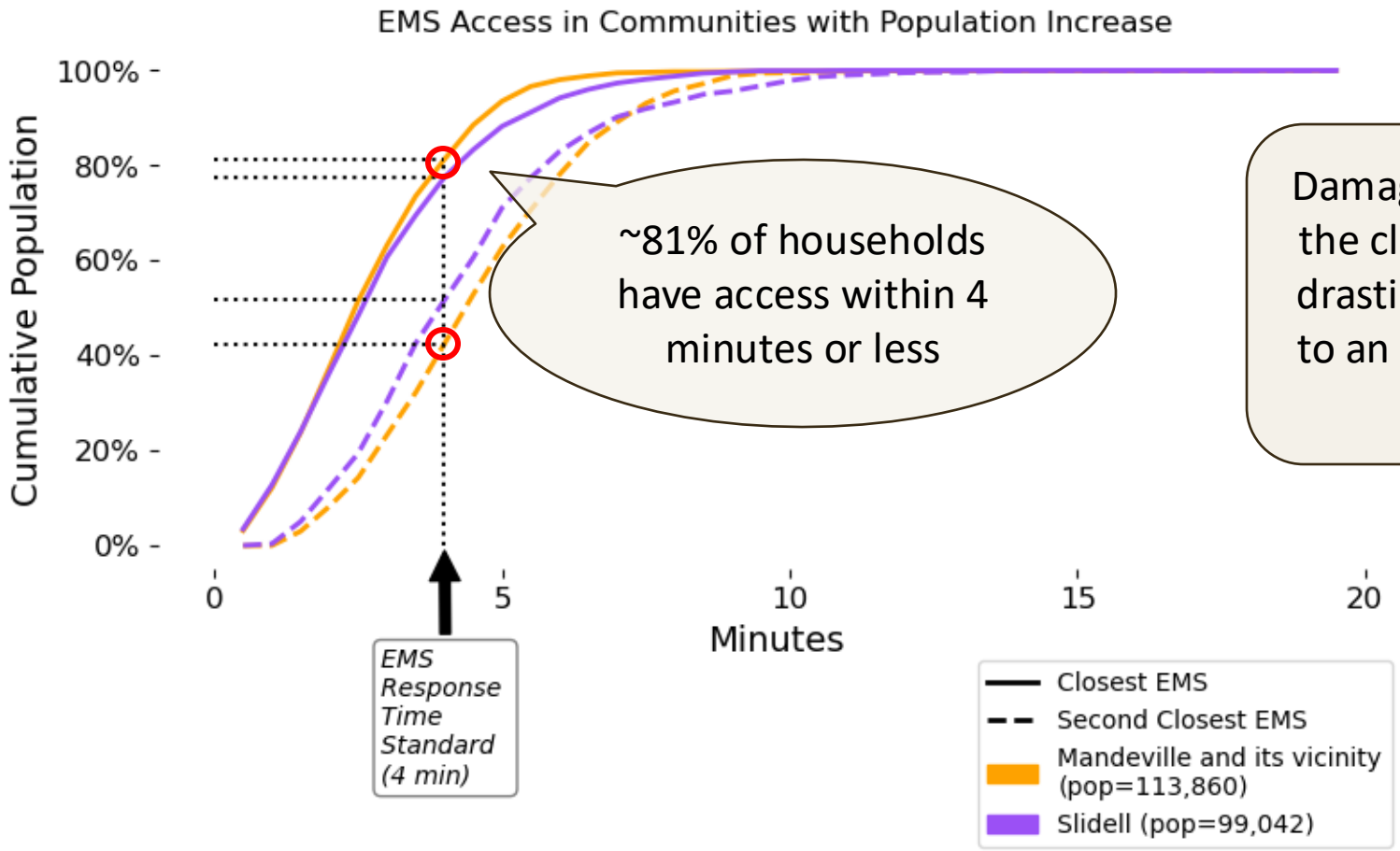
Empirical Setting Communities in Louisiana - Communities with population in Coastal Louisiana Risk Assessment (CLARA)

Methods and Analysis

- Essential Services:
  - Emergency Medial Service (EMS)
  - Fire Station
  - Daycare
  - Public School (Kindergarten, Elementary, Middle, Junior High)
  - Public School (High School)
  - Dialysis Center
  - Hospitals
  - Trauma Hospitals
  - Grocery Store

- Fragility Measures:
  - Drive time to closest location
  - Marginal drive time to second closest location
  - Number of alternative locations within critical time threshold

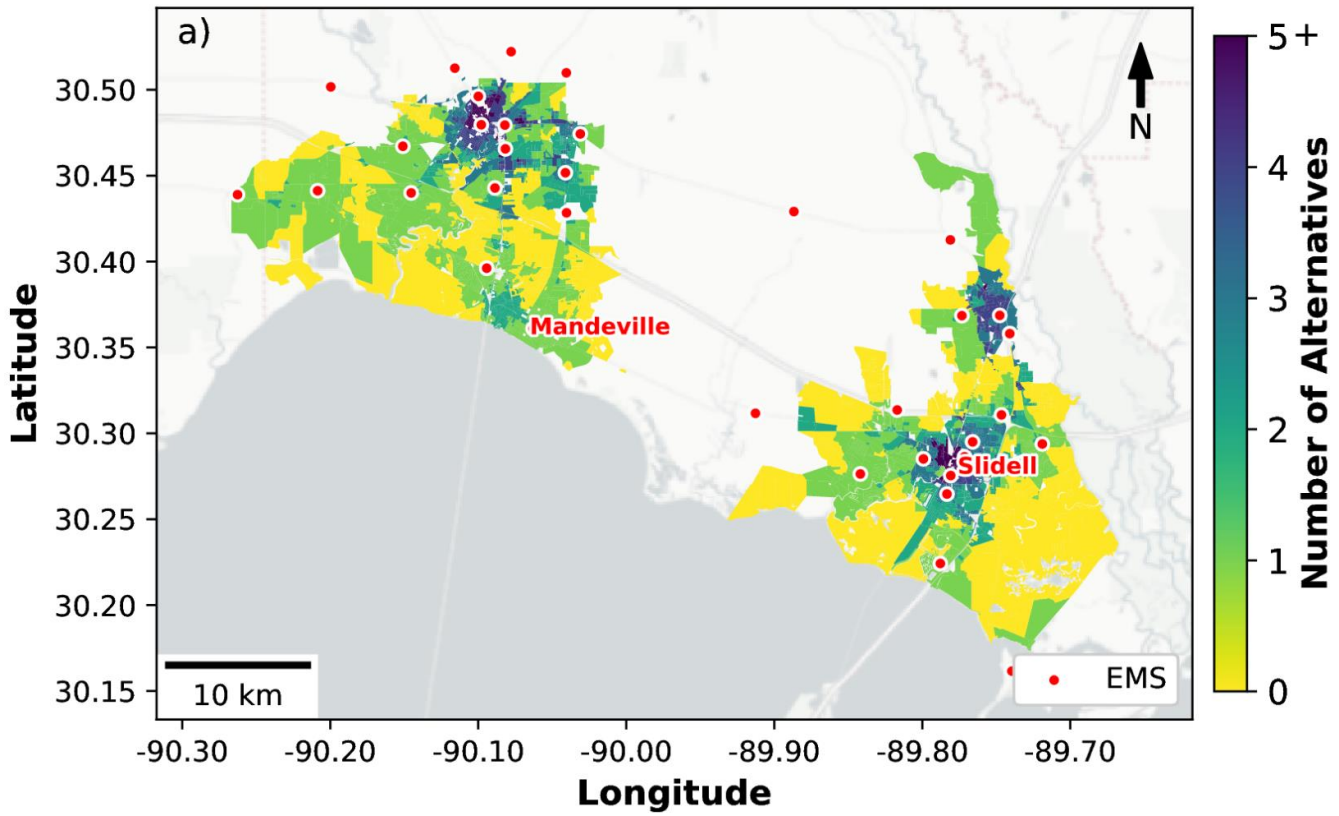
Access to Emergency Medical Services (EMS) Stations



Damage to, or closure of, the closest station could drastically reduce access to an acceptable level of service

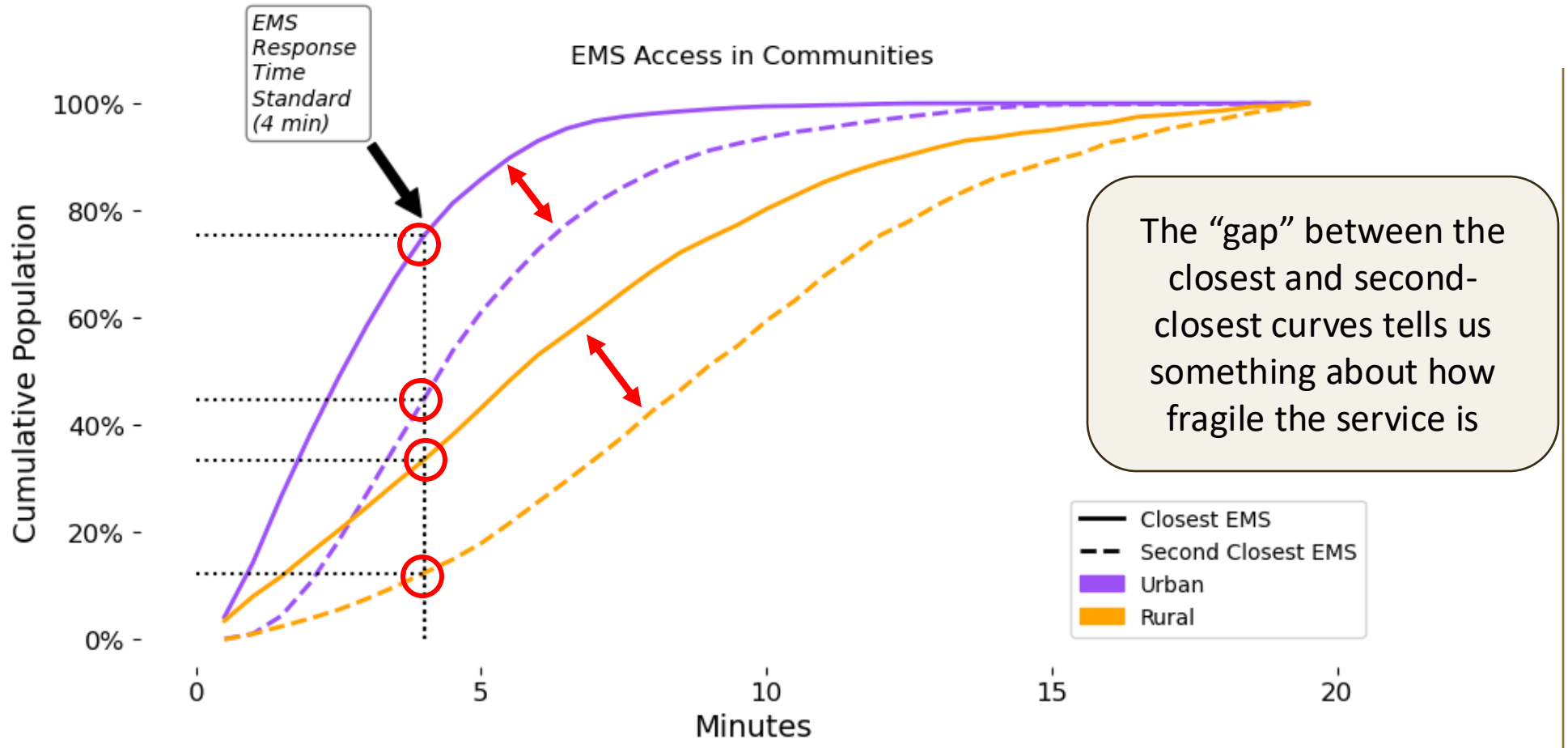
Cumulative population graph of drive time to closest and second closest EMS stations

Access to Emergency Medical Services (EMS) Stations



Number of EMS stations within a 4-minute critical time threshold

Urban and Rural Louisiana Have Stark Differences in Access



The "gap" between the closest and second-closest curves tells us something about how fragile the service is

What Makes an Asset More or Less Critical to a Community?

Planners may have different views on what is most important

- How many people are served by this facility?
- How many of those people have no suitable alternative?
- For those with no suitable alternative, just how bad is the next best option?

What Makes an Asset More or Less Critical to a Community?

Planners may have different views on what is most important

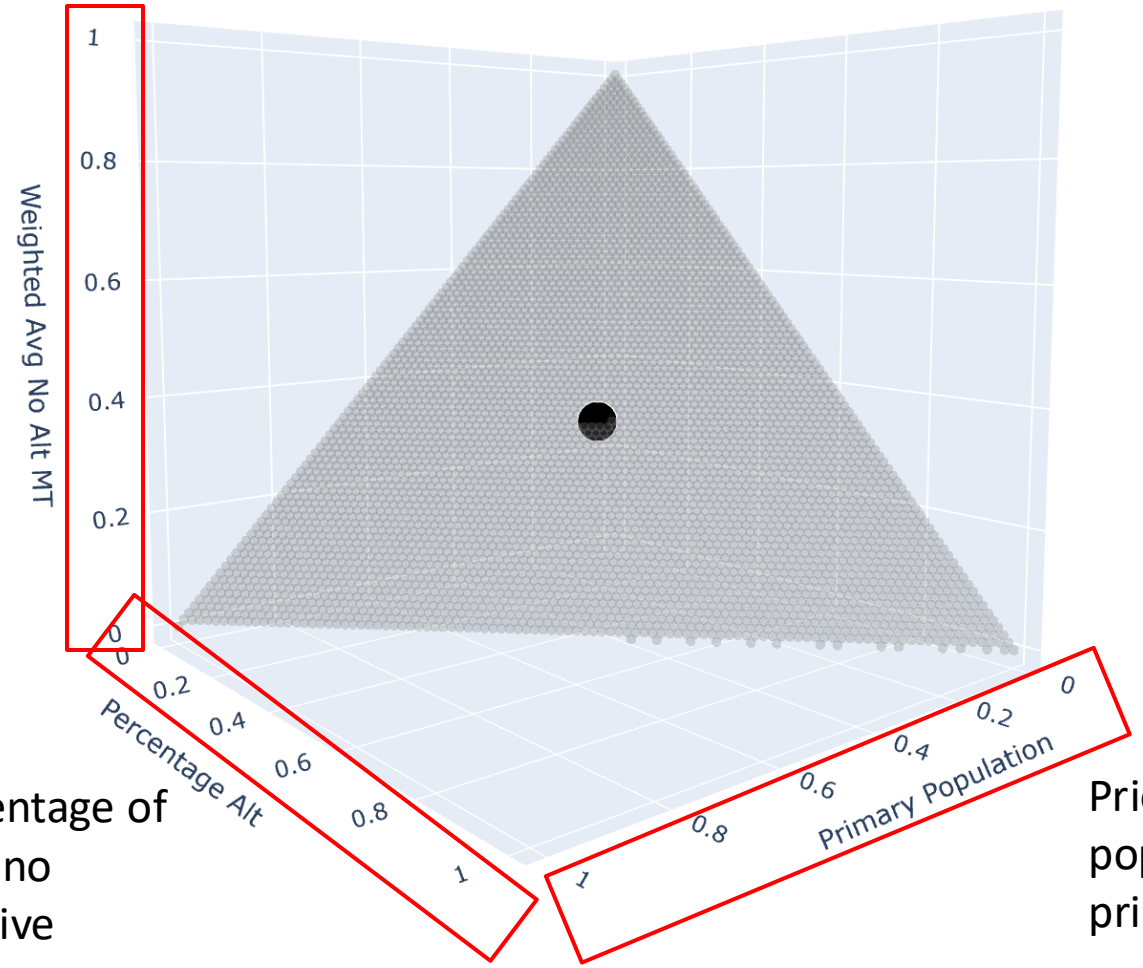
- Total population served as primary provider
- Percentage of primary population with no other alternative within a critical time threshold for service
- Weighted average of marginal travel time for primary population with no other alternative under critical time threshold

Methods and Analysis

- Normalize all three measures
- Create a large combination space of priority weights
- $Criticality = w_1 * P + w_2 * A + w_3 * M$
- w_1, w_2, w_3: Weights assigned to each variable, which must sum to 1 ($w_1 + w_2 + w_3 = 1$)
- P: Primary population served by the facility
- A: Primary population percentage without an alternative
- M: Weighted average of marginal travel time for primary population with no other alternative under critical time threshold
- Rank all facilities within their type between 1-5 based on their criticality score (higher = more critical)
  - We care about rank stability of facilities in determining criticality → facilities that constantly appear in top 5 are critical

How Robust Are Rankings of Criticality to Different Priorities?

Priority on marginal travel time for primary population with no suitable alternative

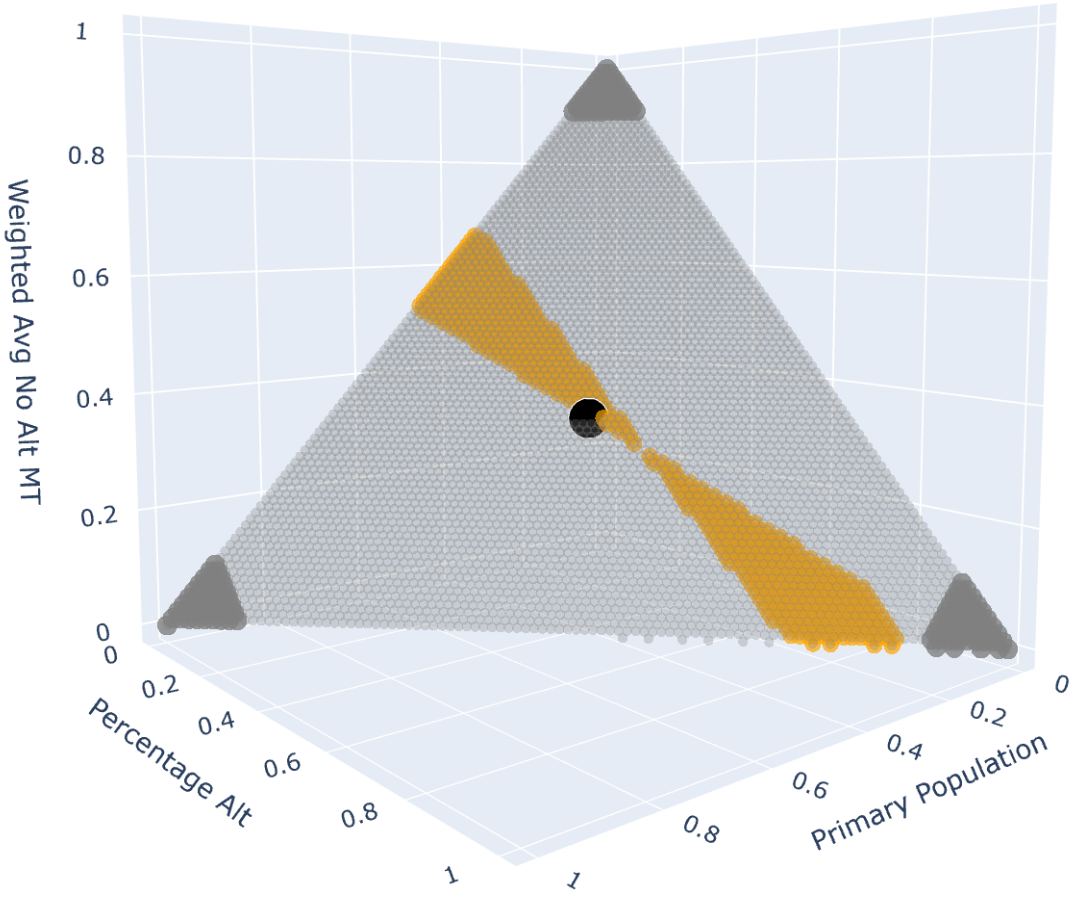


Priority on percentage of population with no suitable alternative

Priority on total population served as primary provider

Criticality – Most Critical EMS Facilities

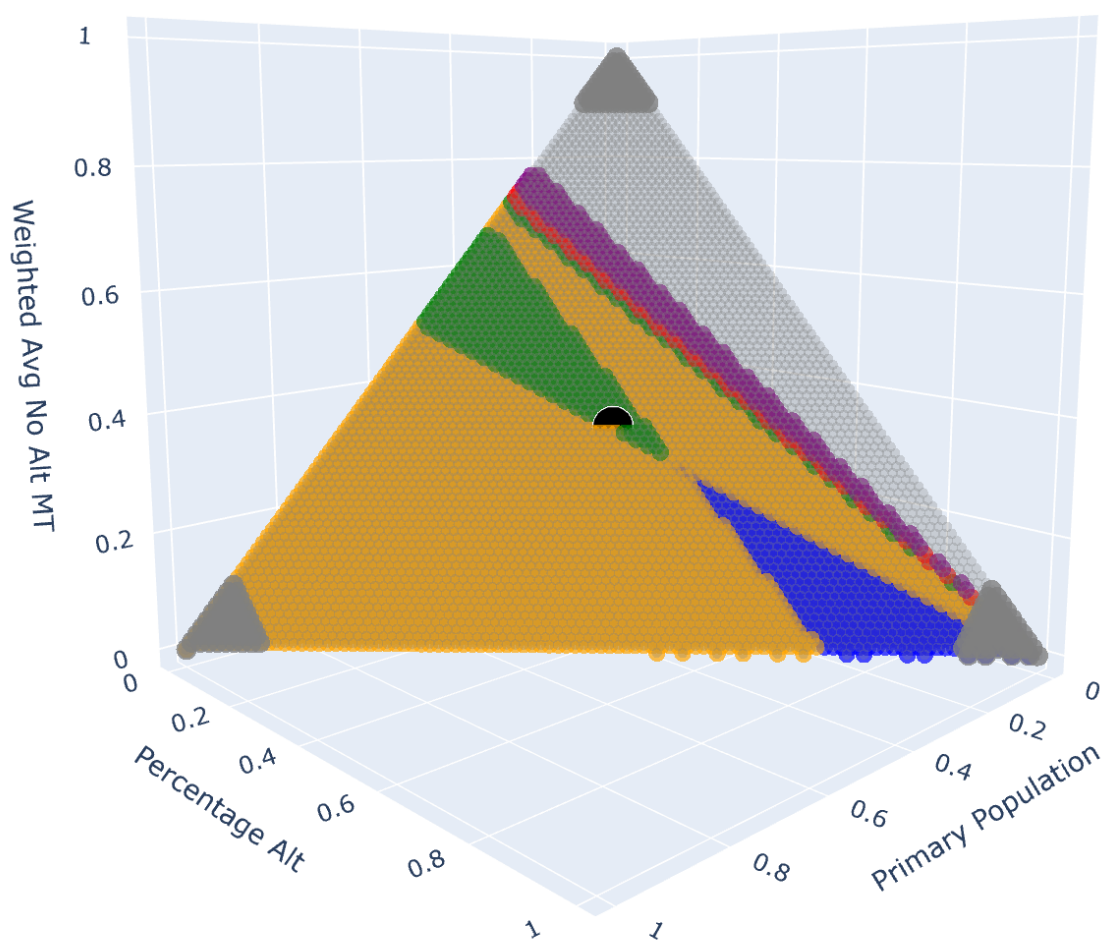
Row Rank	Facility Name	Rank 5%	Total Percentage	Equal Weight Rank
1	NEW ORLEANS LAKEFRONT AIRPORT AIRCRAFT RESCUE ...	3.79	76.72	3.0
2	PLAQUEMINES PARISH AMBULANCE DEPARTMENT - WOOD...	4.47	74.87	2.0
3	NEW ORLEANS EMERGENCY MEDICAL SERVICES	1.37	67.48	1.0
4	EASTBANK CONSOLIDATED FIRE DEPARTMENT STATION 17	1.03	62.44	4.0
5	CAMERON PARISH EMERGENCY MEDICAL SERVICES - GR...	13.11	51.97	NaN



This shows, percentage of instance, New Orleans Em the weight combination space.

n its facility type. For l schools 11.2% of

Some Assets May Be Critical Over a Wide Range of Preferences



- Rank 1
- Rank 2
- Rank 3
- Rank 4
- Rank 5
- Equal Weights Point
- Extreme Scenarios

Example: New Orleans Lakefront Airport Rescue and Fire Station

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Policy Implications

- Redundancy in access can lead to more resilient communities.
  - In rural areas the lack of alternatives is becoming more apparent as different essential services are closing due to decreased demand
- Preferred actions may be fairly robust to divergent priorities
  - In other words, even if we disagree on what is most important, we may agree on the right course of action

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THANK YOU!

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