

IDENTIFYING CRITICAL ESSENTIAL SERVICE FACILITIES USING ACCESSIBILITY MEASURES

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Background – Community Workshops

- To understand local experiences of flood risk and impacts of adaptation actions on residents
- Population change due to mitigation strategies might have unwanted lasting impacts
 - Population decline results in businesses closing down due to lower demand for essential services.
 - OB-GYN service closure in Oschner St Mary. – Morgan City
 - Grocery store shut down in Cameron
 - School closure in Pointe-aux-Chenes
 - Population increase can also result in capacity problems with essential services

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HOSPITAL BOARD: TWO MORE WEEKS OF TALKS TO BRING OB BACK TO OCHSNER ST. MARY

Thu, 07/13/2023 - 12:41pm

STAFF REPORT



Image Source: (Herbert, 2020)

Background – Community Workshops



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Population growth causing health-care capacity issues on P.E.I.

Empirical Setting

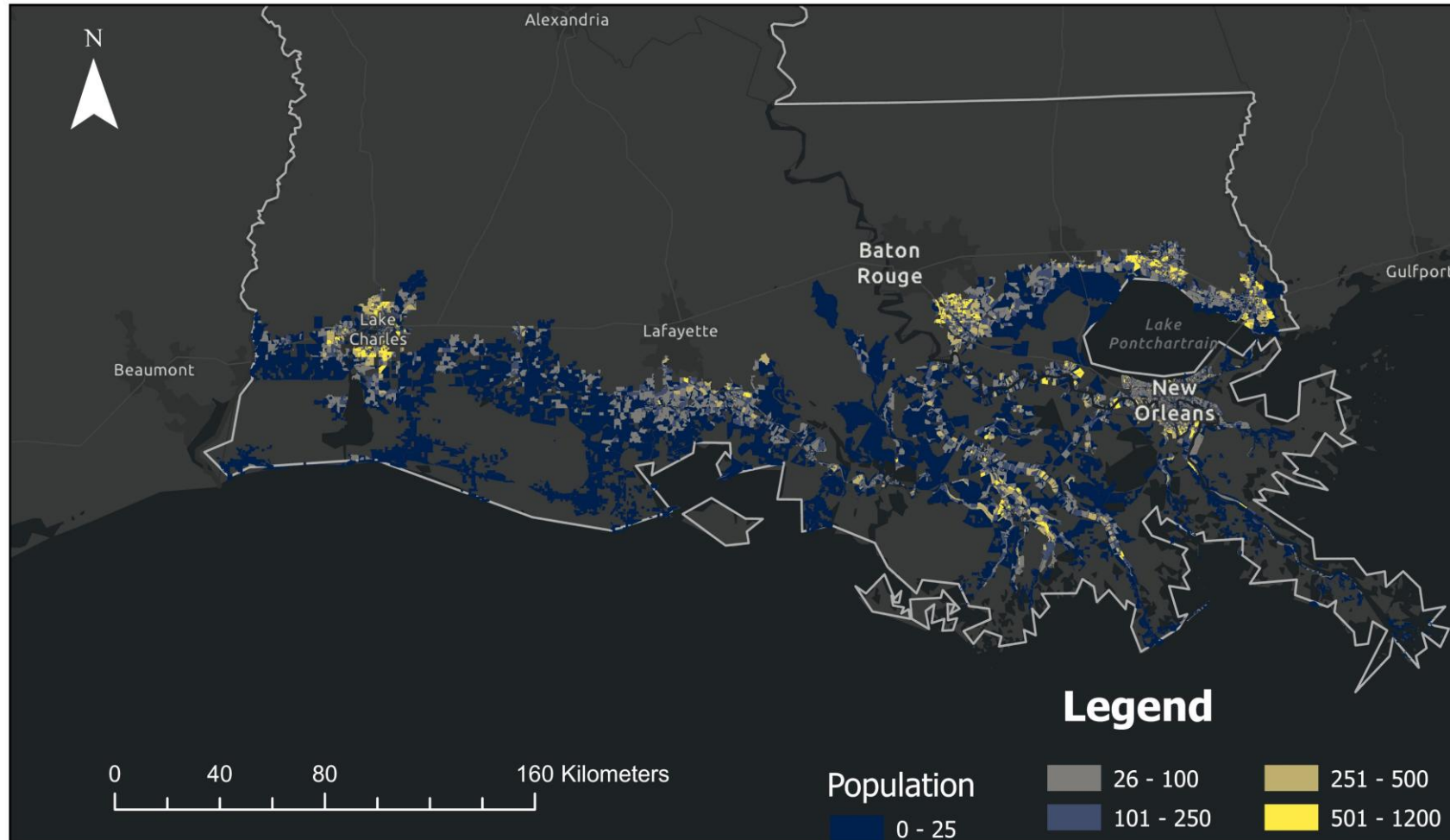


Figure 1. Empirical Setting Communities in Louisiana - Communities with population in Coastal Louisiana Risk Assessment (CLARA)

Methods

■ Essential Services:

- Emergency Medical 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
 - 4 Minutes: EMS
 - 9 Minutes: Fire Station
 - 15 Minutes: Daycare, Public School, Public High School, Grocery Store
 - 30 Minutes: Dialysis Center, Hospital
 - 60 Minutes: Trauma Hospital

Deep Uncertainty: Decision Making Context

- Tversky & Kahneman (1974): Cognitive Biases
 - People have cognitive biases that influence decisions.
 - These biases lead to predictable errors in judgment, especially under uncertainty.
- Slovic et al. (2005): Affect Heuristic Key
 - Decisions are often driven by emotions (affect) rather than facts.
 - Risk is perceived as higher or lower depending on emotional reactions, not just data.
- Marx & Weber (2012): Policy Makers & Analytical Processes
 - Policy makers tend to use less analytical thinking when assessing risks.
 - This can lead to simplified assessments that may overlook critical risks.

Criticality

- How can we evaluate the critical importance of an essential service facility using drive-time analysis?
- How can we present impacts so that policy-makers can easily understand how their judgment toward a certain measure will affect which facility is protected?

Criticality Measures

- Total population served as primary provider
- Primary population percentage with no other alternative under critical time threshold
- Weighted average of marginal travel time for primary population with no other alternative under critical time threshold

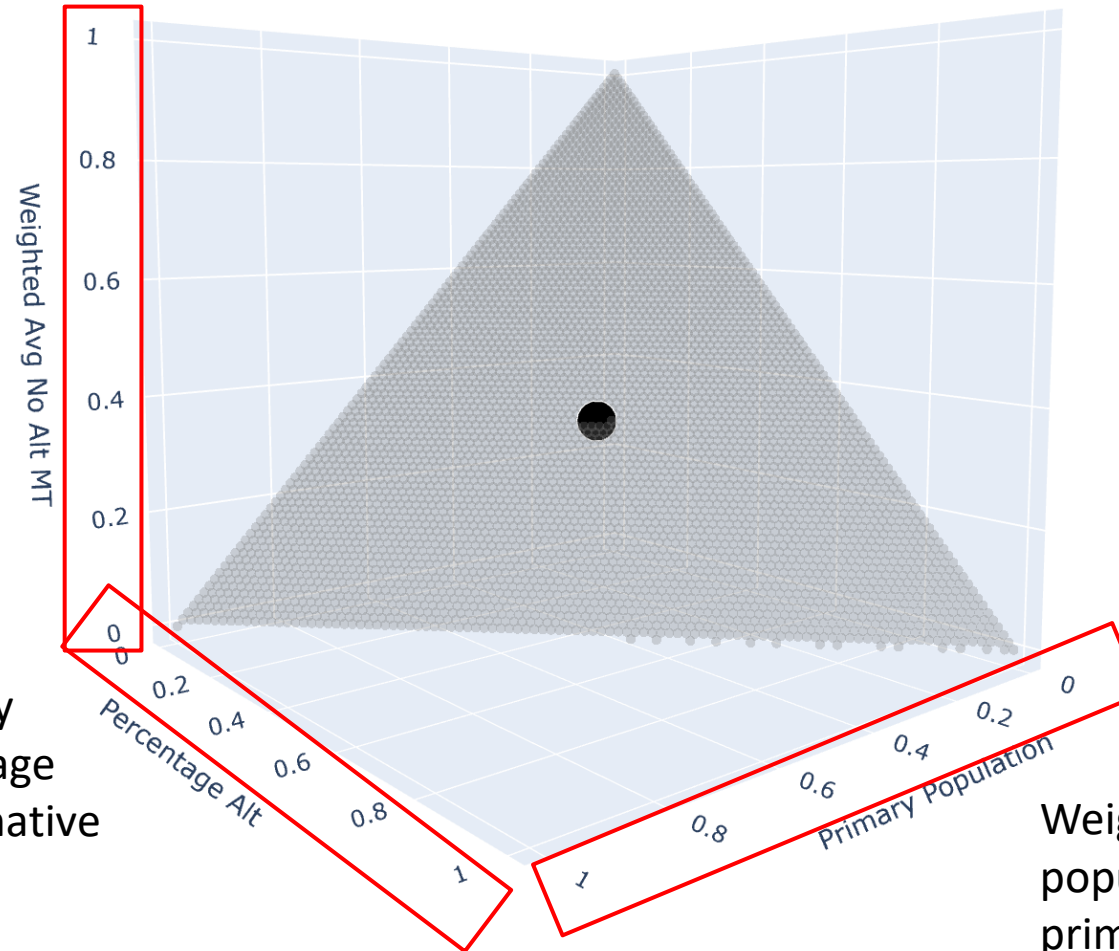
Criticality

- Normalize all three measures
- Create a large combination space of 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

Weight Space

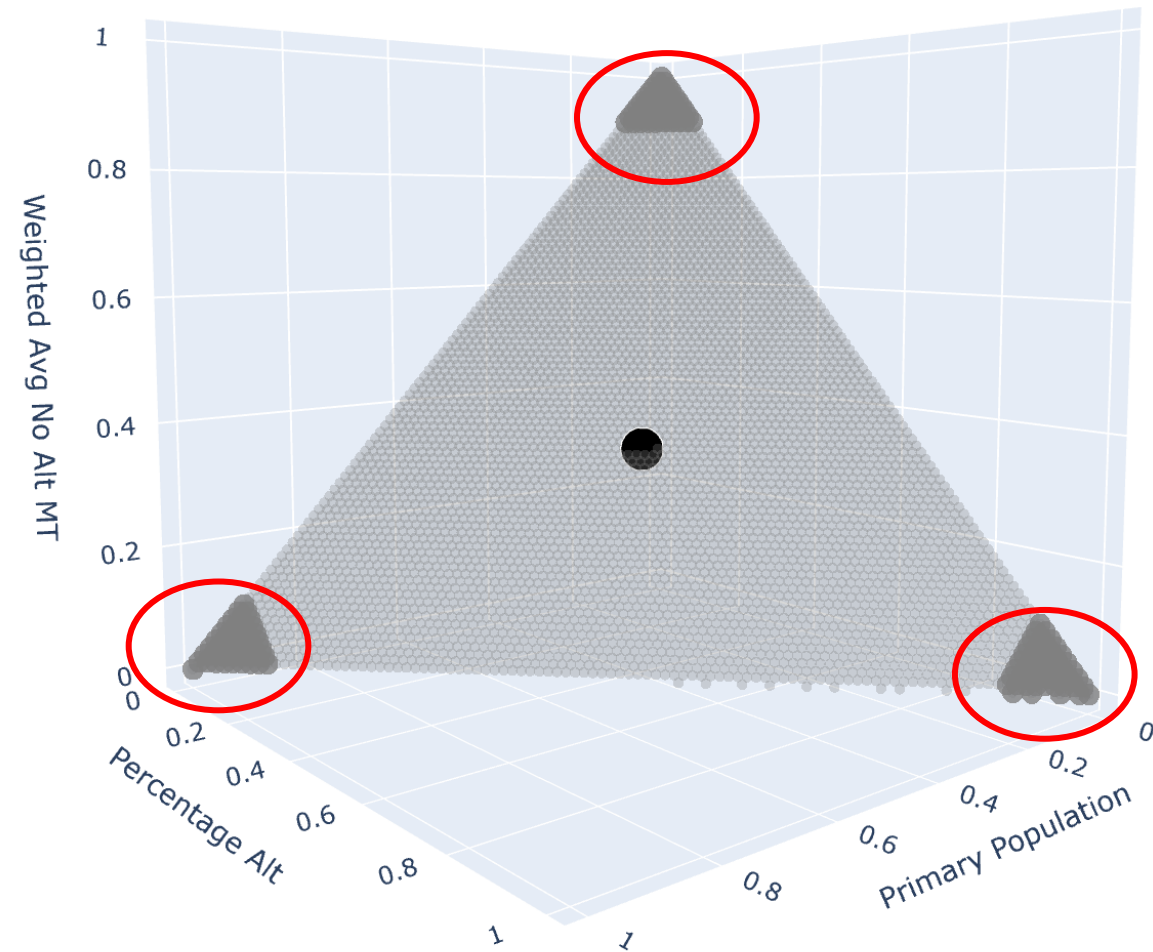
Weights for: weighted average of marginal travel time for primary population with no other alternative under critical time threshold

Weights for: Primary population percentage with no other alternative under critical time threshold



Weights for: total population served as primary provider

Weight Space

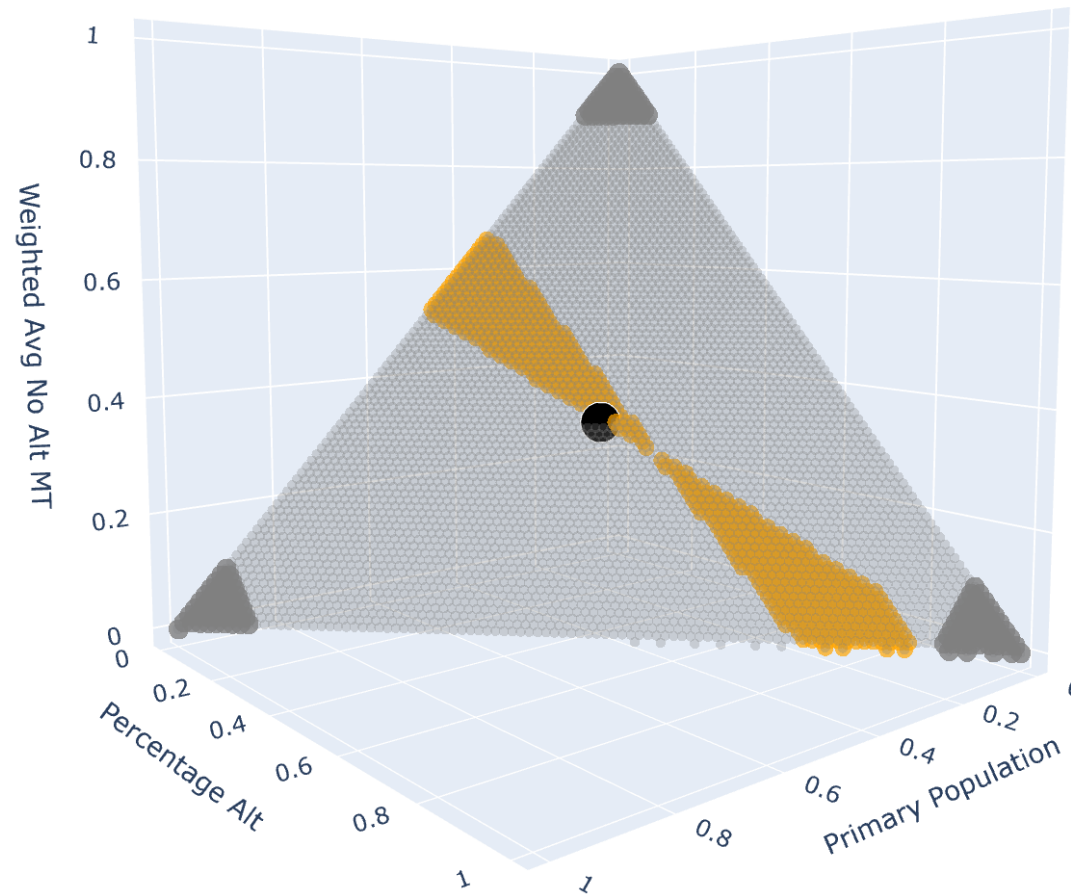


Criticality – Most Critical EMS Facilities

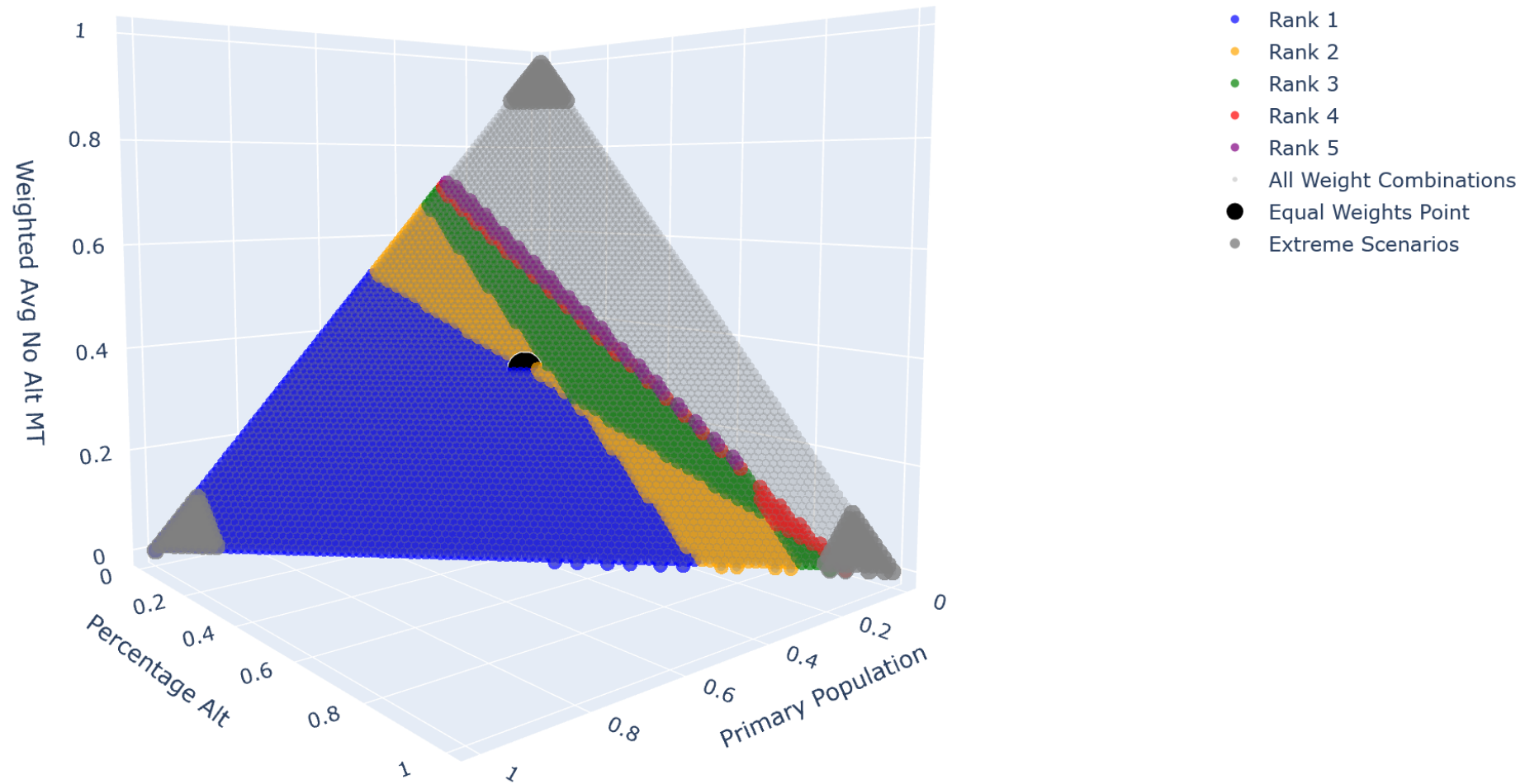
Row Rank	Facility Name	Primary Population	Percentage without Alternative	Weighted Avg Marginal Time (No Alt)	Rank 1%	Rank 2%	Rank 3%	Rank 4%	Rank 5%	Total Percentage	Equal Weight Rank
1	NEW ORLEANS LAKEFRONT AIRPORT AIRCRAFT RESCUE ...	103195	100.00	5.53	6.67	55.88	8.56	1.83	3.79	76.72	3.0
2	PLAQUEMINES PARISH AMBULANCE DEPARTMENT - WOOD...	374	100.00	32.39	50.28	2.17	4.89	13.05	4.47	74.87	2.0
3	NEW ORLEANS EMERGENCY MEDICAL SERVICES	125109	94.19	2.67	43.03	11.20	10.53	1.35	1.37	67.48	1.0
4	EASTBANK CONSOLIDATED FIRE DEPARTMENT STATION 17	92471	97.70	3.17	0.00	0.58	42.81	18.02	1.03	62.44	4.0
5	CAMERON PARISH EMERGENCY MEDICAL SERVICES - GR...	312	100.00	16.50	0.00	30.10	4.21	4.55	13.11	51.97	NaN

This shows, percentage of combination space each facility appears in each rank within its facility type. For instance, New Orleans Emergency Medical Services is ranked 2 most critical among all schools 11.2% of the weight combination space.

Criticality – Most Critical EMS Facilities



Criticality – Most Critical Facilities



Policy Implications

- Visualizing criticality in a weight space allows for policy-makers to understand implication of their preferences
 - Blurring out extreme scenarios allows them to see which facilities are important when they value criticality measures similarly
 - Equal weight rank might be the is the most straightforward way for decision makers however, as we saw with EMS it does not always highlight the most critical facility
- This method is highly adaptable to different hazards, or planning processes
- Primary population served should not be the default decision making process in determining critical facilities

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THANK YOU!

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