Group #I2.04 – Optimizing Texas Trauma Care Access

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Problem Statement

Trauma is a serious health problem with high social and economic costs, yet adequate access to trauma care centers is lacking in the state of Texas. Increasing access and availability of such care, especially considering the effects of COVID-19, will require government funding and decision-making, but can possibly lessen the economic burden of trauma incidents and improve patient outcomes.

Project Purpose

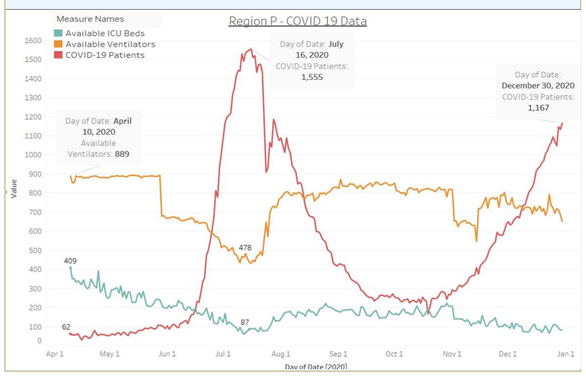
Develop a linear programming model to propose options, which include constructing new helipads or converting non-trauma hospitals into trauma care centers, for optimally expanding the trauma network of TSA P.

Project Objectives

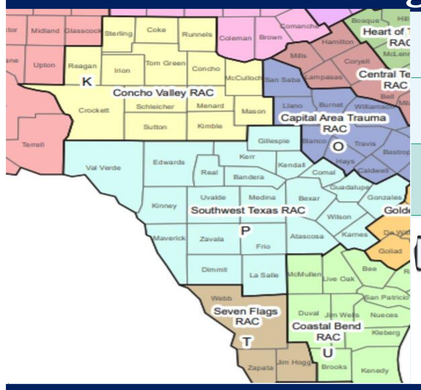
- ***Analyze*** data from COVID-19 infections in Texas to showcase burden on patient stabilization and increased need for trauma network expansion
- ***Formulate*** a model that's representative of the trauma care network
- ***Propose*** strategies to expand the trauma care network and increase coverage

Heightened Necessity

COVID-19 hospitalizations and the burden on trauma care resources (ICU beds and ventilators) in 2020 for Trauma Service Area (TSA) P)

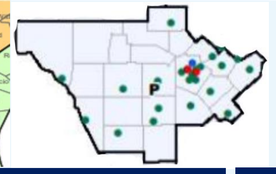


Background Information – TSA P



Focus: Region P Trauma Centers

TSA	Cities Examples	Population (Ni)
P: Southwest Texas	San Antonio, Kerrville, Uvalde	NP : 2,945,792



Trauma Centers in TSA P

- ***2 Level I***
- ***4 Level III***
- ***24 Level IV***

*Many rural areas lack any at all

Model Formulation

Objective function (written in AMPL)

```
maximize coverage: sum{i in I} a[i]*y[i]
```

# of trauma cases * if demand node is covered

Sets: zip code locations, network locations

Parameters: establish known numerical values like patient demand per day per zip code

Decision Variables: location sites of additional TC's and AD's

Constraints: limit model configurations

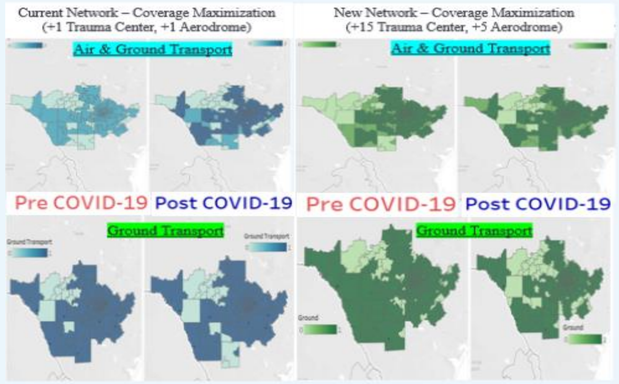
Limitations

- fails to account for existing TC and AD locations
- logical constraint not suitable for AMPL
- budget not made a consideration
- doesn't consider medical facility resource capacities

Design of Experiments

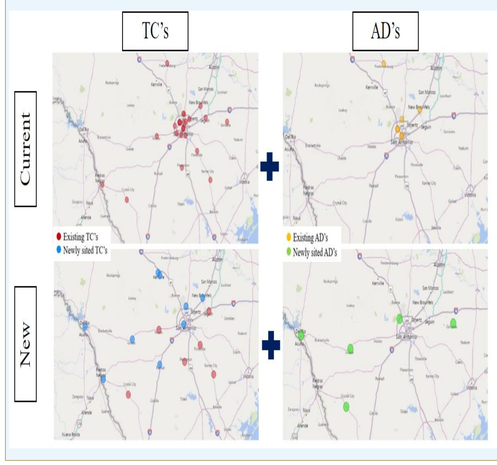
Models: Pre & Post COVID-19

- New Network – Coverage Maximization
- Current Network – Coverage Maximization



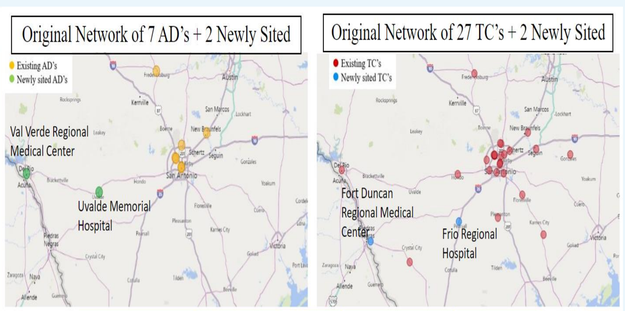
New and Current Network Location Proposals

Current Network vs. Proposed New Network



% Coverage
96.36%
100%

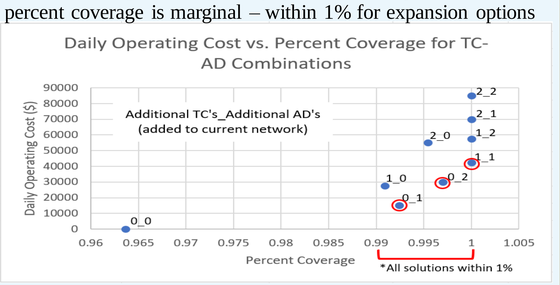
Current Network with Additional Sites Added



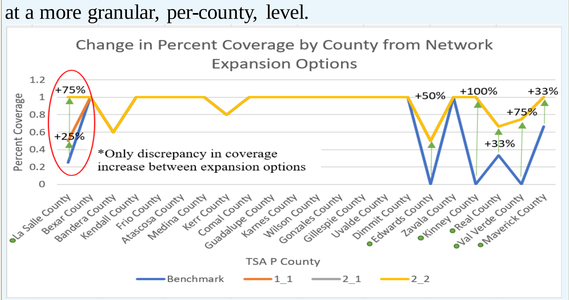
Network	Additional Cost/Day	Time for Service	% Coverage
Current	-	60 min	96.36%
Current + 2 TC's & 2 AD's	$85,000	60 min	100%

Evaluation of Proposals

Solutions in the bottom right of the graph (high percent coverage, low cost) are optimal, especially given the change in overall percent coverage is marginal – within 1% for expansion options



There is very little change in overall percent coverage between possible expansion options, but the impact becomes more apparent at a more granular, per-county, level.



Future Improvements

- Regard hospital capacity inb model formulation and input data to increase robustness
- Consider location-specific costs of proposal options rather than use average daily operating costs
- Acquire more representative trauma patient demand data
  - Currently used *patient demand per day* statistic allows for values of 0, discounting many rural zip codes

Team Members

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Mary Van (PM)

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