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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**

Provide a proposal to the Texas Department of State Health Services regarding ways to increase adequate access to trauma care.

**Project Objectives**

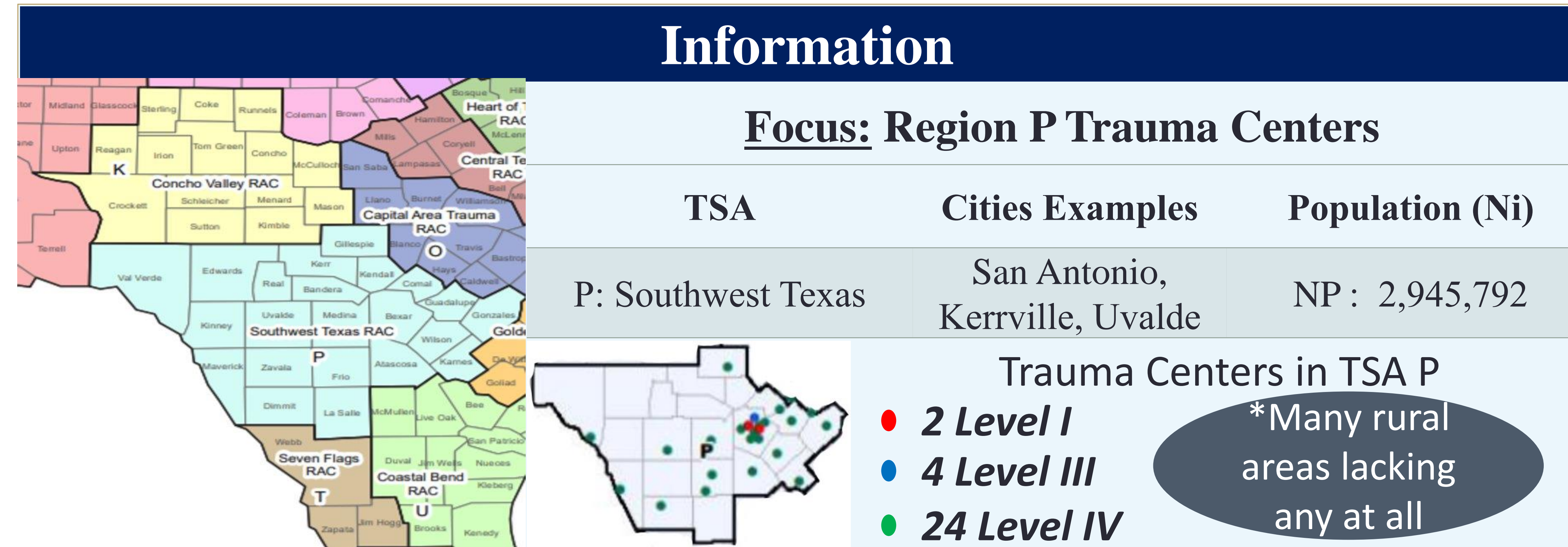
- *Evaluate* COVID-19 infections in Texas to showcase burden on patient stabilization.
- *Identify* trauma service areas in Southwest Texas in need of greater access to trauma care and network expansion strategies.
- *Analyze* net present cost for allocating trauma resources.

**Background Information**

- **Trauma:** Physical injuries characterized by severity and sudden onset needing immediate medical attention
- **Adequate Access** to trauma care should be within **60 minutes travel time** of a TC by ground and/or air

**Information**

**Focus: Region P Trauma Centers**



**Model Formulation**

**Objective function**

maximize coverage:  $\sum_{i \in I} a[i] * y[i]$

# of trauma cases \* if demand node is covered

**Sets** define demand nodes (zipcodes), eligible medical centers, helipads

**Parameters** establish known numerical values

**Decision Variables** : values altered through optimization

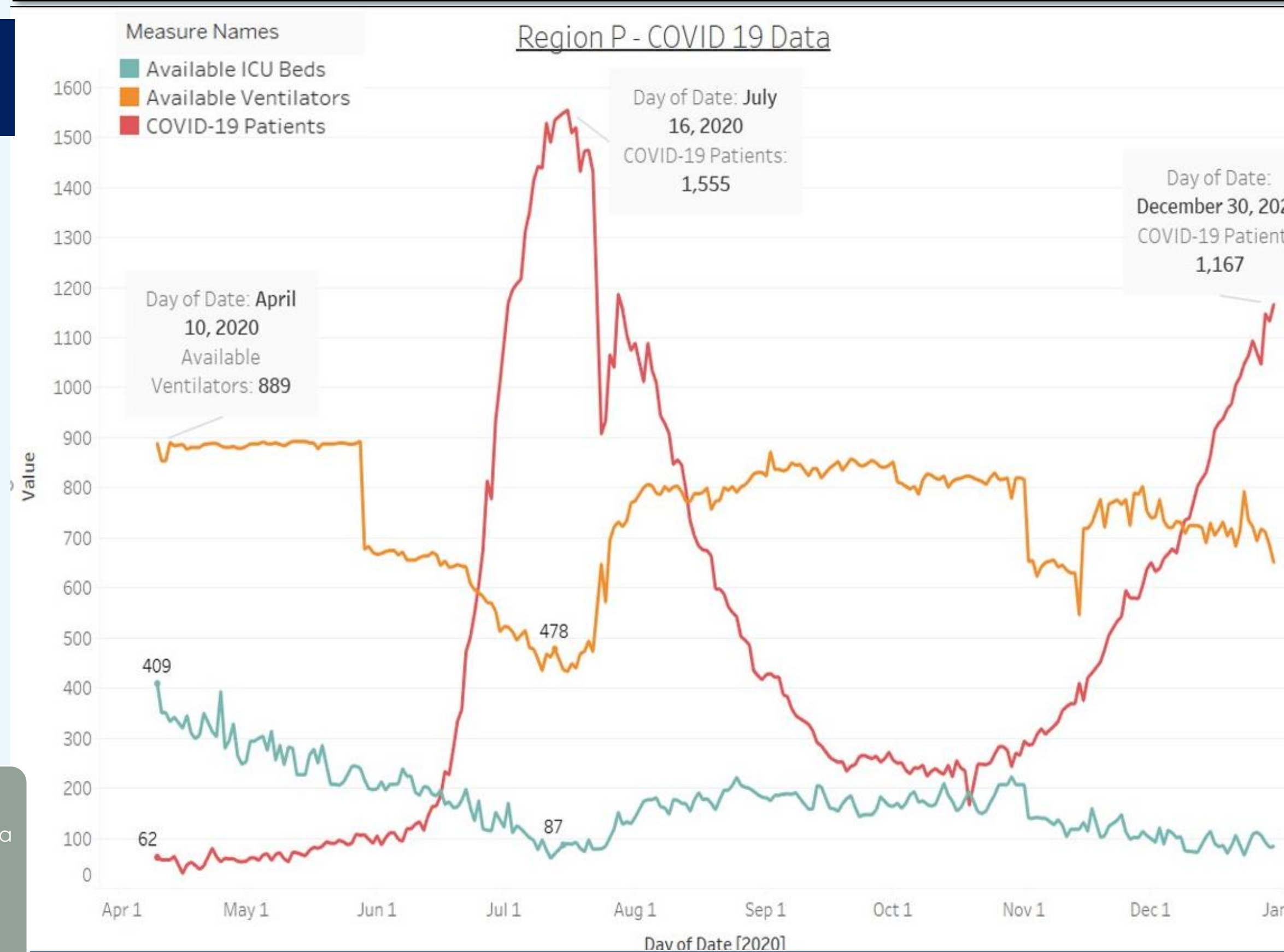
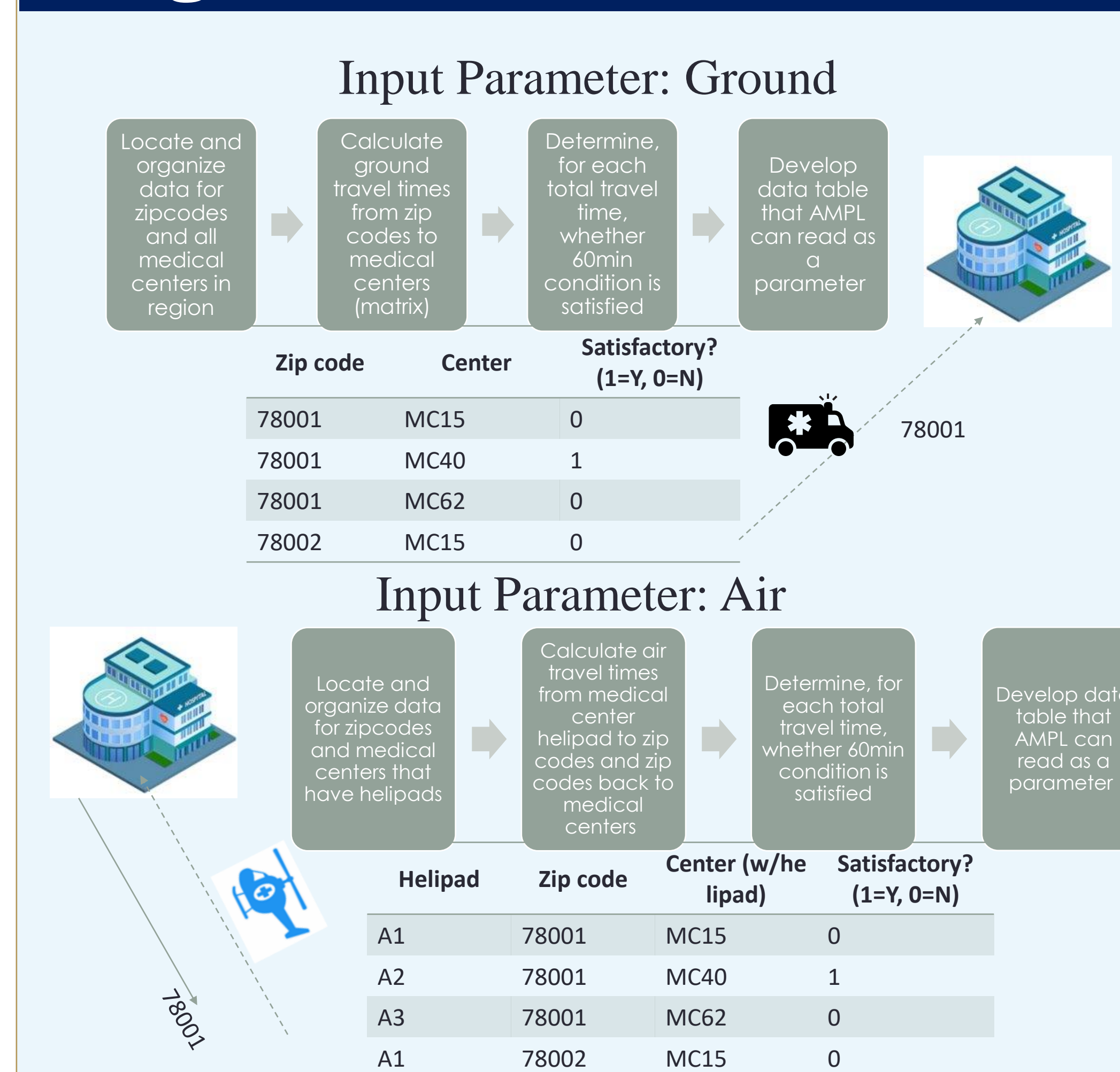
**Constraints** limit model configurations

```
set I; # demand // origins
set J; # trauma hospital locations // destinations
set K; # Aerodome
set N within {I,J}; # tc within a standard driving time S
set M within {K,I,J}; # ad, tc pairs within a standard time S
```

```
#####
# PARAMETERS #
#####
param p_TC >= 0; # number of trauma centers to be sited
param p_AD >= 0; # number of aerodome centers to be sited
param a {i in I} >= 0; # population demand at node i
param t_dummy {i in I, j in J} >= 0; # =1 within time standard and 0 otherwise
param a_dummy {k in K, i in I, j in J} >= 0; # =1 within time standard and 0 otherwise
```

```
#####
# DECISION VARIABLES #
#####
var u {i in I} binary >= 0; # = 1 if demand node i is covered by air
var v {i in I} binary >= 0; # = 1 if demand node i is covered by ground
var z {k in K, j in J} binary >= 0; # = 1 if an AD is sited at node k and a TC is sited at node j
var x_TC {j in J} binary >= 0; # = 1 if a trauma center is sited at node j
var x_AD {k in K} binary >= 0; # = 1 if an aeromedical depot is sited at node k
var y {i in I} >= 0; # = 1 if demand i is covered
```

**Organization of Model Data**



**Measuring TC Demand**

COVID-19 highlights areas on changes in hospitalizations and capacity requirements

**Trauma Center (TC)**

- Trauma level designations are obtained by centers w/ the appropriate levels of resources.

**Level I (Comprehensive):**  
 Capable of providing total care for every aspect of injury

**Level II (Comprehensive):**  
 Capable of providing total care for every aspect of injury

**Level III (Advanced):**  
 24- hour coverage to provide assessment, resuscitation, surgery, intensive care & stabilization

**Level IV (Basic):**  
 Provide advanced trauma life support prior to transfer to a higher level trauma center.

**Future Plans**

- Analyze changes in patterns of COVID-19 data and demographics affected
- Analyze challenges and limitations
- Make model more realistic in representing scenarios and constraints
- Determine optimal expansion strategies
- Perform economic analysis on costs of trauma network expansion strategies

**Team Members**

- Ana Jimenez Rivera
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  - Kayla Streber
- Mary Van (Project Manager)

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