Military Health System (MHS) Beneficiary Access to Trauma Centers

Health Program Analysis and Evaluation (HPA&E)
Geographical Information System (GIS) Studies and Support

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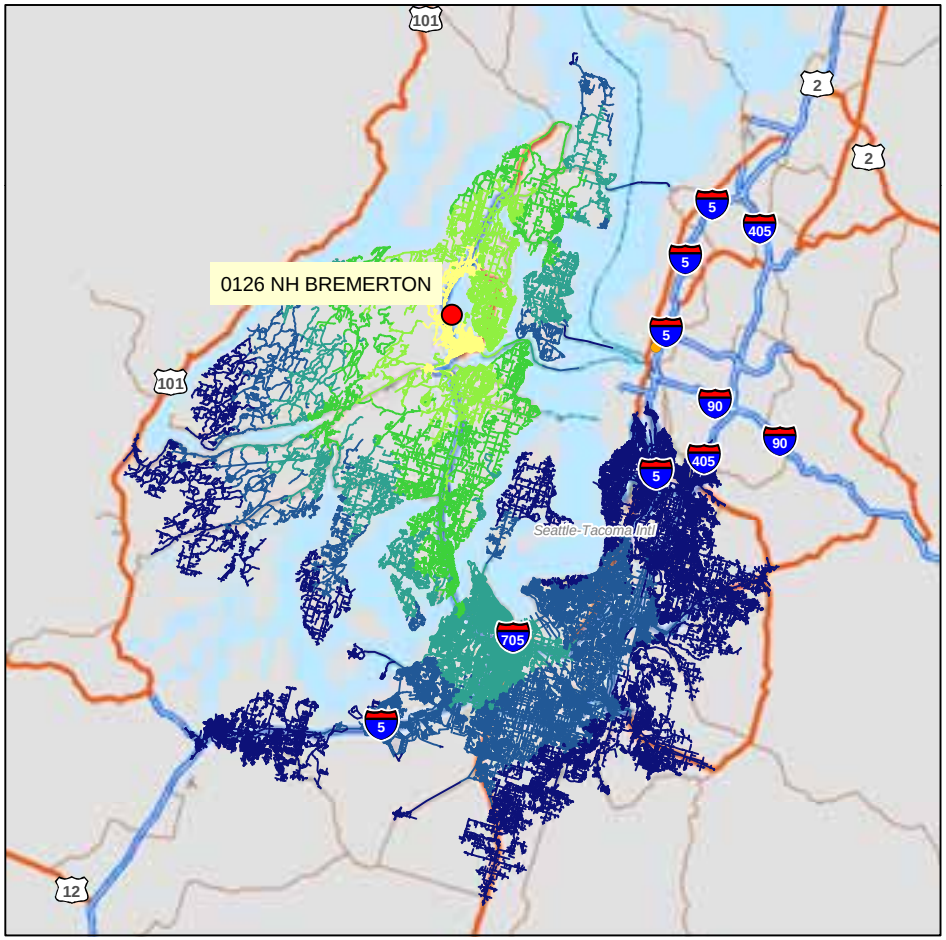
Purpose

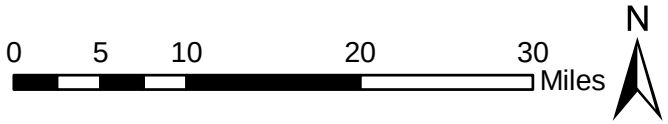
- Branas, et al. (2005) examined accessibility of Trauma Centers (Level 1, 2 and 3) by the US population
  - Ground transportation via ambulance
  - Air transportation by medical helicopter
  - Found 69% within 45 minutes of level 1 or 2, of which 26.7% by air only
  - Found 84% within 60 minutes of level 1 or 2, of which 27.7% by air only
- Study Question: Using the ArcView Network Analyst drive time tool already developed for government, how does the Military Health System (MHS) population compare with the general population for access to (mostly civilian) trauma centers?

Developing Drive Time Market Area Polygons
Example: Drive-Time Market Area-NH Bremerton

Previous work had established the feasibility of using Network Analyst to create drive-time areas around hospitals



Drive-time areas as calculated based on several assumptions including:
- average travel speed for a given road class is based on national averages, and does not vary with the time of day
- U-turns are allowed at all intersections
- only one-way travel on designated streets is allowed



Legend

drive-time facility locations

Drive Time Line Network

- 0 - 10 minutes
- >10 - 20 minutes
- >20 - 30 minutes
- >30 - 40 minutes
- >40 - 50 minutes
- >50 - 60 minutes

Methods

Step 1: Map Trauma Centers

- Trauma Center data received from Trauma Information Exchange Program (TIEP)
  - TIEP holds the Trauma Center Inventory for American Trauma Society under grant from CDC; managed by Johns Hopkins Center for Injury Research and Policy
  - Geocoded street addresses to **latitude/longitude coordinates**
  - Includes four military hospitals (Madigan AMC, Brook AMC, Wilford Hall Medical Center, William Beaumont AMC)

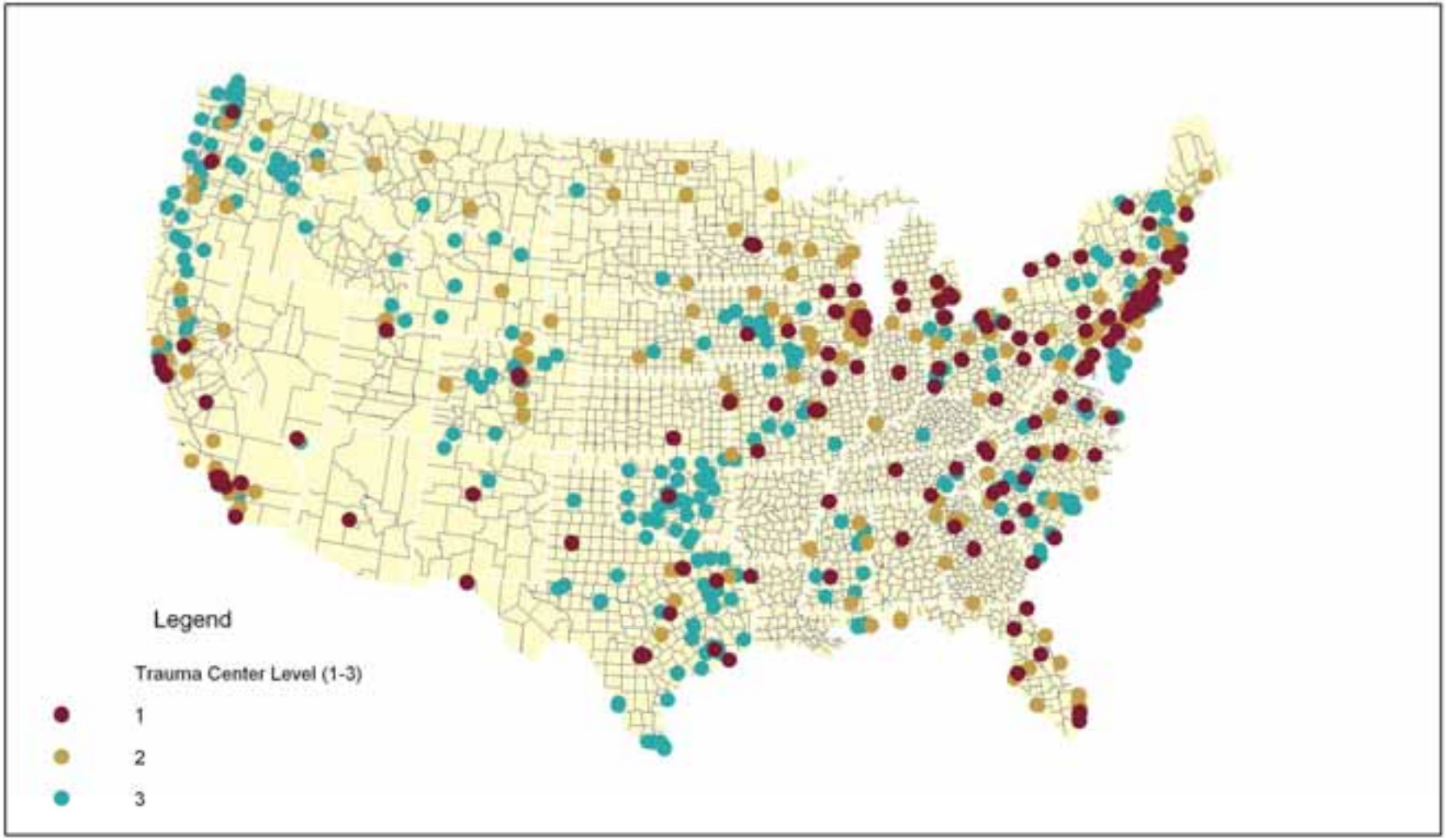
Trauma Center Level	Geocoded
Level 1	186
Level 2	248
Level 3	285
Total	719

Source: TIEP Trauma Center Inventory Extract, July 2006

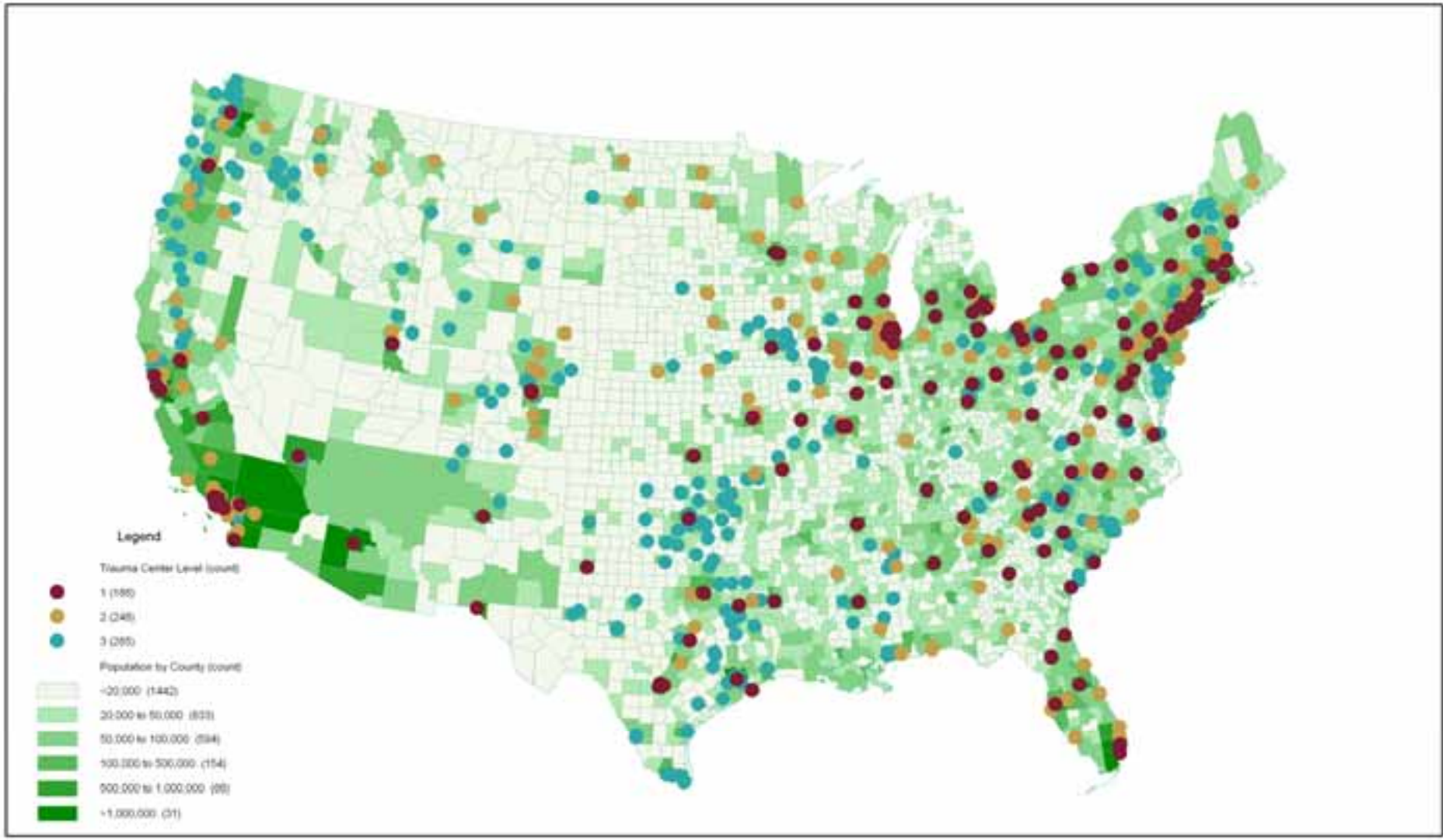
Step 2: Locate Military Health Services (MHS) Population

- All U.S. beneficiaries by AD, ADFM, Others under 65, Others 65 and older, counts **by ZIP Code** extracted from MCFAS
- Spans 37,556 ZIP Codes; totals 8,715,170 beneficiaries

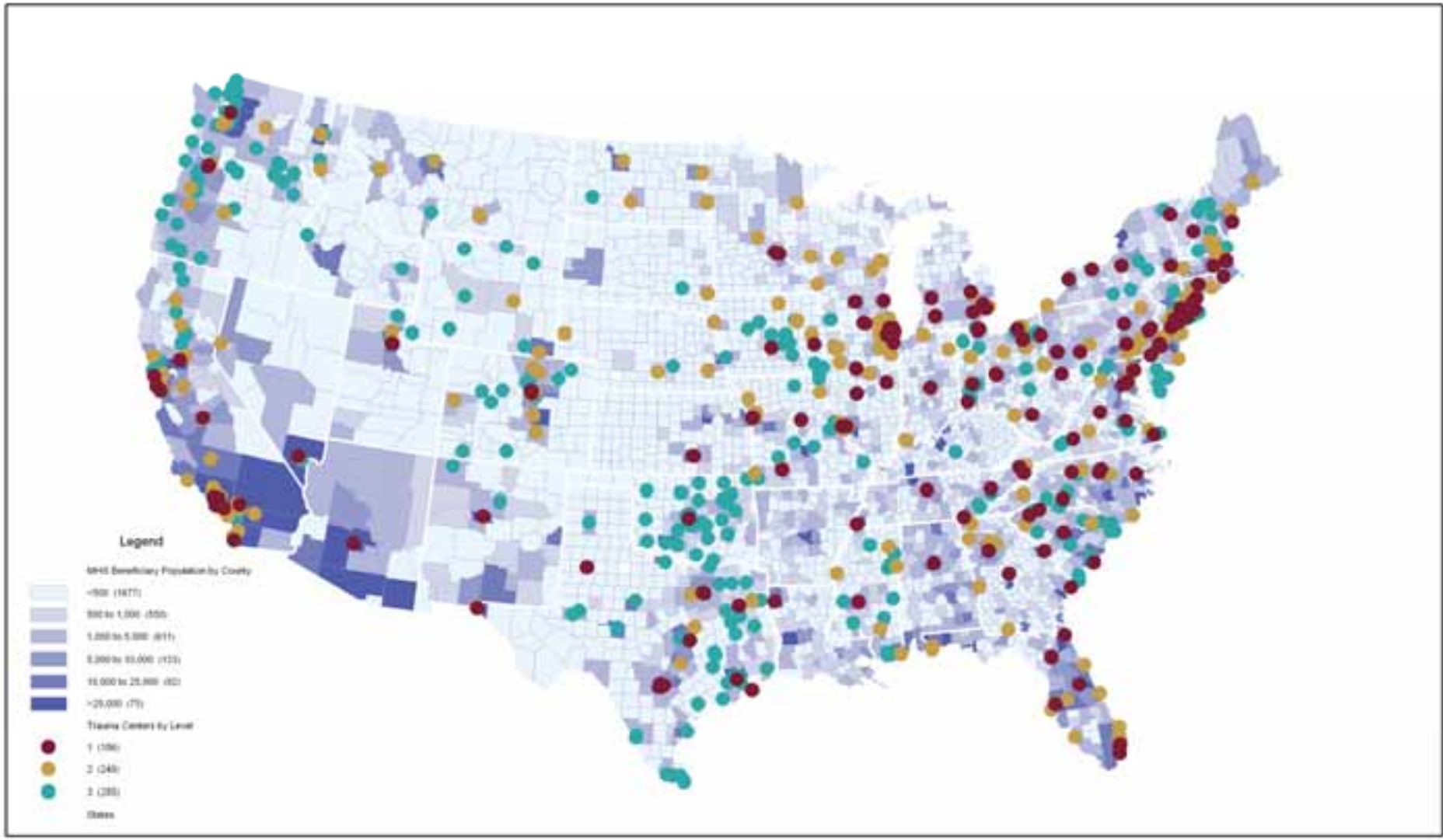
Civilian Trauma Centers (CONUS)



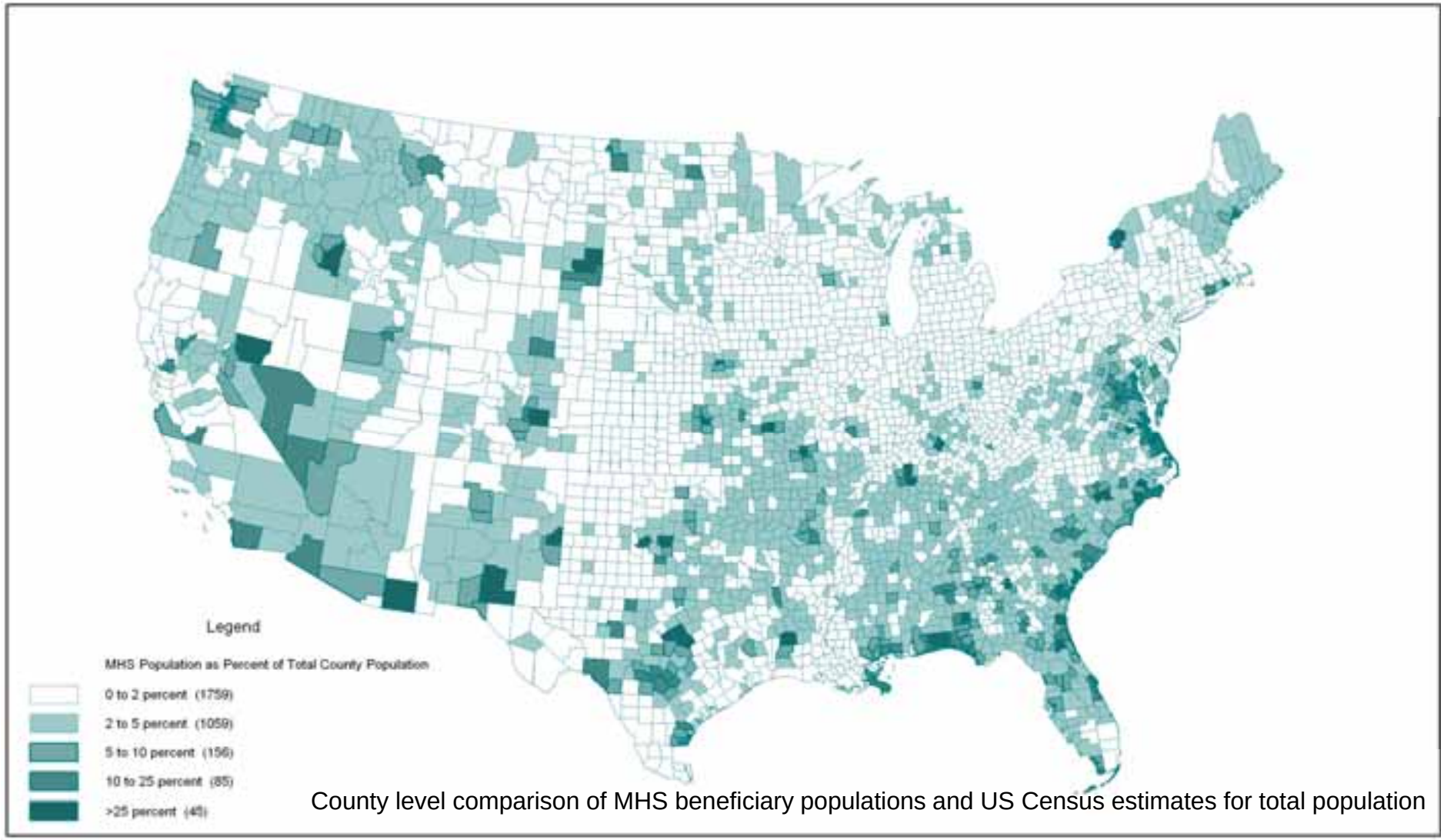
U.S. Civilian Trauma Centers Relative To Civilian Population



MHS Beneficiaries and Trauma Centers



MHS Population Compared with Civilian



County level comparison of MHS beneficiary populations and US Census estimates for total population

Methods (Continued)

Step 3a: Establish Drive Time Polygons

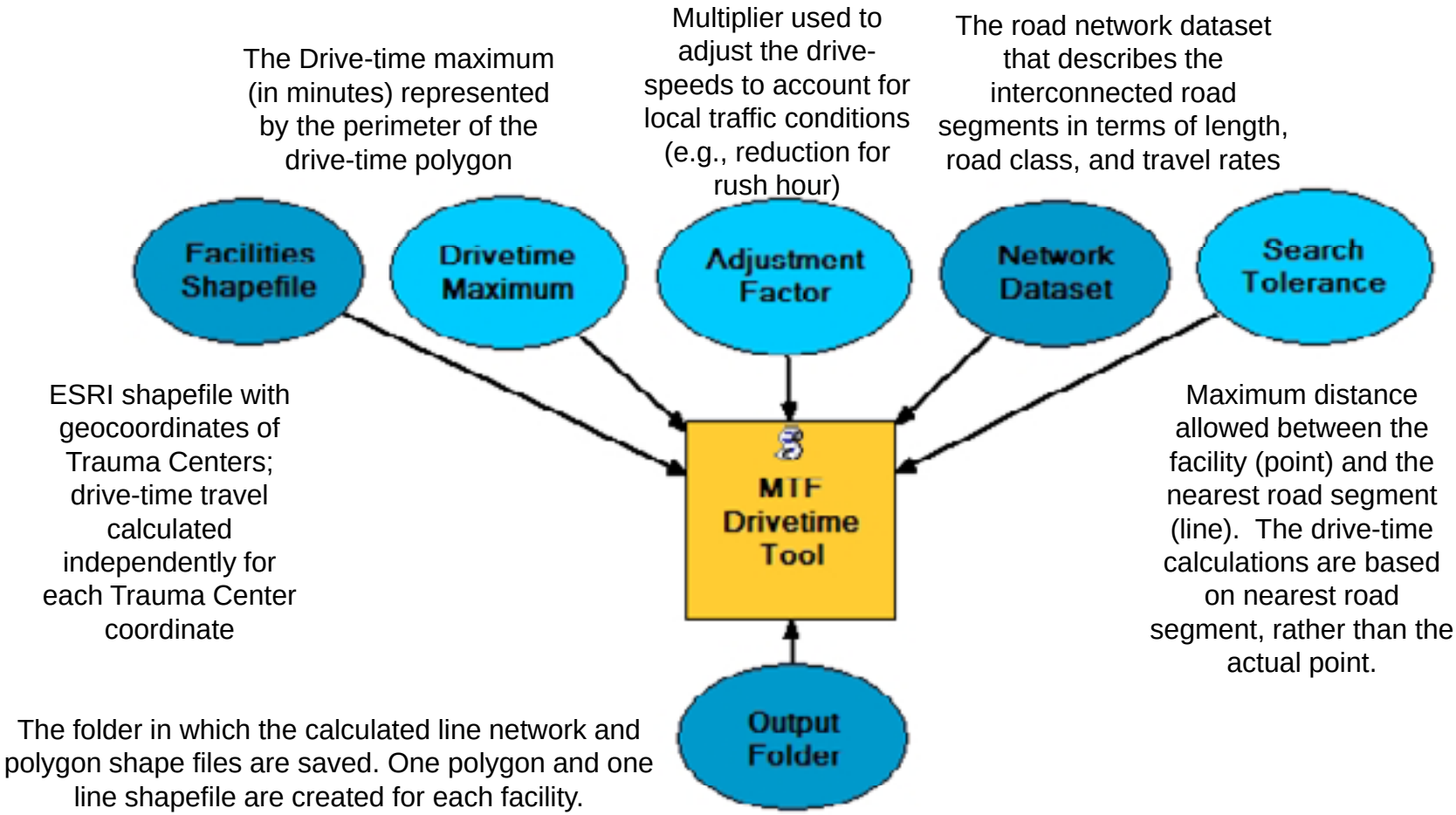
- Drive Times constructed around each Trauma Center using MTF Drive-time Tool, StreetMap segments and posted speed limits
  - "45 minute" round trip to Trauma Center operationalized by 15 one-way driving time (call, response, 15 minutes on sites to stabilize and return)
  - "60 minute" round trip translates to 22.5 minute one-way driving time
    - Assumes ambulance leaves from hospital and returns there, with 15 minutes total for ambulance response and patient pickup

Step 3b: Calculate Coverage Areas

- "Closed" the network into a single polygon based on outer envelope of furthest extents
- Using the drive time polygons, calculate percentage of each ZIP code area that is covered, and use that as a weight or scaling factor for population covered by the drive time
  - Assumes uniform distribution of population across ZIP Code land area

Methods

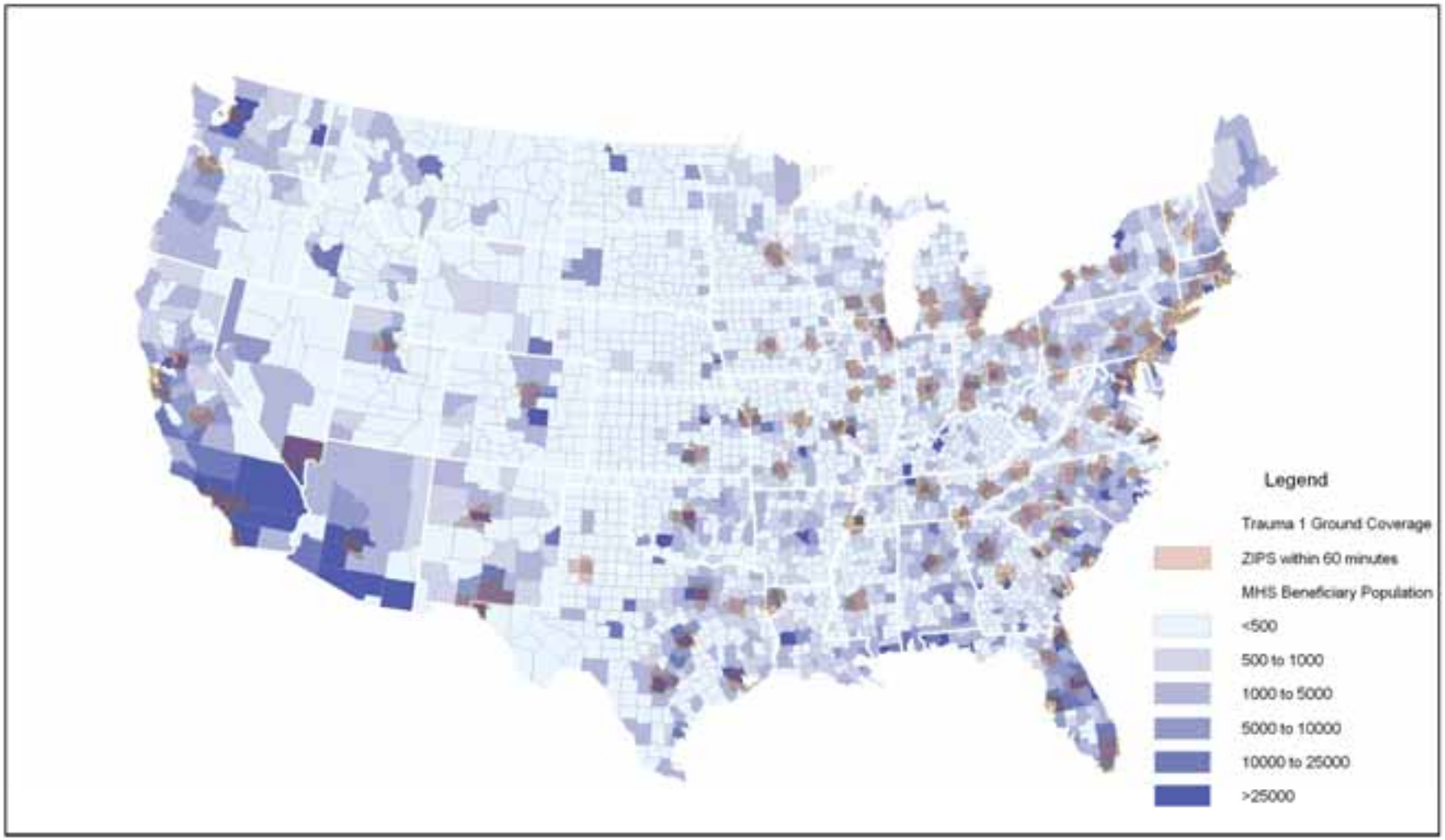
Drive-Time Market Area Creation Tool



Level 1 Trauma Center Ground Access

ZIP Code Coverage areas for 60-minute ground access to Level 1 Trauma Centers

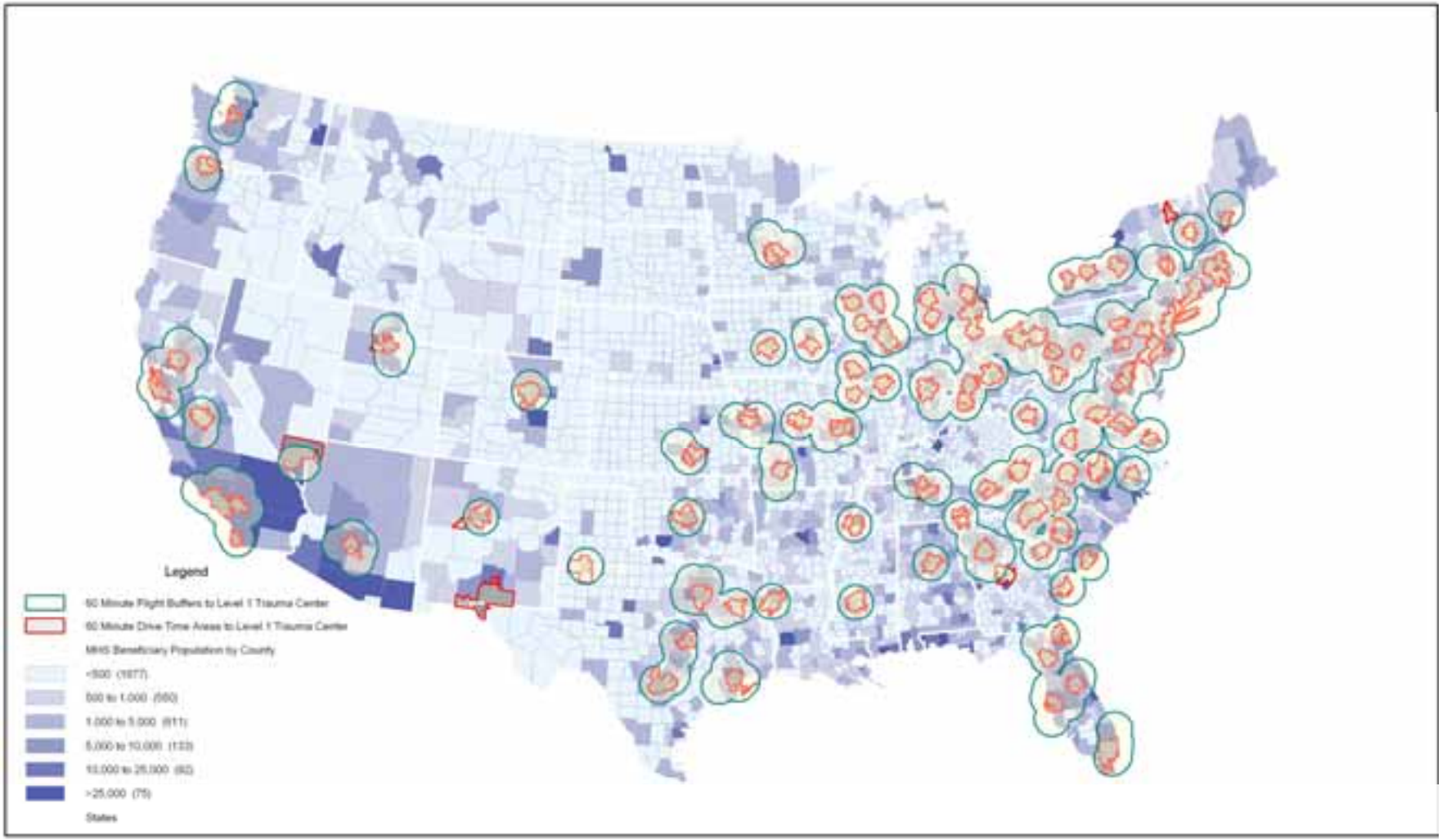
Overlay: Ground Access to Level 1 Trauma Centers and MHS Population



Methods

- **Step 4: Calculate Helicopter Medical Evacuation Coverage**
  - 614 Civilian Medevac base lat-long locations received from ADAMS (Atlas & Database of Air Medical Services) for rotary wing services
  - 150 MPH average speed, 21.6 minute on-site time, 3.5 minute time to launch yields flight circles of 25 miles for 45 minute response, 43.625 miles for 60 minute response
  - 297 buffers contain at least one Trauma 1 Center in 60 minutes, 392 contain at least one Trauma 1 or Trauma 2 Center, 453 contain at least one Trauma 1, 2 or 3 Center
  - Any ZIP Code centroid covered by the Medevac buffer was considered to be “inside” the coverage area
  - Calculate additional population covered by air transport

60 minute Ground and Air Access to Level 1 Trauma Centers



Methodological Issues

- No national database of (ground) ambulance locations or general response times
  - Mix of private, public, volunteer; regulated at the State and County/city level (public health, highway safety)
  - Estimates of response times and travel distances from ambulance source to accident site are difficult to test empirically
- Need a tool to draw ellipses around medevac – hospital pairs
- Variance from Branas et al methods
  - Population at ZIP not census, road network tool not segments by rural/urban nature of census blocks at start./end, different travel time factors used for ground travel
  - We revised the analysis to compare MHS beneficiaries using our method against general civilian population also using our method, to ensure apples-apples comparison

Thank You

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