GIS, Optimization Modeling, and Trauma Center Siting

Trauma Resource Allocation Model for Ambulances and Hospitals

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Background

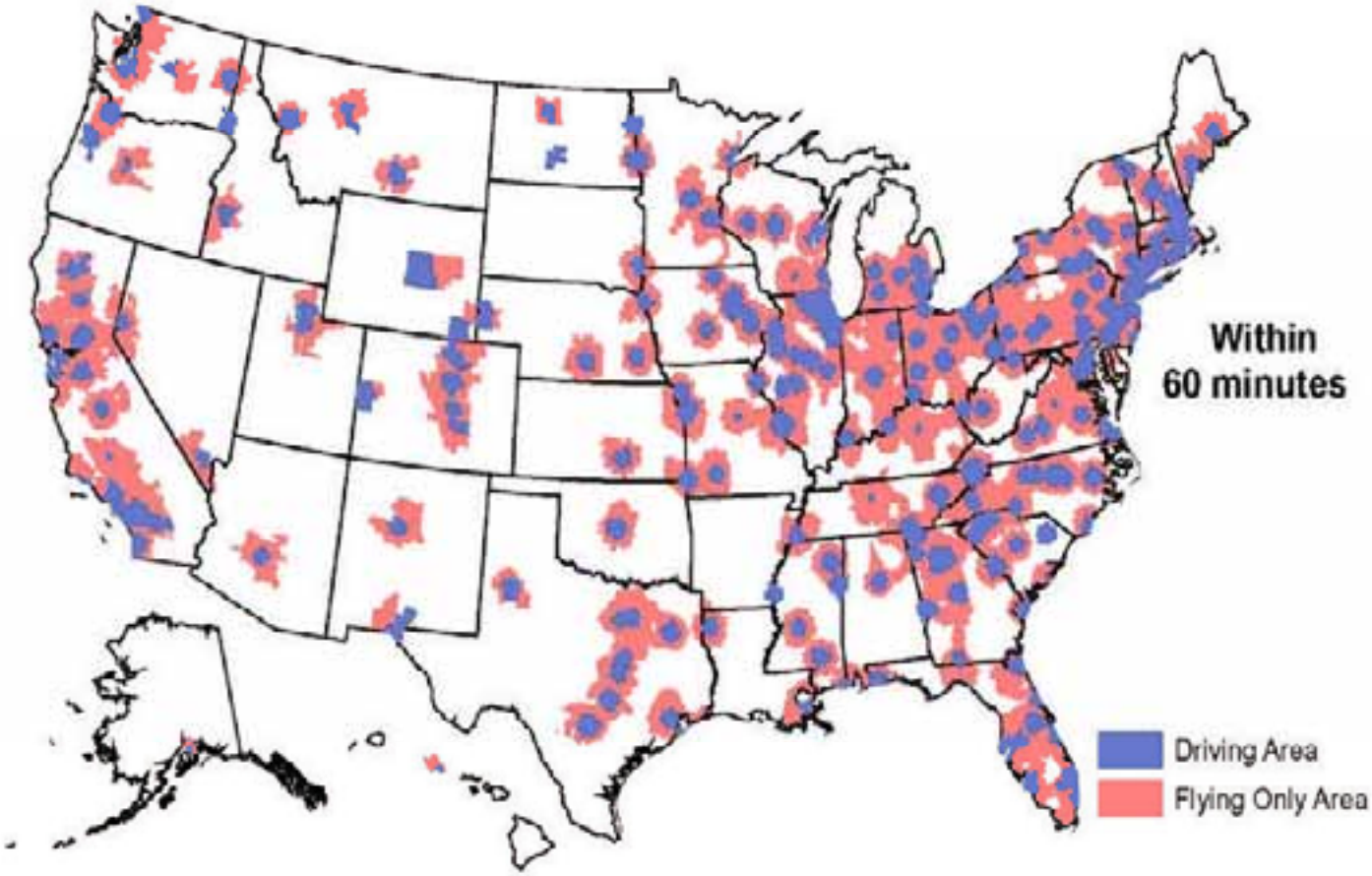
Trauma Resource Allocation Model for Ambulances and Hospitals (TRAMAH)

- Collaboration between researchers at University of Pennsylvania and Johns Hopkins University
- Mathematical model designed to optimize the location of trauma centers and related resources

Rationale

- Roughly 600 Americans die or sustain long-term disability each day from traumatic injuries
- Leading cause of death in US for people under 45
- ~40% of deaths would be preventable with improved access to well-organized trauma systems
- Currently, services duplicated in urban areas, lacking in rural regions

Areas of US where residents can reach a trauma center within 60 min.

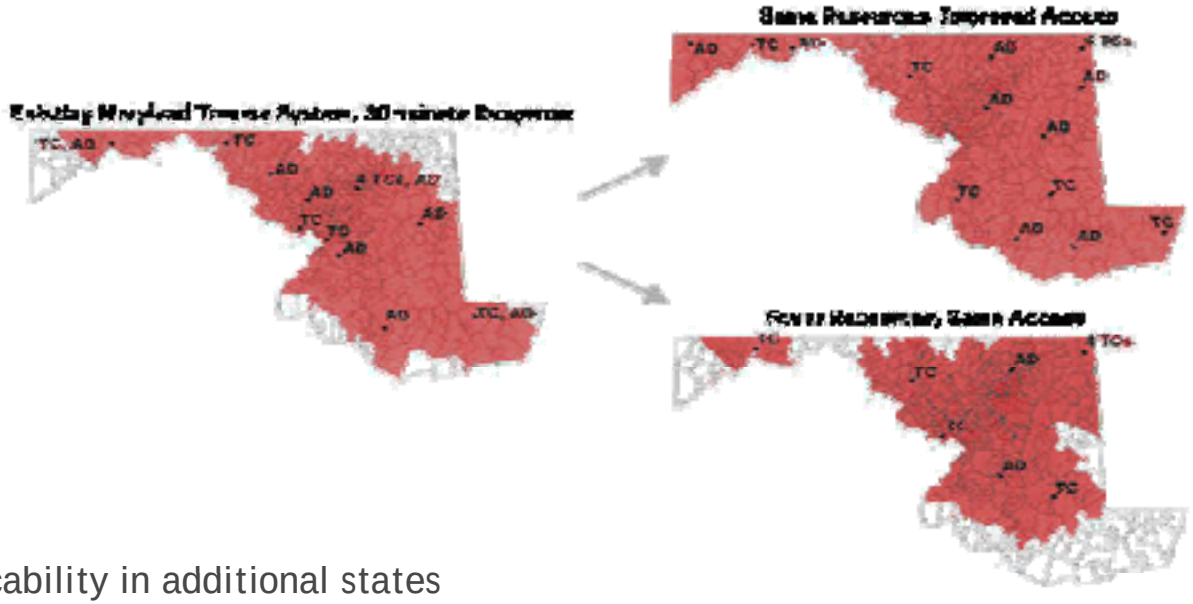


Map published in USAToday July 19, 2005.

Objective: Improve trauma resource allocation

- Re-siting existing resources to improve access
- Reconfiguring resources to provide same access with fewer resources

- Maryland State Trauma System



- Test applicability in additional states
- Develop online application

Model Details

Trauma Resource Allocation Model for Ambulances and Hospitals (TRAMAH)

- Census Population – Blockgroups
- Trauma Center Database
- Hospital Database
- Helicopter Models, ranges and speeds
- Include / Exclude Adjacent States

AMERICAN TRAUMA SOCIETY
IMPROVING CARE, SAVING LIVES

MAPS HOME

Map Tool to Assess Timely Access to Trauma Centers

Select Year:
2005

Select Response Time:
60 Minutes

Select Transport Method:
Helicopter or Ambulance

Map Layers
- Major Cities
- States
- Interstates

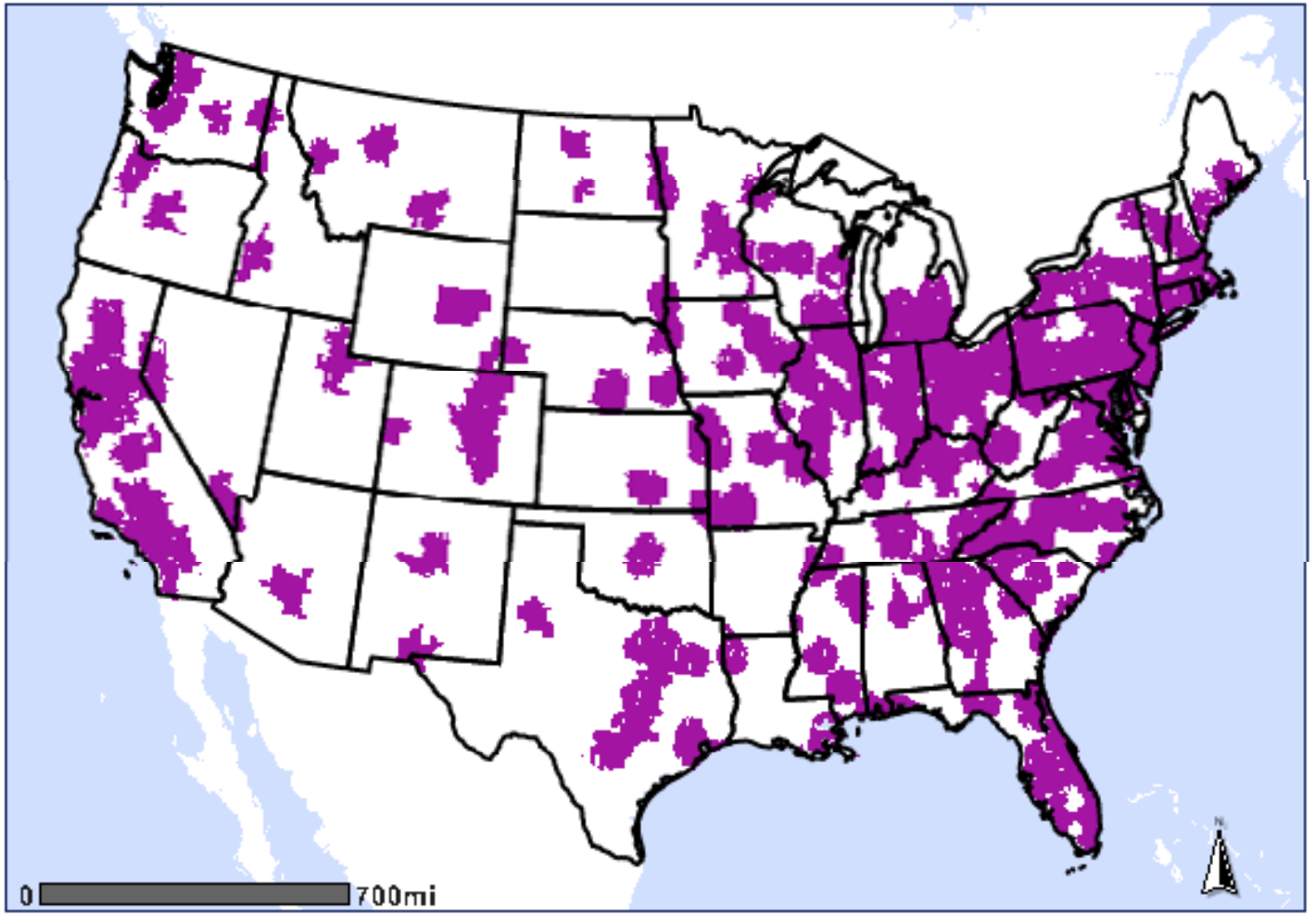
Continental US | Alaska | Hawaii

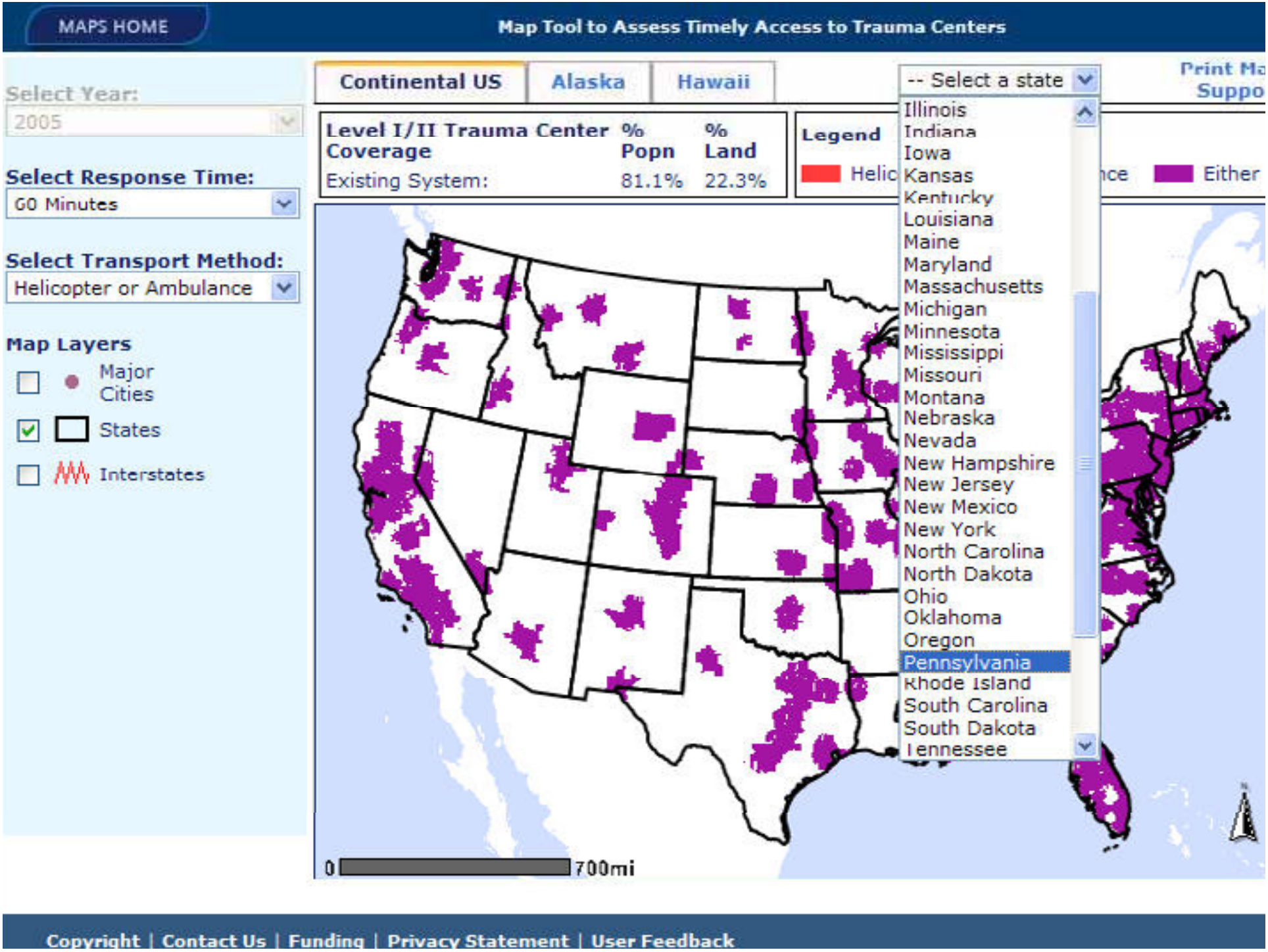
-- Select a state

Print Map
About

Level I/II Trauma Center Coverage	% Popn	% Land
Existing System:	81.1%	22.3%

Legend
Helicopter Ambulance Either




MAPS HOME
Map Tool to Assess Timely Access to Trauma Centers
Select Year:
2005
Select Response Time:
60 Minutes
Select Transport Method:
Helicopter or Ambulance
Map Layers
Major Cities
States
Interstates
Continental US
Alaska
Hawaii
-- Select a state
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
South Dakota
Tennessee
Level I/II Trauma Center Coverage
% Popn
% Land
Existing System:
81.1%
22.3%
Legend
Either
0
700mi
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MAPS HOME

Map Tool to Assess Timely Access to Trauma Centers

Include Neighboring States

Pennsylvania

full extent | zoom in | zoom out | re-center | select | measure

Print Map
Support

Select Year:
2005

Select Response Time:
60 Minutes

Select Transport Method:
Helicopter or Ambulance

Map Layers

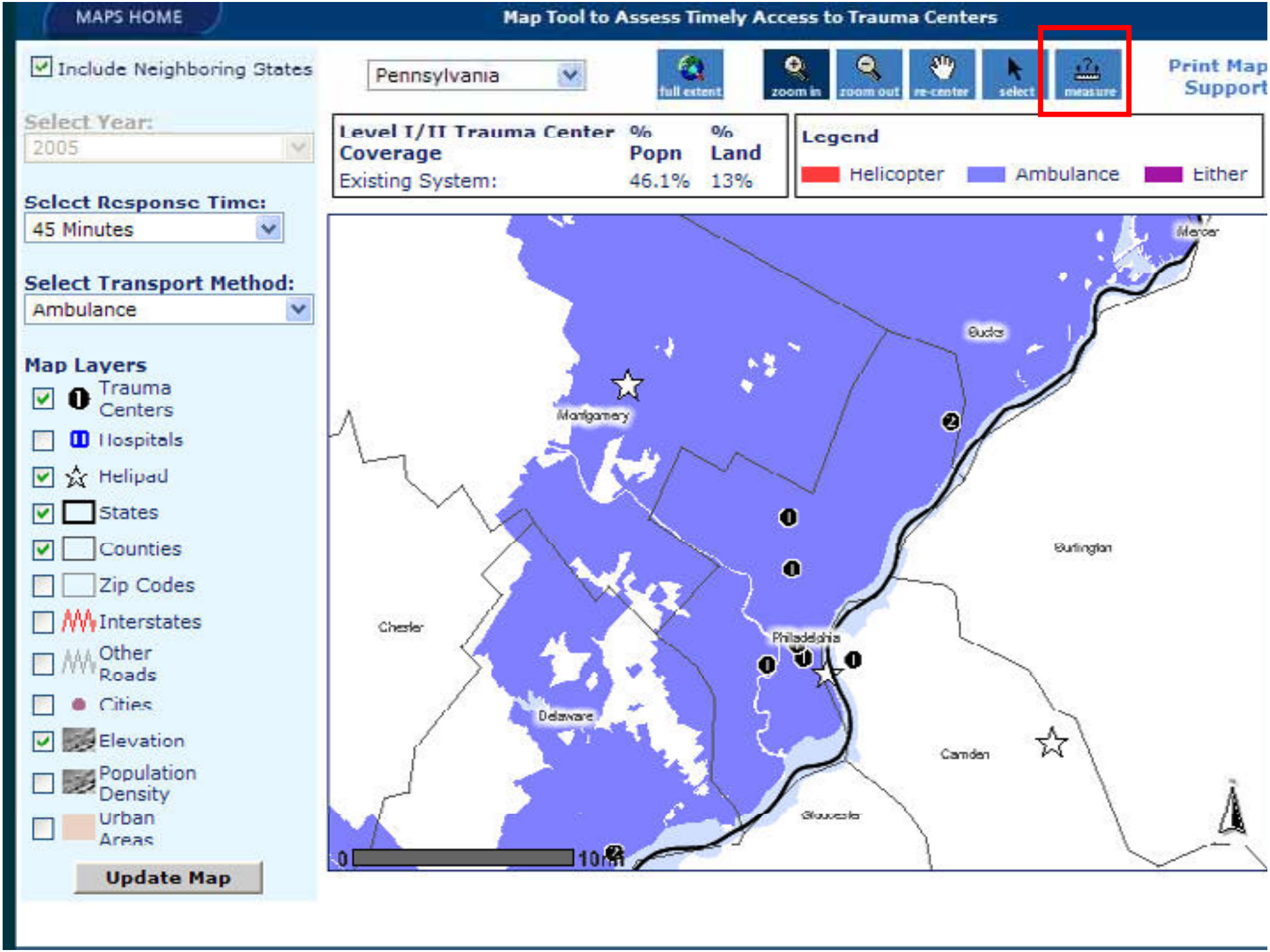
- Trauma Centers
- Hospitals
- Helipad
- States
- Counties
- Zip Codes
- Interstates
- Other Roads
- Cities
- Elevation
- Population Density
- Urban Areas

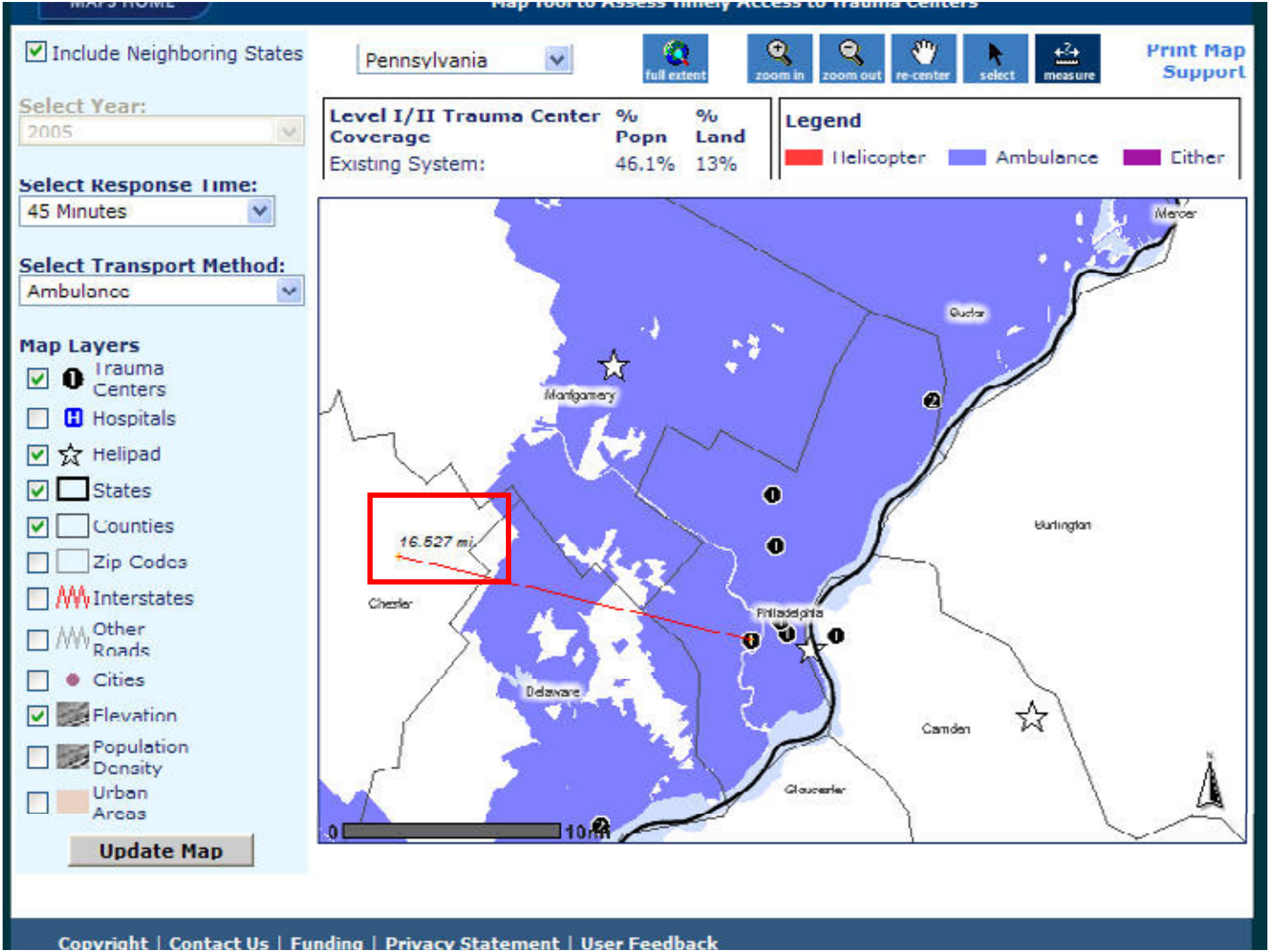
Update Map

Level I/II Trauma Center Coverage	% Popn	% Land
Existing System:	99%	90.4%

Legend

Helicopter | Ambulance | Either


MAPS HOME
Map Tool to Assess Timely Access to Trauma Centers
Include Neighboring States
Pennsylvania
full extent
zoom in
zoom out
re-center
select
measure
Print Map
Support
Select Year:
2005
Select Response Time:
45 Minutes
Select Transport Method:
Ambulance
Map Layers
Trauma Centers
Hospitals
Helipad
States
Counties
Zip Codes
Interstates
Other Roads
Cities
Elevation
Population Density
Urban Areas
Update Map
Level I/II Trauma Center Coverage
% Popn
% Land
Existing System:
46.1%
13%
Legend
Helicopter
Ambulance
Either
Mercer
Bucks
Montgomery
Burlington
Chester
Philadelphia
Delaware
Camden
Gloucester
0
10mi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Print Map
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2005
Level I/II Trauma Center Coverage
% Popn
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Legend
Helicopter
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Either
Select Response Time:
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Map Layers
Trauma Centers
Hospitals
Helipad
States
Counties
Zip Codes
Interstates
Other Roads
Cities
Elevation
Population Density
Urban Areas
Update Map
16.527 mi
Montgomery
Chester
Philadelphia
Delaware
Camden
Burlington
Mercer
Ocean
Gloucester
0
10mi
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Technology

ArcIMS®

ArcSDE®

Microsoft

Microsoft SQL Server 2005

Microsoft ASP.net

Future Developments

- Expand available data sets to include 2004, 2006 and 2007 data
- Add demographic reference data
- Enable on-the-fly calculations of different resource location scenarios

Acknowledgements

Cartographic Modeling Lab

University of Pennsylvania TRAMAH Project, Dept of Biostatistics and Epidemiology

American Trauma Society

Centers for Disease Control

US Dept of Health and Human Services

Questions? **Visit Us Online!**

www.cceb.upenn.edu/pages/tramah/
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