Estimating Allogeneic Hematopoietic Cell Transplantation Unmet need

ESRI User Conference 2015

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NATIONAL MARROW DONOR PROGRAM®

BE THE MATCH®

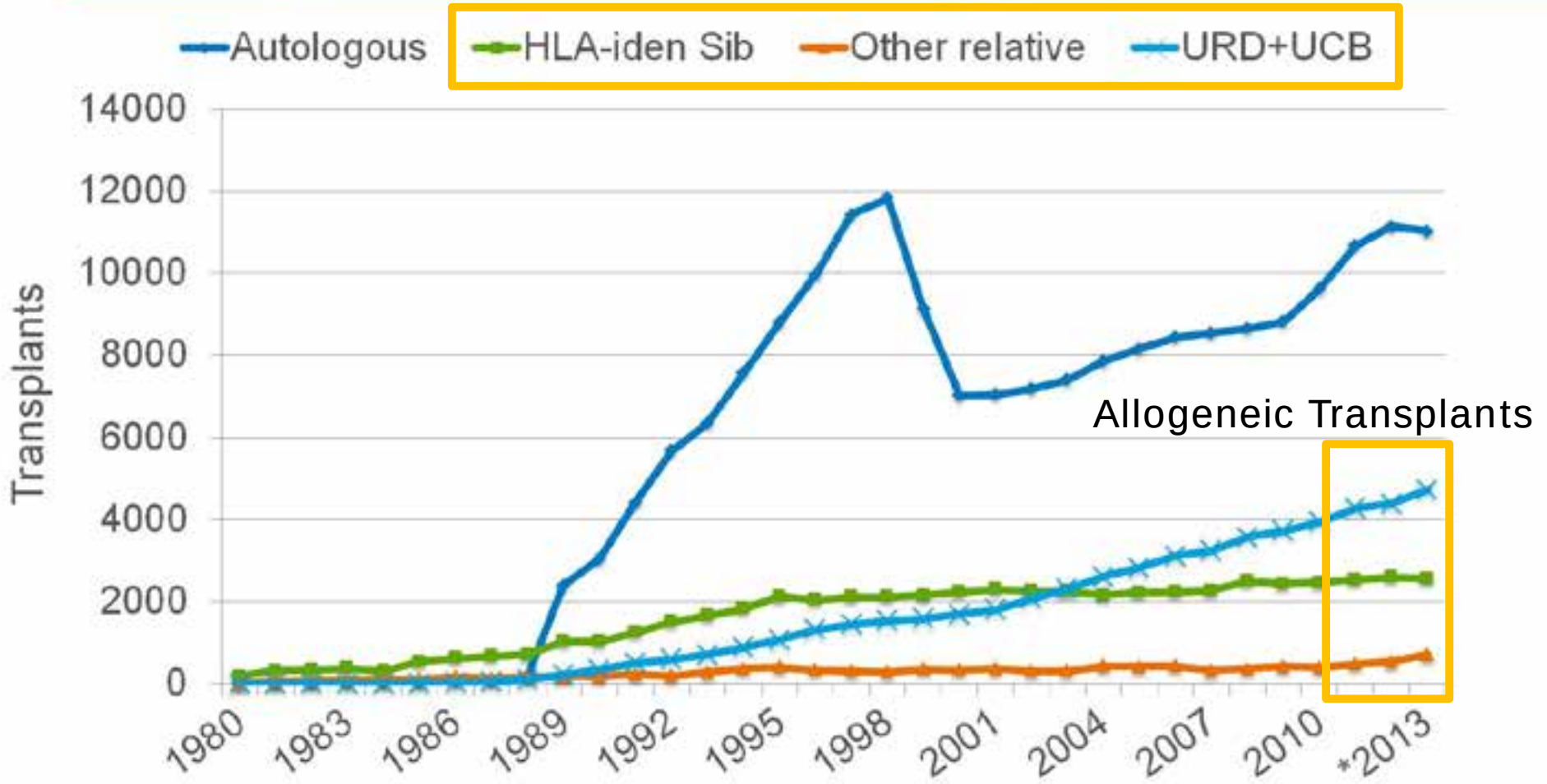
About NMDP / Be The Match

Henry, transplant recipient

Many people with life-threatening blood cancers like leukemia and lymphoma or other diseases, need a life-saving marrow or umbilical cord blood transplant.

Be The Match works with transplant centers to facilitate transplants for patients who need an unrelated donor.

Transplants in the U.S. by Donor Type



CIBMTR
CENTER FOR INTERNATIONAL BLOOD & MARROW TRANSPLANT RESEARCH

* 2013 Data incomplete

Estimating the Need for Transplant

70+ Diseases:

- Incidence by age – SEER and other sources
- Population – US Census
- Treatment protocols – NCCN guidelines
- Therapy success/failure – scientific literature, expert opinion

Age	All Allogeneic Transplants per 100,000
O to 19	5.4
20 to 54	5.5
55 to 75	12.3*

The Need is Much Greater than Actual[1]

- By applying the optimal transplant rate to the U.S. population (2012), the need for allogeneic (related and unrelated) transplant is 20,700 per year.
  - Adult (ages 20-74) – 16,100 per year
  - Pediatric (ages 0-19) – 4,600 per year

System Capacity Initiative[2]

Understand and address institutional barriers and capacity of the heath care system to meet the growing need for transplant.

- Three-year
- Multidisciplinary
  - Physician
  - Insurance
  - Infrastructure
  - Other health professionals

Regional Market Mapping

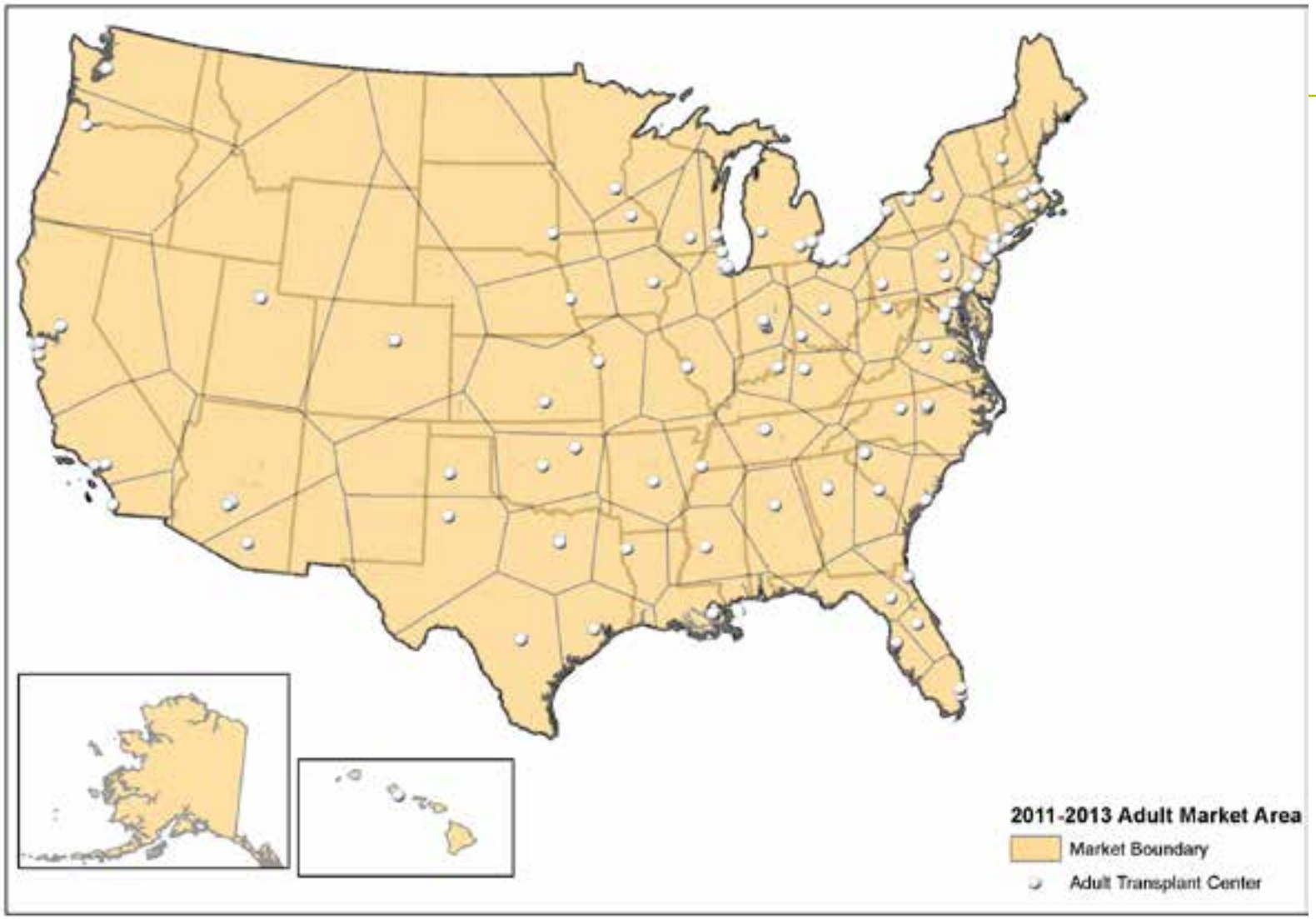
- Although useful for policy purposes, the national need analysis wasn't helpful to transplant programs in assessing local need
- What is the need in my market?
- How is a market defined?
- Are people leaving this market to get a transplant elsewhere?
- What else can we learn about the unmet need?

Market Potential Analysis[3]

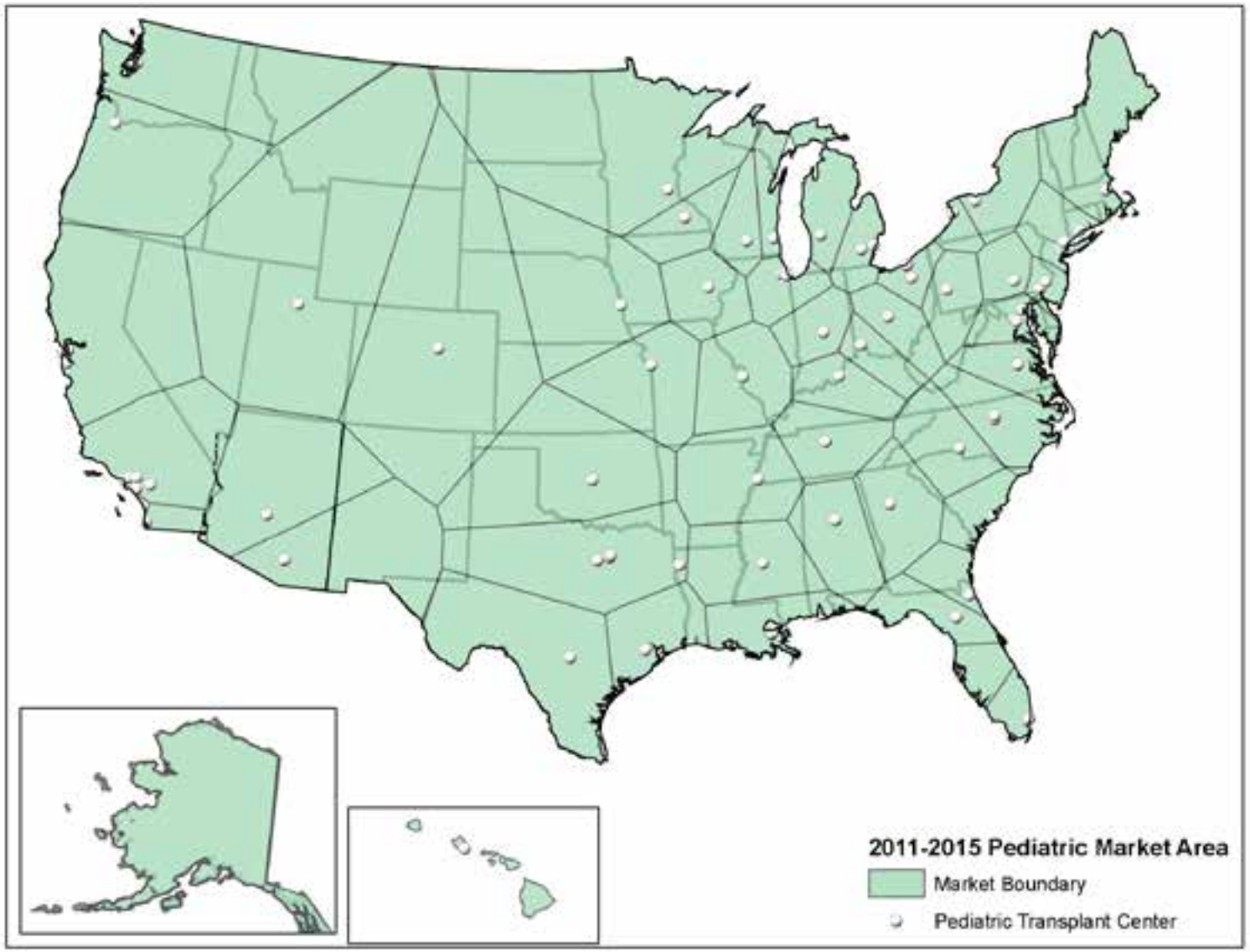
- Concept:
  - Determine ***unmet transplant demand*** within individual U.S. geographic markets around transplant center(s)

- Purpose:
  - Visualize growth potential within individual markets to assist program/hospital administration in making informed decisions regarding BMT program expansion
  - Potentially visualize underserved markets within U.S. for additional consideration
  - Apply socioeconomic variables to identify general market barriers for strategic planning & initiatives (in progress)

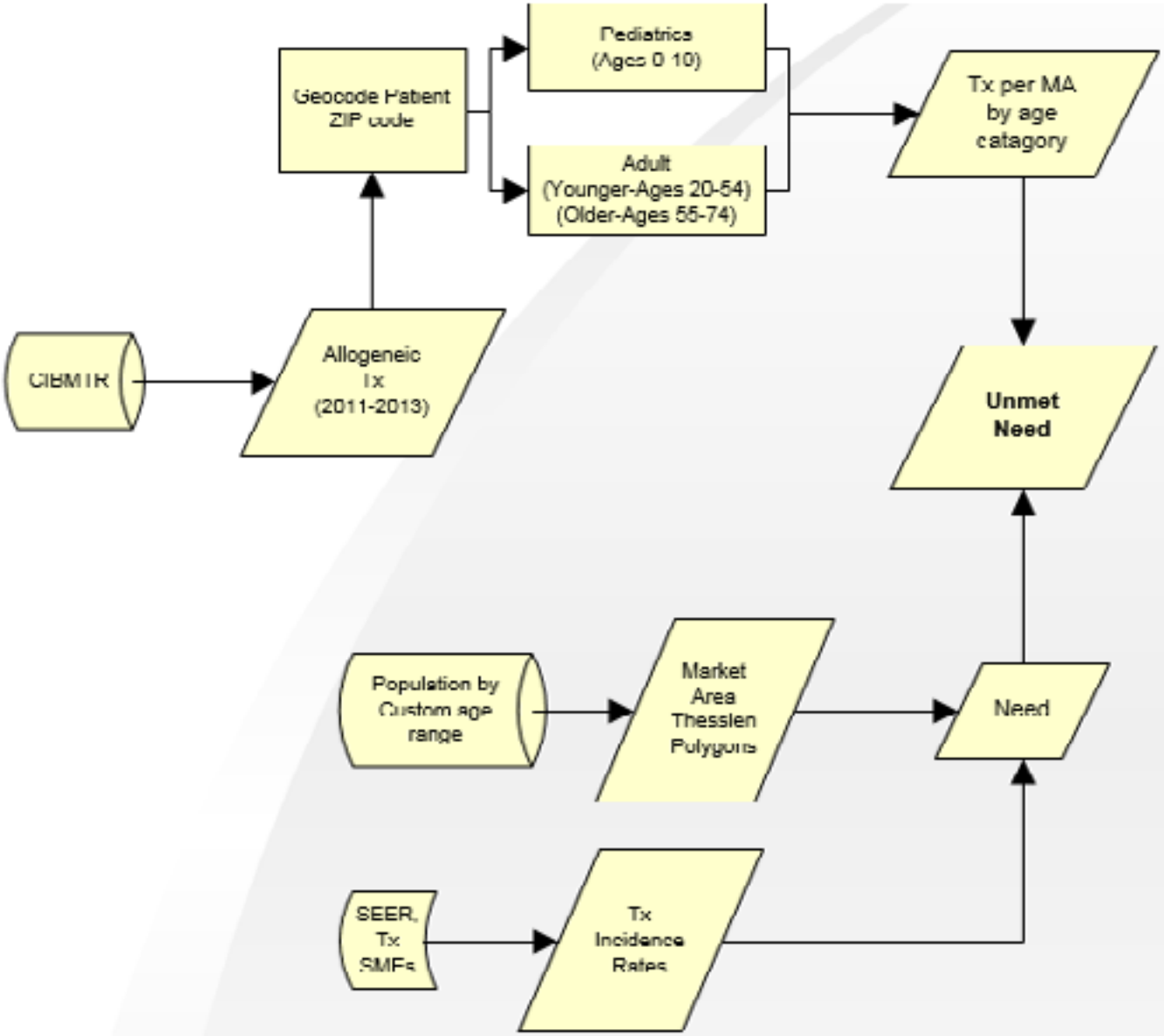
Adult Transplant Market Areas



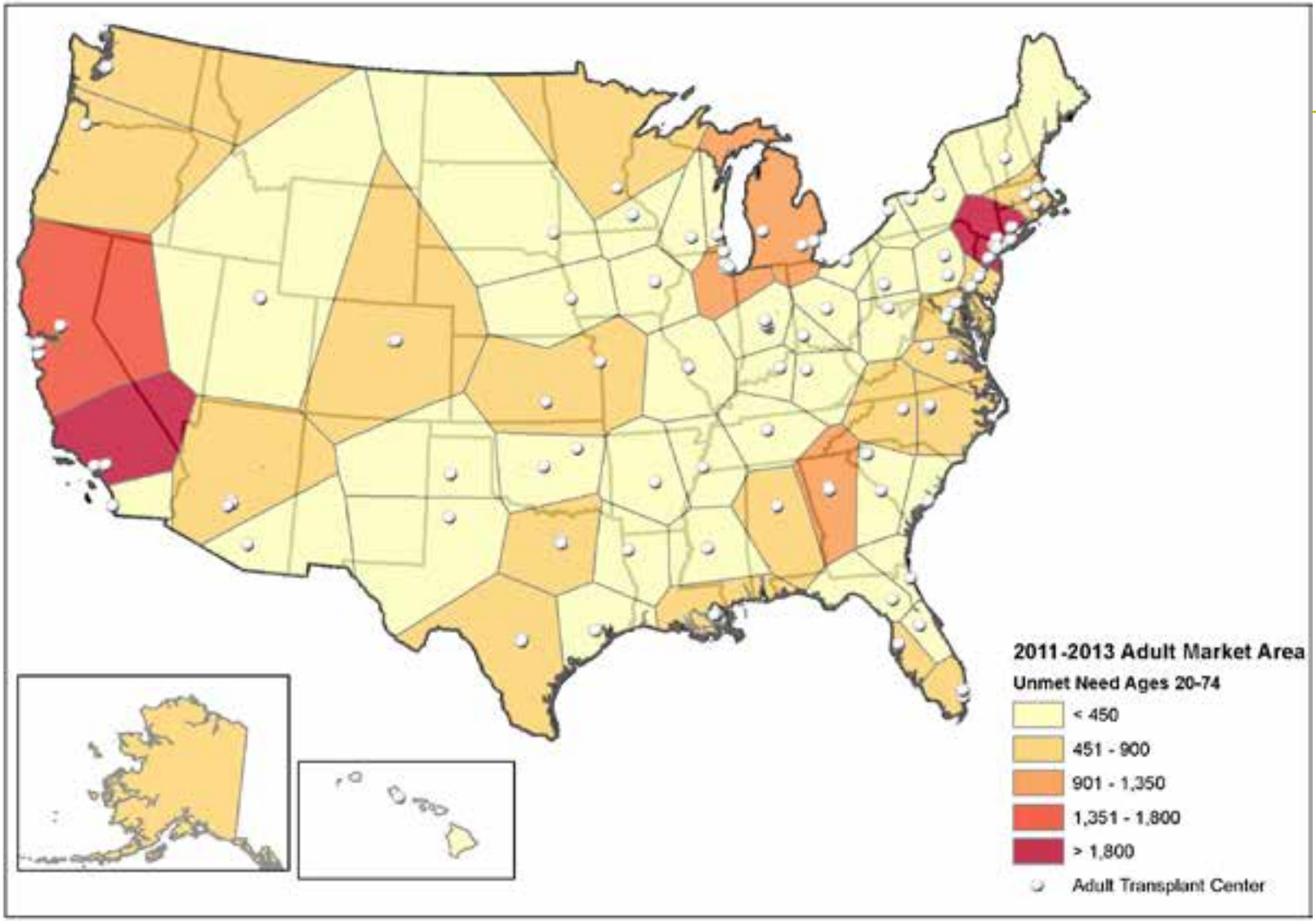
Pediatric Allogeneic Transplant Centers



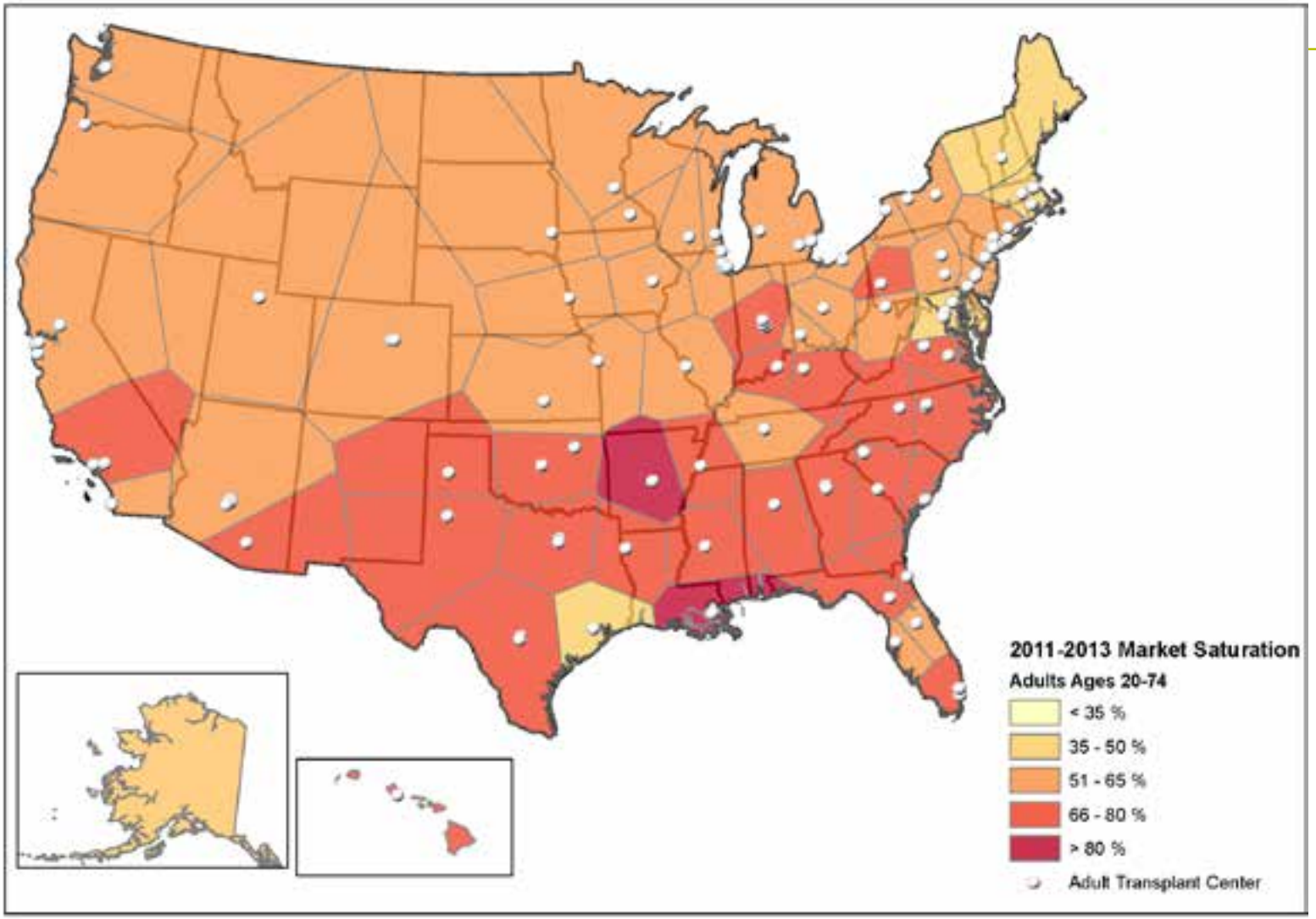
Unmet Need Calculation by Market Area



Unmet Need U.S. Market Areas (2012) - Adult Ages 20-74 All Indications



Percent Market Saturation, 20-74 years
(Actual / Calculated Demand)



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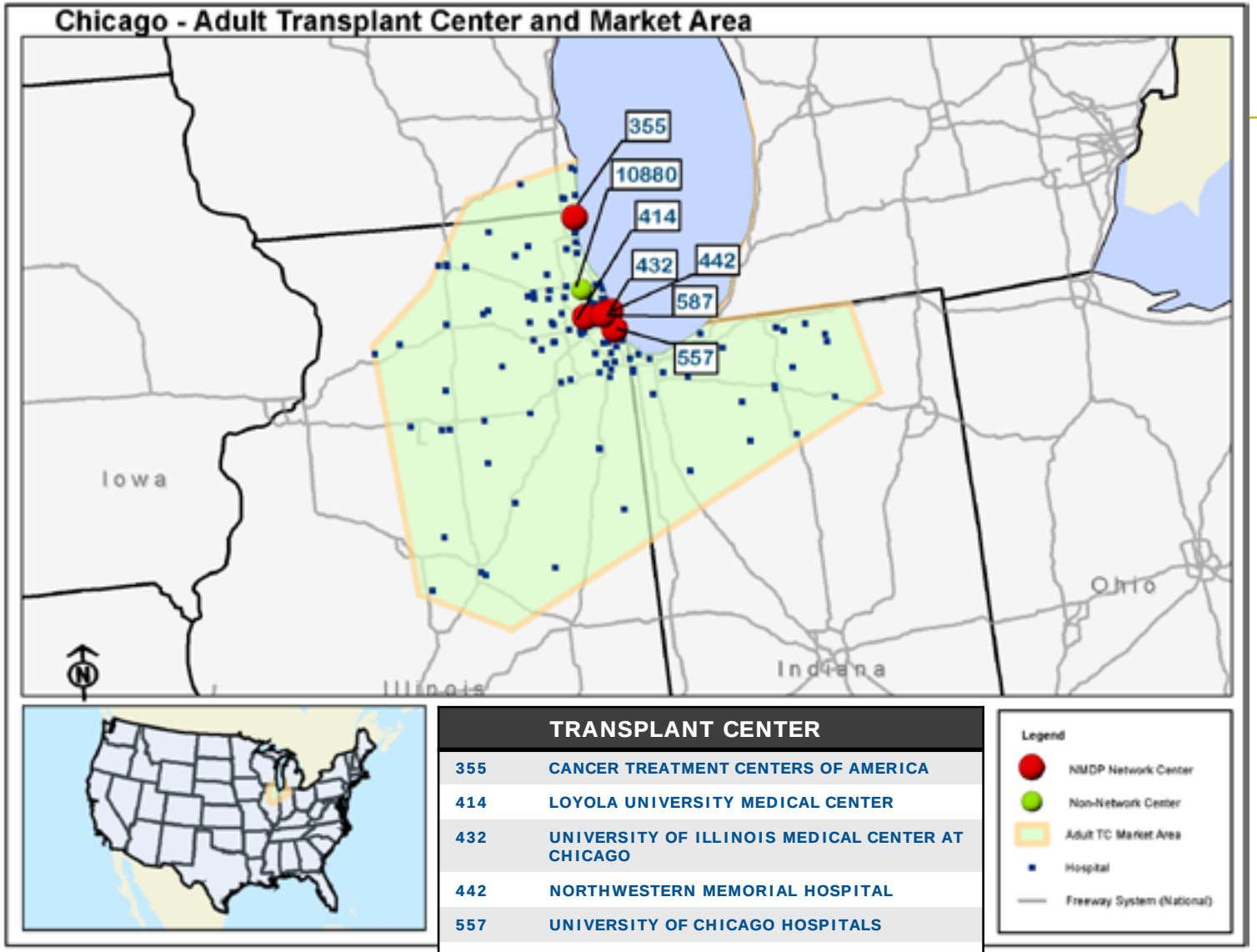
Chicago- Adult Transplant Center and Market Area



TRANSPLANT CENTER	
355	CANCER TREATMENT CENTERS OF AMERICA
414	LOYOLA UNIVERSITY MEDICAL CENTER
432	UNIVERSITY OF ILLINOIS MEDICAL CENTER AT CHICAGO
442	NORTHWESTERN MEMORIAL HOSPITAL
557	UNIVERSITY OF CHICAGO HOSPITALS
587	RUSH UNIVERSITY MEDICAL CENTER
10880	ADVOCATE LUTHERAN GENERAL HOSPITAL

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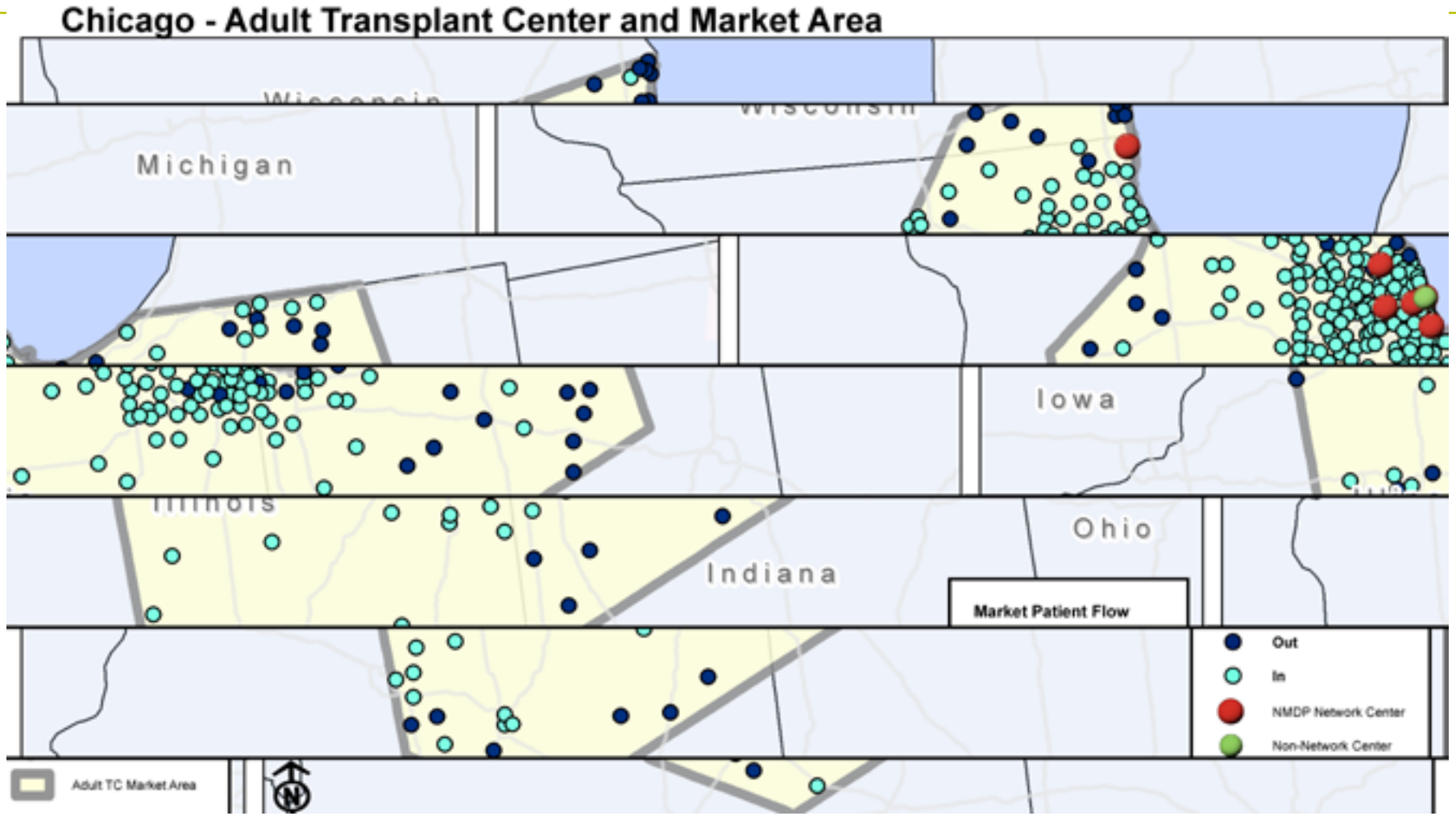
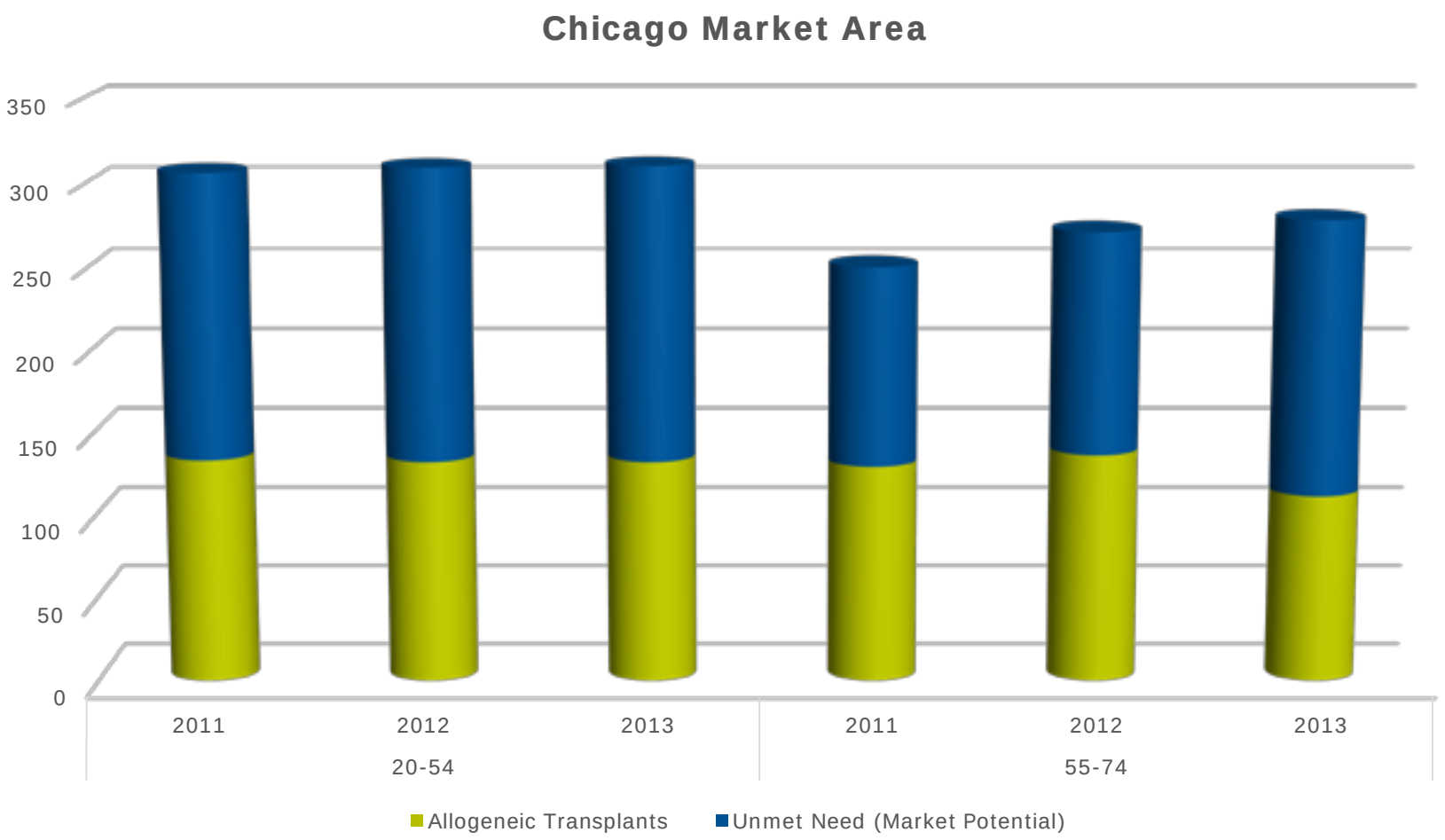
Market Potential and Patient Flow

Chicago	Ages 20-54			55-74		
	2011	2012	2013	2011	2012	2013
Transplant Demand = pop x (demand / 100,000)	307	310	311	251	272	279
2013 Allogeneic Transplants (related + unrelated)	135	134	134	131	138	113
Market Potential = demand - actual	172	176	177	120	134	166
Percent of Tx: **"In" Market Area**	66	78	75	73	80	76
"Out" of Market Area	18	11	18	14	11	11
Not Assigned	16	11	7	13	9	13

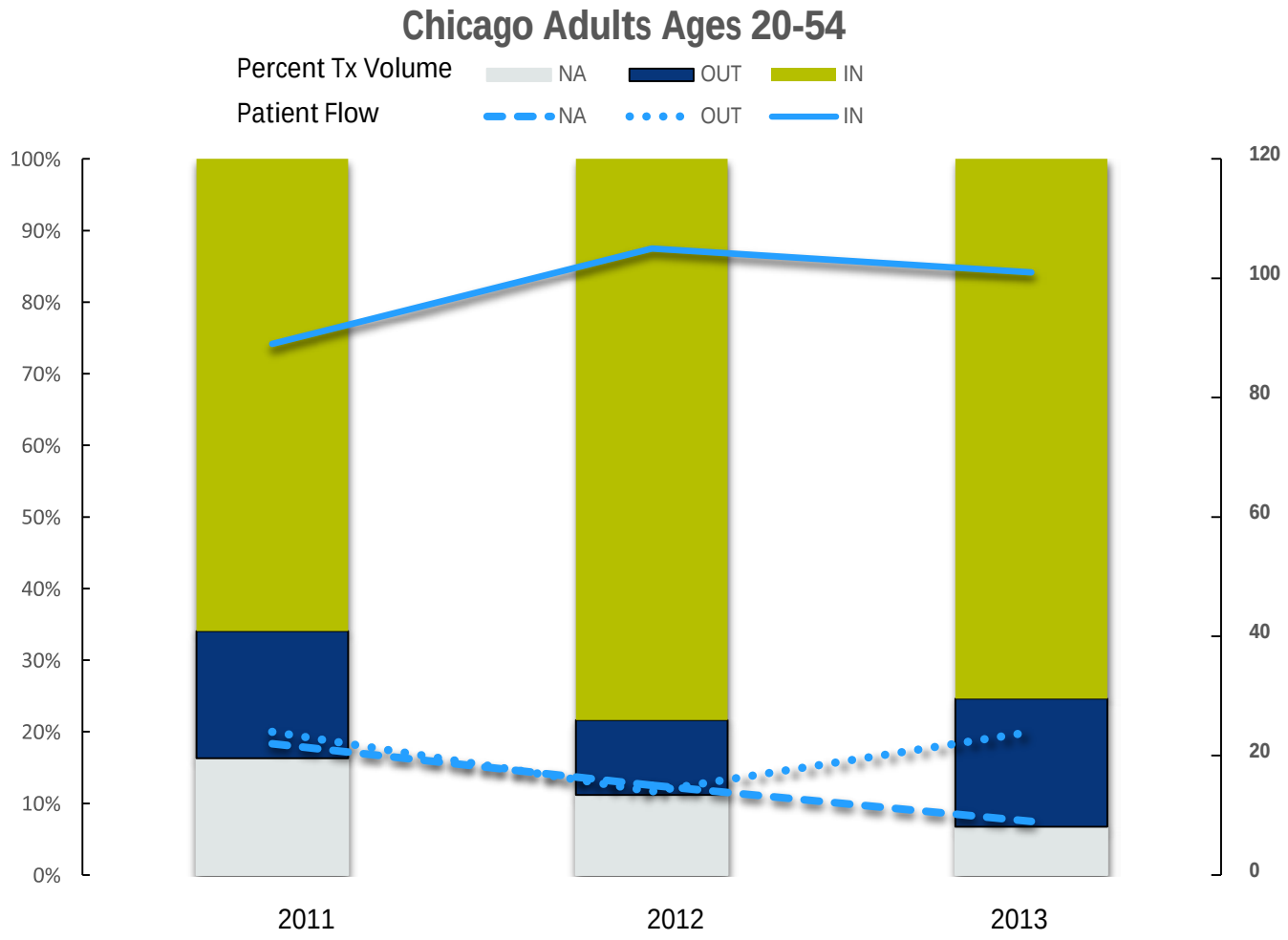
Adult Patient Flow within Market Area



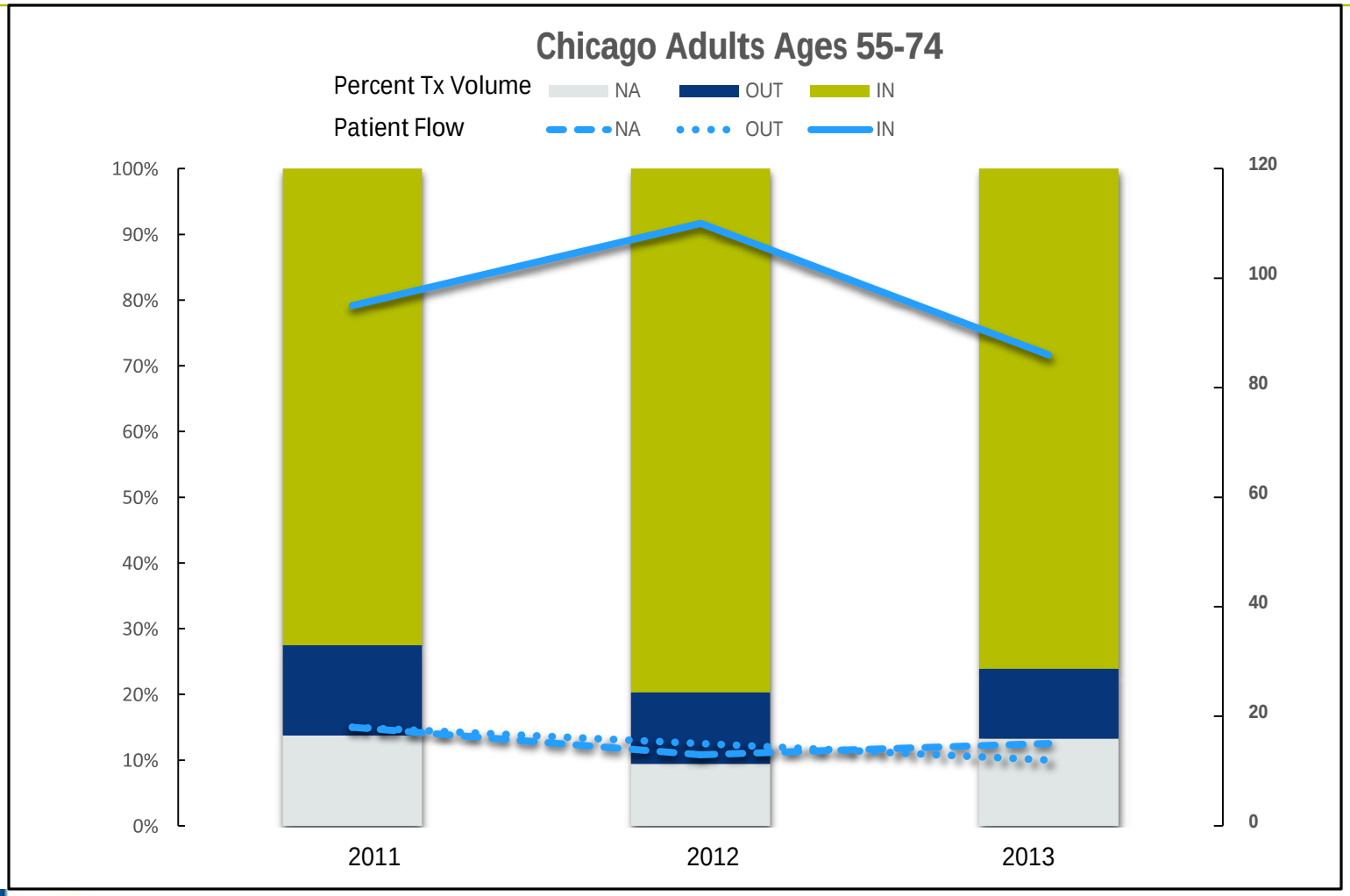
Transplant Demand



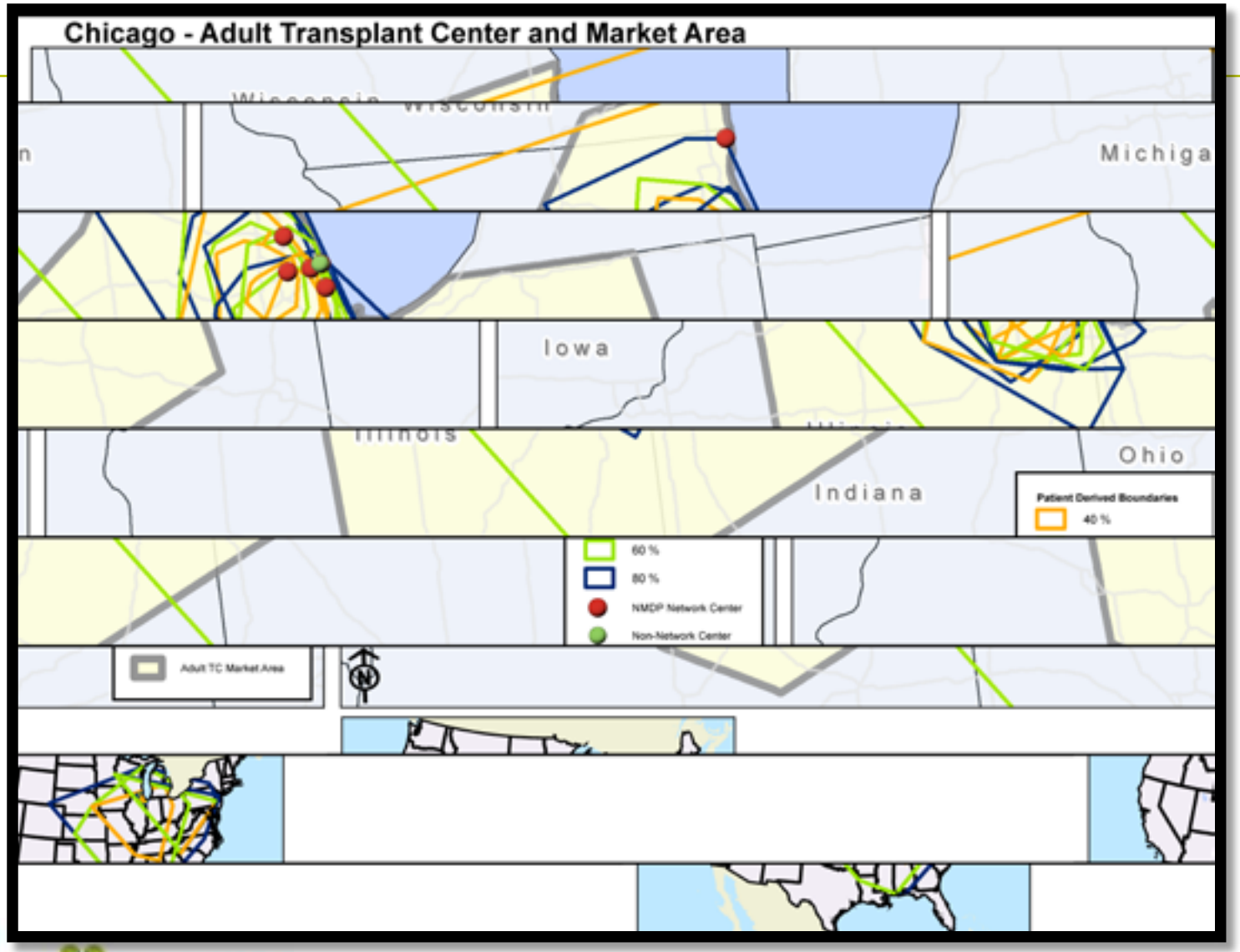
Market Area Patient Flow



Market Area Patient Flow



Adult Patient Distribution



Conclusions

- This analysis may prove to be an aid in capacity planning for regional healthcare
  - The model will work for other diseases or procedures

- May help transplant program directors access future staffing needs and access capital for investment in infrastructure and program development

The Impact

- Developing outreach programs with referring physicians
- Use to inform location of a satellite center outside current market
- National cancer program establishing centers to meet availability
- Working with administrators to garner funding to expand their programs
  - 3 Centers were awarded a combined $40 million FY2012

Beds	MD FTE	HCT
↑ 21%	↑ 19%	↑ 126%

Next Steps

- Further refine the model to determine the attributes of patients represented by the unmet need
  - Race and ethnicity
  - Health Insurance
  - SES
- Develop plans to meet the needs
  - Facility capacity
  - Programs to address SES

References

1. Nietfeld JJ, Pasquini MC, Logan BR, Verter F, Horowitz MM. Lifetime Probabilities of Hematopoietic Stem Cell Transplantation in the U.S. *Biology of Blood and Marrow Transplantation*. 2008;14(3):316-322. doi:10.1016/j.bbmt.2007.12.493.

2. Denzen EM, Majhail NS, Stickney Ferguson S, et al. Hematopoietic Cell Transplantation in 2020: Summary of Year 2 Recommendations of the National Marrow Donor Program's System Capacity Initiative. *Biology of Blood and Marrow Transplantation*. 2013;19(1):4-11. doi:10.1016/j.bbmt.2012.10.005.

3. Besse KL, Preussler JM, Murphy EA, et al. **Estimating Demand and Unmet Need for Allogeneic Hematopoietic Cell Transplantation in the United States Using Geographic Information Systems.** *Journal of Oncology Practice*. 2015;11(2):e120-e130.

Questions or Comments

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Supplemental Material

Estimating the Need

Example: Acute myelogenous leukemia

Age in years	2012 U.S. Population	AML Incidence per 100,000	Estimated Annual New Diagnoses	Proportion eligible for HCT	Allo HCT Demand
Pediatric 0-19	82,504,800	0.7	609	0.45	274
Adult 20-54	149,677,682	1.7	2,552	0.70	1,786
Adult 55-64	38,586,202	5.2	2,016	0.55	1,109
Adult 65-74	23,985,392	11.5	2,770	0.25	692
Total	294,754,076		7,947		3,861

1) Create BDS layer with desired variables (Business Analyst)
Minority
- Individual Ages 0-74
- Total Population
- Total Income
- Total House Holds
- Total Health Care Expenditures

2) Export BDS layer to shapefile or featureclass
3) Create and calculate the following new columns:
- Ped-> sum counts for individual ages 0-19
- Adult 20-54->sum counts for individual ages 20-54
- Adult 55-74->sum counts for individual ages

4) Use model builder in ArcGIS to manipulate the data (see image below for example of Adult MA)
5) Create and calculate the following new columns by MA:
- Percent Minority->Minority/Total Population
- Average HH Income->Total Income/Total HH
- Average Health Care Expenditures-> Total Health Expenditures/Total HH