AST | AMERICAN SOCIETY OF TRANSPLANTATION

Beyond the LAS: Looking at Combined Endpoints to Evaluate Urgency for Lung Transplantation

Erika D. Lease, MD, FCCP

University of Washington

CUTTING EDGE OF TRANSPLANTATION

TRANSPLANT SUMMIT 2020

BALANCING EQUITY AND UTILITY IN THE FACE OF AN ORGAN SHORTAGE

Disclosures

None

Learning Objectives

- Review the current state of the Lung Allocation Score (LAS) in the United States
- Discuss the framework of a continuous distribution system
- Identify the possible components of a future composite allocation score

Timeline of Organ Allocation in the US

1954 – 1st successful kidney transplant

1968 Uniform Anatomical Gift Act

Organ allocation as a local process

1984 US Congress passes NOTA, creates OPTN

1986 UNOS receives contract

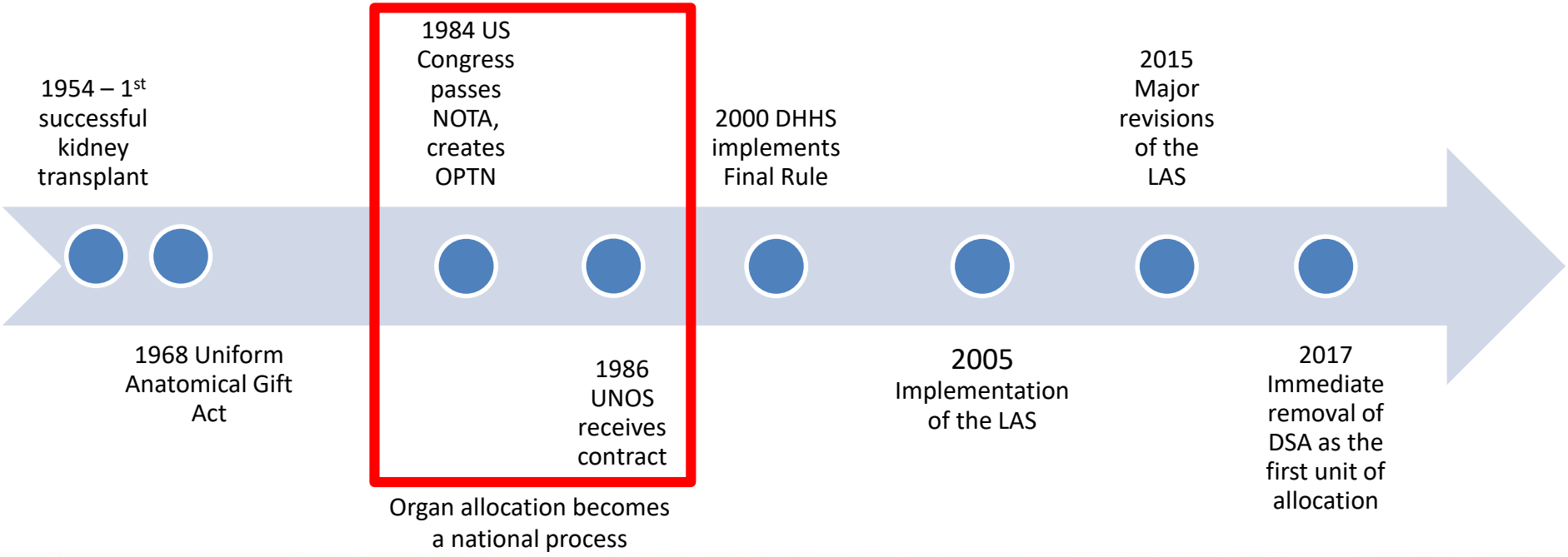
2000 DHHS implements Final Rule

2005 Implementation of the LAS

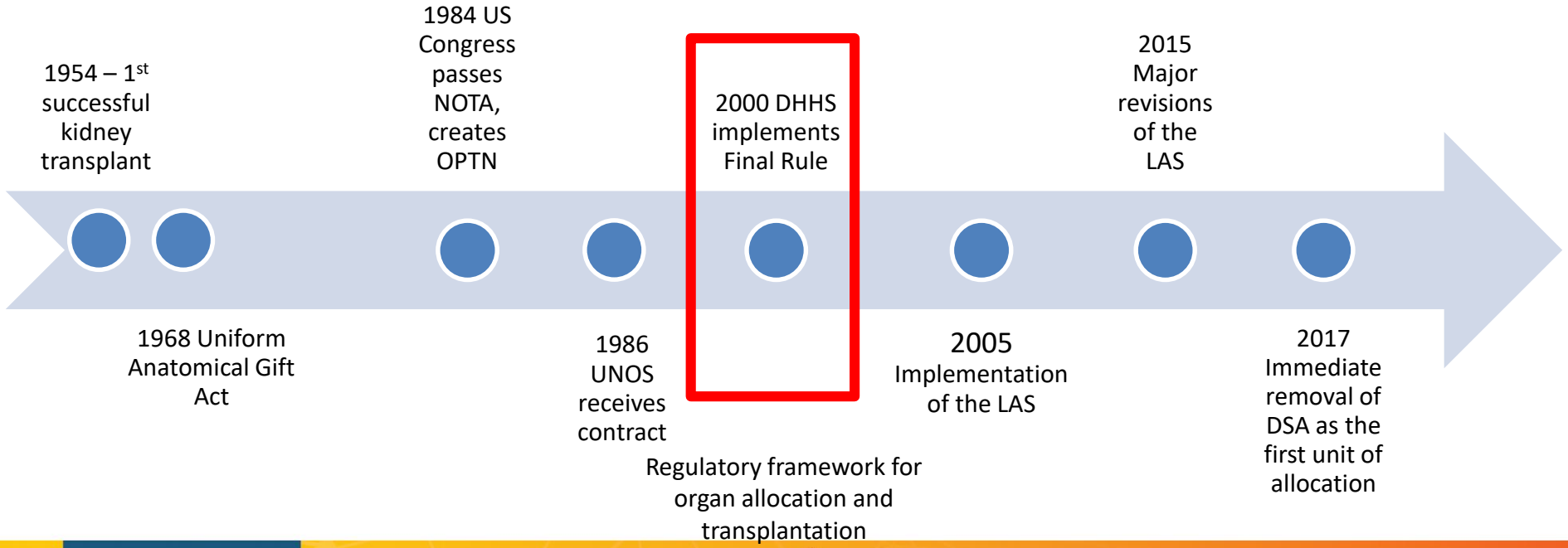
2015 Major revisions of the LAS

2017 Immediate removal of DSA as the first unit of allocation

Timeline of Organ Allocation in the US



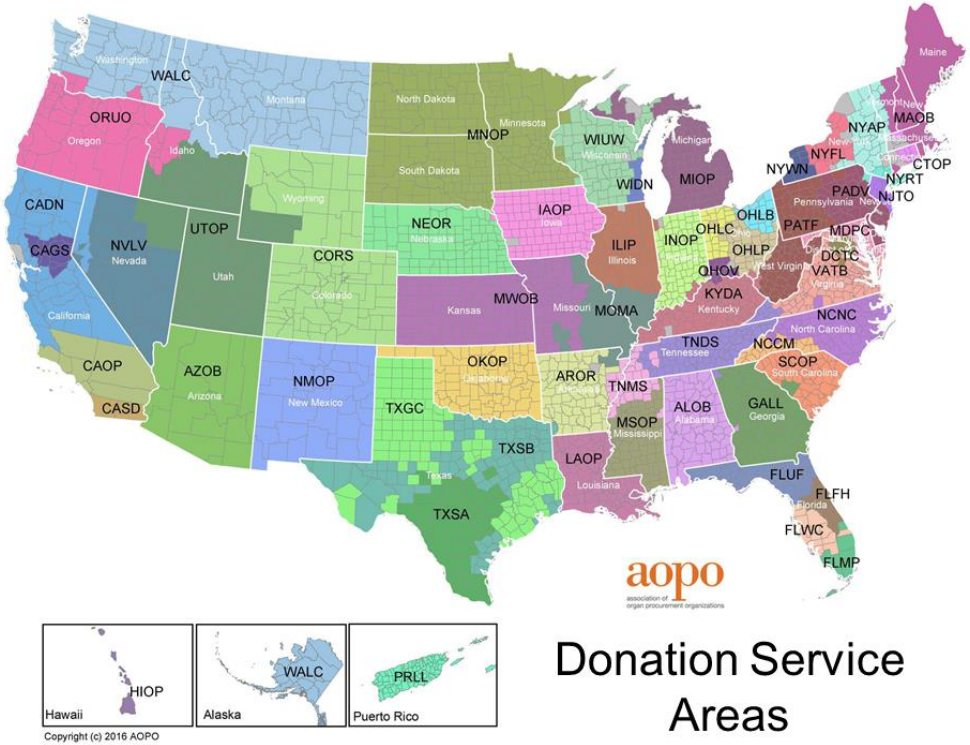
Timeline of Organ Allocation in the US



OPTN Final Rule

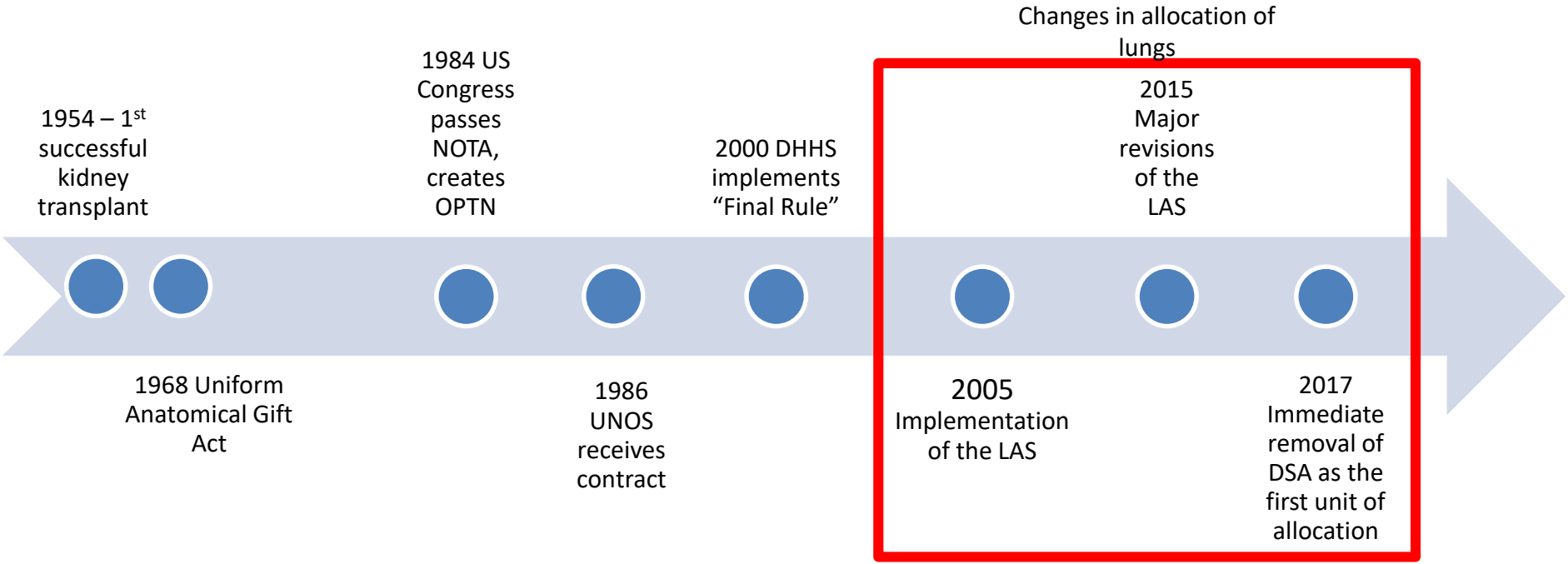
- The Final Rule was implemented to develop organ allocation policies with an emphasis on limiting the impact of geography and waiting time, and prioritizing medical urgency:
  - (1) Shall be based on sound medical judgment;
  - (2) Shall seek to achieve the best use of donated organs;
  - (3) Shall preserve the ability of a transplant program to decline an offer of an organ or not to use the organ for the potential recipient;
  - (4) Shall be specific for each organ type or combination of organ types to be transplanted into a transplant candidate;
  - (5) Shall be designed to avoid wasting organs, to avoid futile transplants, to promote patient access to transplantation, and to promote the efficient management of organ placement;
  - (6) Shall be reviewed periodically and revised as appropriate;
  - (7) Shall include appropriate procedures to promote and review compliance including, to the extent appropriate, prospective and retrospective reviews of each transplant program's application of the policies to patients listed or proposed to be listed at the program; and
  - (8) Shall not be based on the candidate's place of residence or place of listing

Donation Service Areas (DSAs)



Donation Service Areas

Timeline of Organ Allocation in the US



History of Lung Allocation in the US

- In 1998, in response to the Final Rule, a committee was formed to review lung allocation with the emphasis on prioritizing by medical urgency
- May 4th, 2005 – implementation of lung allocation via the Lung Allocation Score "LAS"

10.1.F The LAS Calculation

The LAS calculation uses *all* of the following measures:

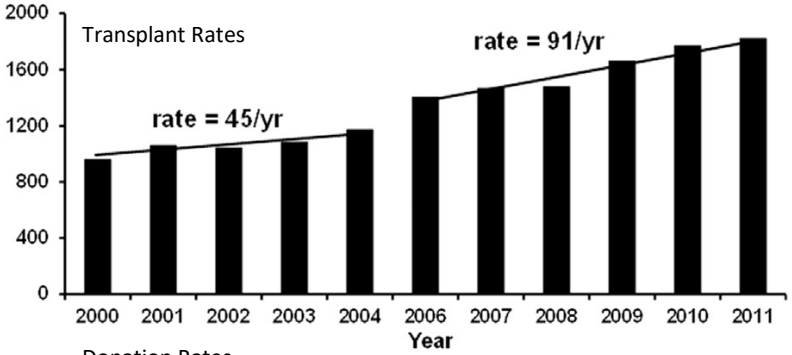
- Waiting List Urgency Measure, which is the expected number of days a candidate will live without a transplant during an additional year on the waiting list.
- Post-transplant Survival Measure, which is the expected number of days a candidate will live during the first year post-transplant.
- Transplant Benefit Measure, which is the difference between the Post-transplant Survival Measure and the Waiting List Urgency Measure.
- Raw Allocation Score, which is the difference between Transplant Benefit Measure and Waiting List Urgency Measure.

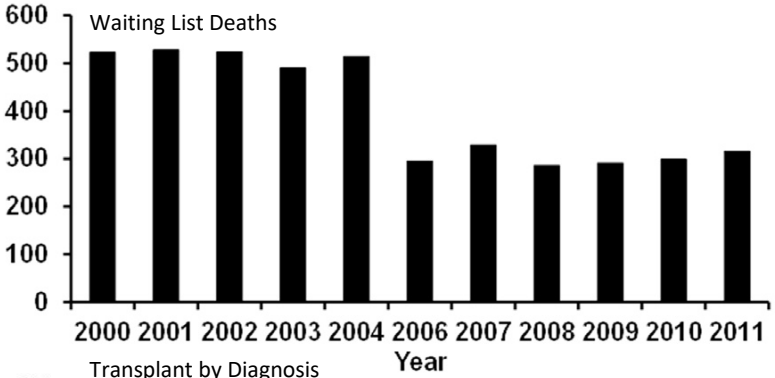
To determine a candidate's LAS, the Raw Allocation Score is normalized to a continuous scale of zero to 100.

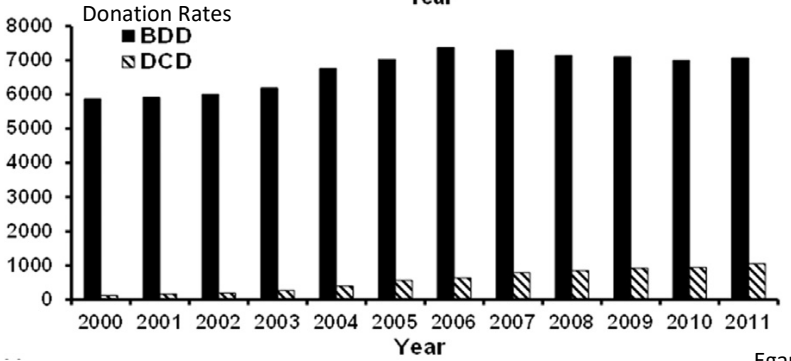
The equation for the LAS calculation is:

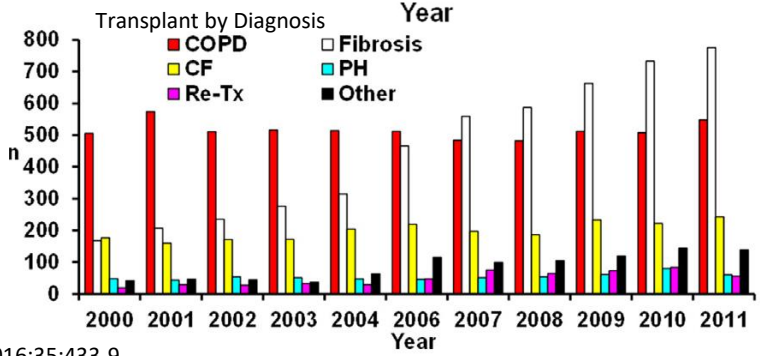
$$LAS = \frac{100 * [PTAUC - 2 * WLAUC + 730]}{1095}$$

Lung Allocation in the US: Impact of LAS





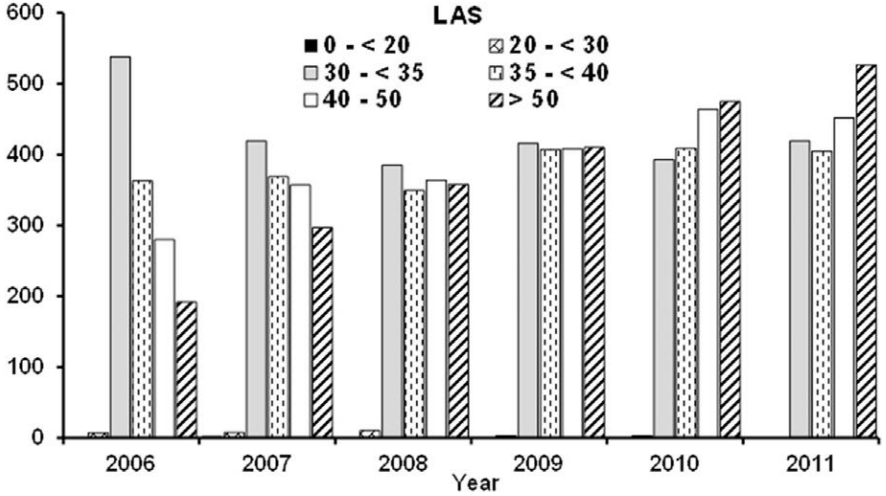




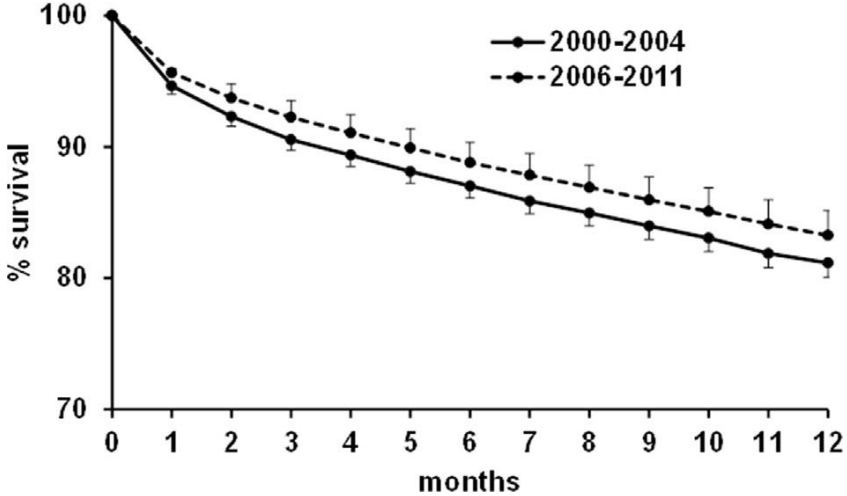
Egan et al. JHLT 2016:35;433-9

Lung Allocation in the US: Impact of LAS

LAS at Transplant



1-year Survival



Egan et al. JHLT 2016:35;433-9

Lung Allocation in the US: Removal of DSA

- In November 2017, a lawsuit was filed by a patient against the OPTN/DHHS arguing geographic boundaries were arbitrary
- UNOS agreed that allocation by DSA was inconsistent with the Final Rule, thus proposed an initial unit of allocation as 250nm
- Allocation change went into effect on Saturday, November 24th, 2017

Future of Lung Allocation in the US

- An ad-hoc Geography Committee was formed to determine potential geographic frameworks for all organ allocation

Future of Lung Allocation in the US

Medical priority + Geographic feasibility = Allocation priority

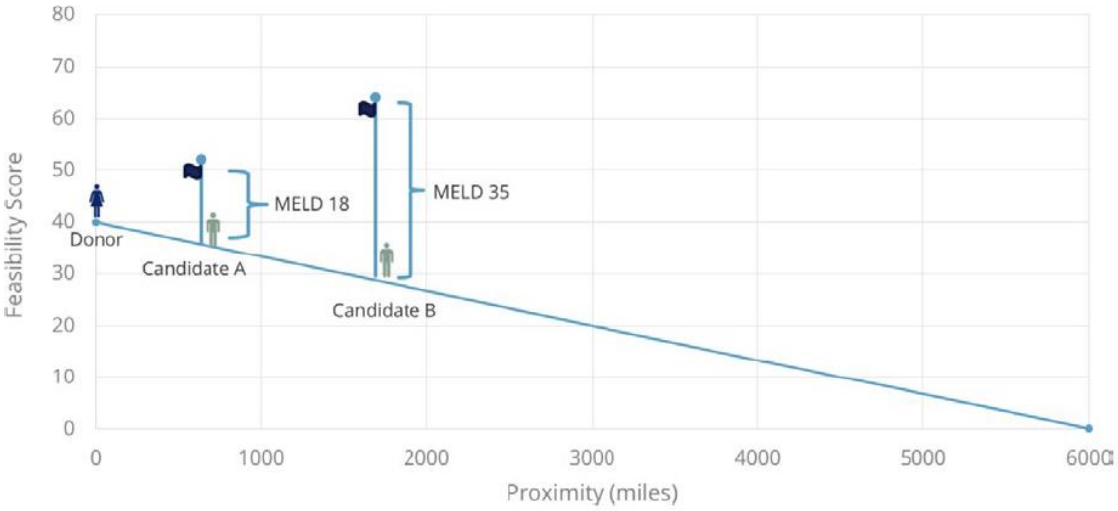
PERSONAL VIEWPOINT

AJT

Organ distribution without geographic boundaries: A possible framework for organ allocation

Jon J. Snyder[1,2] | Nicholas Salkowski[1] | Andrew Wey[1] | Joshua Pyke[1] | Ajay K. Israni[1,2,3,4] | Bertram L. Kasiske[1,2,3,4]

Am J Transplant. 2018;18:2635–2640.

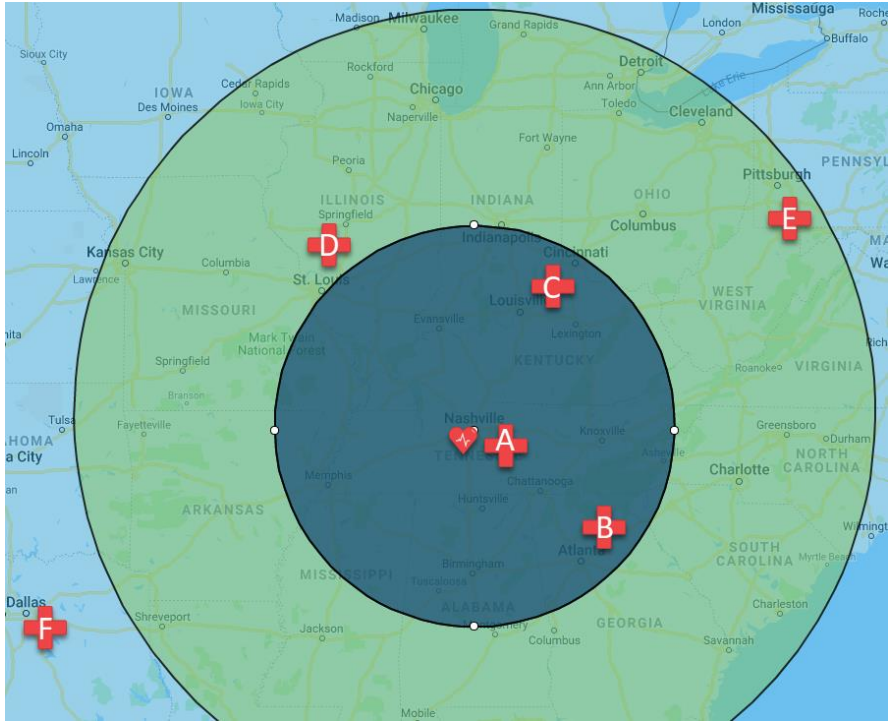


Continuous Distribution of Lungs

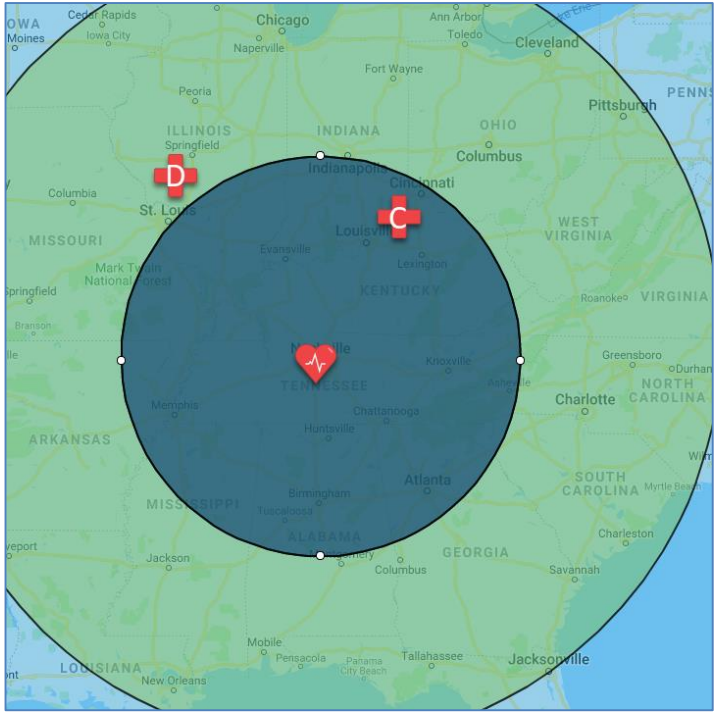
The current system has hard boundaries that create inequities. Examples:

- ABO compatibility
- Age groups
- Geography

Concept is to change from a **classification-based system** to a **points-based system**.

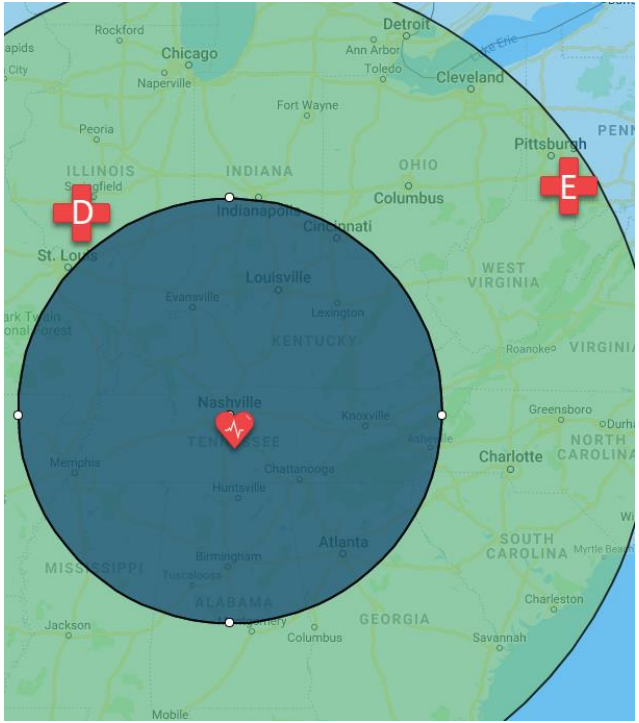


Continuous Distribution of Lungs



LAS Scenario	Candidate	
Attribute	**C**	**D**
Medical Priority	LAS 38.03	LAS 90
Ischemic Time	2-hours	2-hours

Continuous Distribution of Lungs

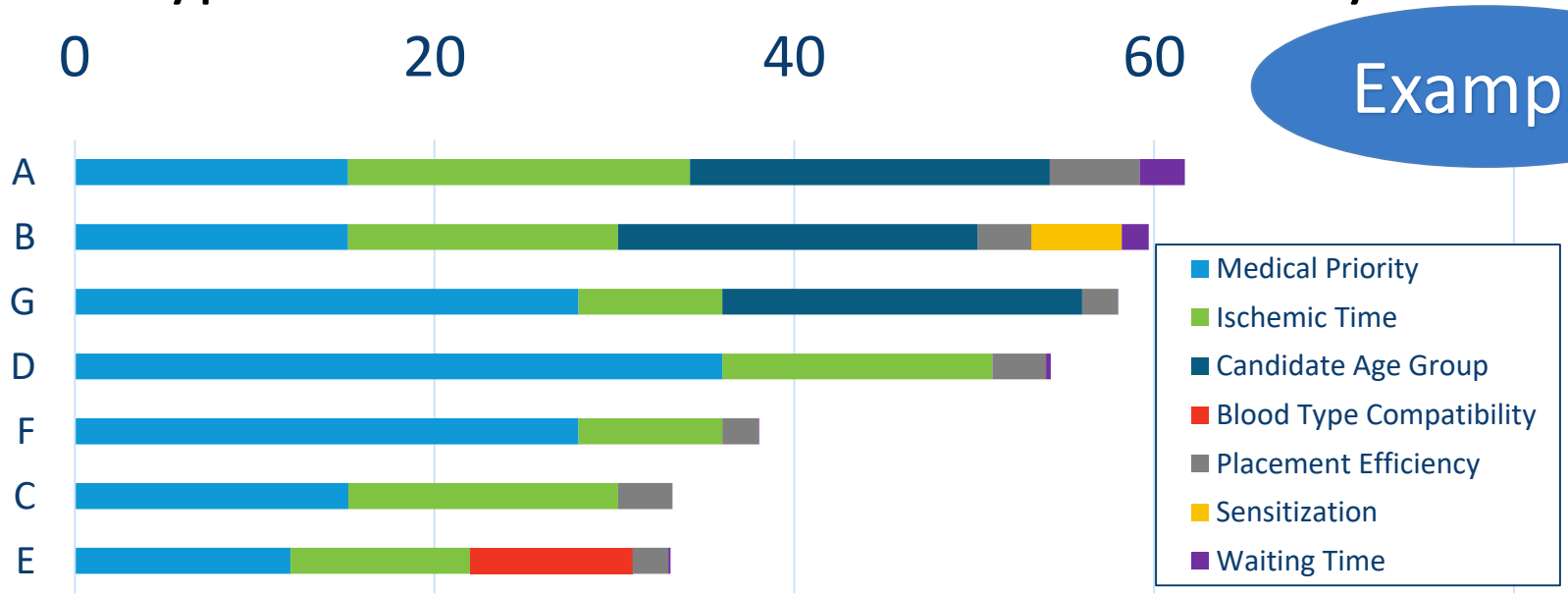


Blood type Scenario	Candidate	
Attribute	**D**	**E**
Medical Priority	LAS 90	LAS 30
Blood Type	✔ Compatible	★ Identical
Ischemic Time	2-hours	2.5-hours

	Candidate					
Attribute	**A**	**B**	**C**	**D**	**E**	**F**
Medical Priority	🚑 LAS 38.01	🚑 LAS 38.02	🚑 LAS 38.03	🚑 LAS 90	🚑 LAS 30	🚑 LAS 70
Placement Efficiency	High efficiency	Medium efficiency	Medium efficiency	Medium efficiency	Low efficiency	Low efficiency
Ischemic Time	🕒 30 minutes	🕐 2 hours	🕐 2 hours	🕐 2 hours	🕐 2.5 hours	🕐 3 hours
Blood Type	✔ Compatible	✔ Compatible	✔ Compatible	✔ Compatible	★ Identical	✔ Compatible
Waiting Time	📅 5-years	📅 3-years	📅 1-day	📅 6-months	📅 3-months	📅 1-month
Highly Sensitized	🌡 No	🌡 Yes	🌡 No	🌡 No	🌡 No	🌡 No
Candidate Age Group	Pediatric	Pediatric	Adult	Adult	Adult	Adult

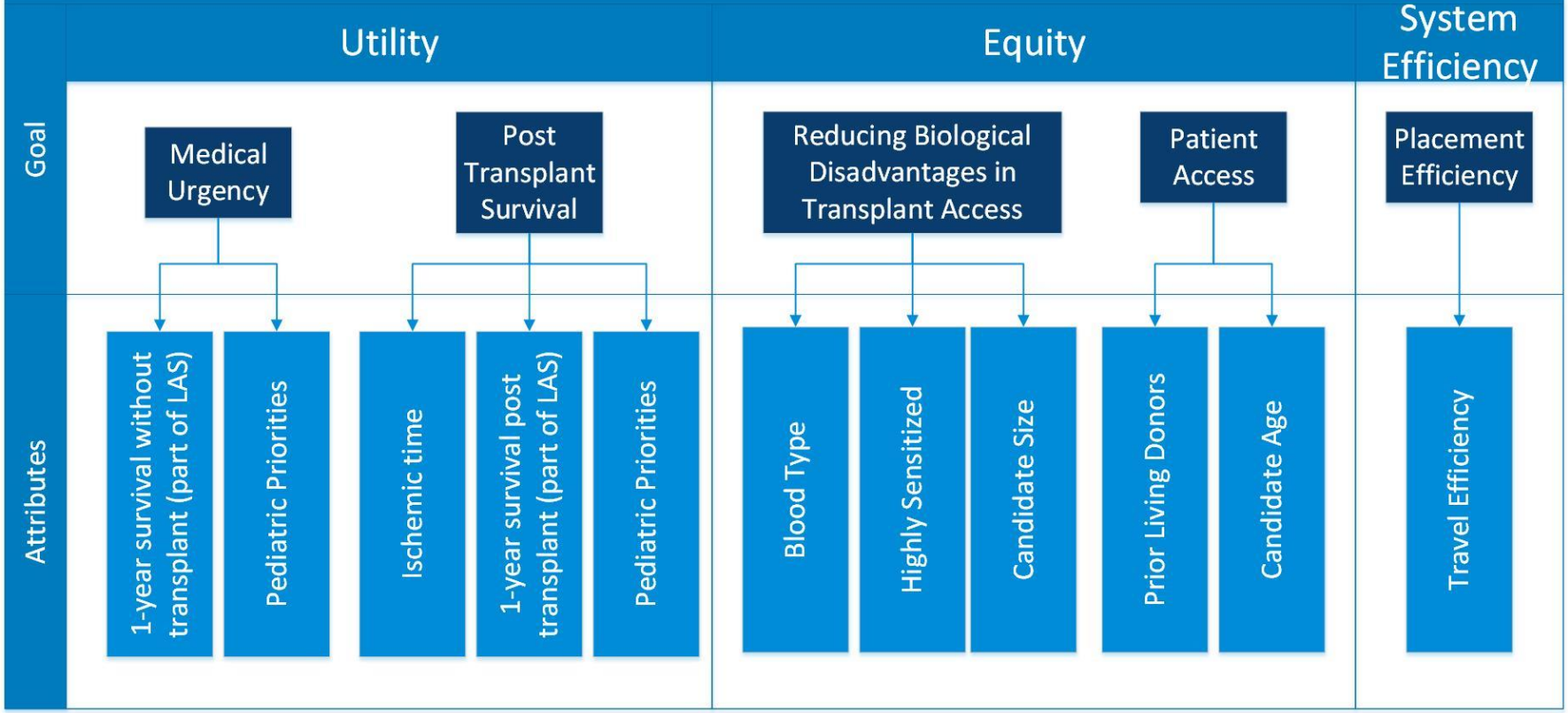
Continuous Distribution of Lungs

Hypothetical Match Run – Points-Based System



Example

Allocation of Deceased Donor Lungs

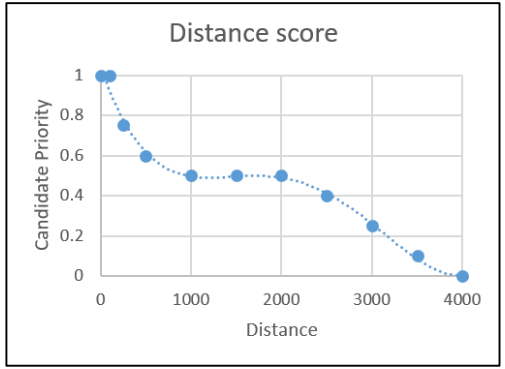


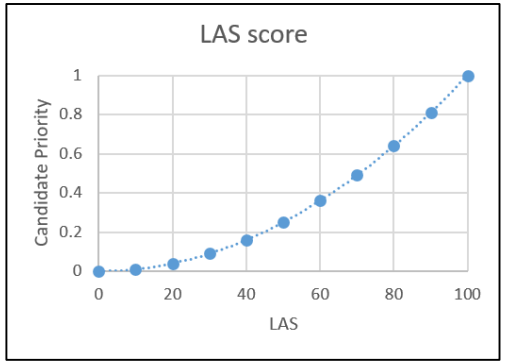
Continuous Distribution of Lungs

Weighing Attributes

- **Clinically Weighted:**
  - Medical Urgency: LAS, Pediatric Priority
  - Post Transplant Survival: Ischemic Time, LAS, Pediatric Priority
  - Reducing Biological Disadvantages: ABO, Sensitization, Height
- **Values Laden:**
  - Medical Urgency
  - Post Transplant Survival
  - Reducing Biological Disadvantages
  - Prior Living Donors
  - Candidate Age
  - Placement Efficiency

Continuous Distribution of Lungs





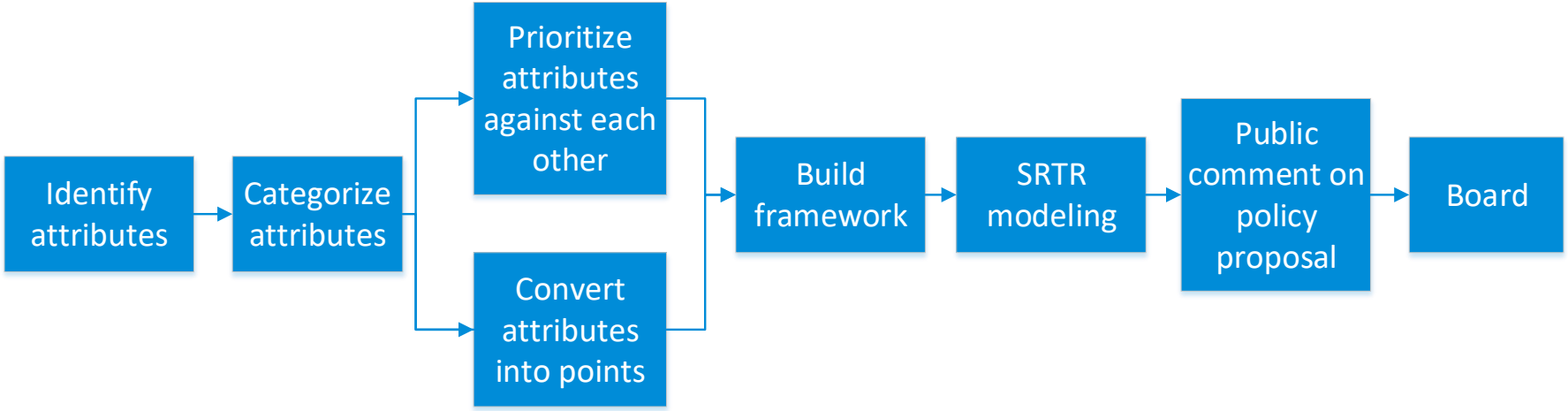
Hypothetical Lung Distribution

Attribute Weighting	
Attribute	**Weight**
LAS	65%
Distance	35%
Total	**100%**

LAS											
0	0.35	0.35	0.26	0.21	0.18	0.18	0.18	0.14	0.09	0.04	0.00
10	0.36	0.36	0.27	0.22	0.18	0.18	0.18	0.15	0.09	0.04	0.01
20	0.38	0.38	0.29	0.24	0.20	0.20	0.20	0.17	0.11	0.06	0.03
30	0.41	0.41	0.32	0.27	0.23	0.23	0.23	0.20	0.15	0.09	0.06
40	0.45	0.45	0.37	0.31	0.28	0.28	0.28	0.24	0.19	0.14	0.10
50	0.51	0.51	0.43	0.37	0.34	0.34	0.34	0.30	0.25	0.20	0.16
60	0.58	0.58	0.50	0.44	0.41	0.41	0.41	0.37	0.32	0.27	0.23
70	0.67	0.67	0.58	0.53	0.49	0.49	0.49	0.46	0.41	0.35	0.32
80	0.77	0.77	0.68	0.63	0.59	0.59	0.59	0.56	0.50	0.45	0.42
90	0.88	0.88	0.79	0.74	0.70	0.70	0.70	0.67	0.61	0.56	0.53
100	1.00	1.00	0.91	0.86	0.83	0.83	0.83	0.79	0.74	0.69	0.65
Distance	0	100	250	500	1000	1500	2000	2500	3000	3500	4000

Continuous Distribution of Lungs

The Path Forward



Continuous Distribution of Lungs

The Path Forward

- Most importantly, the goal is to create an allocation system that:
  - Fulfills the requirements of the Final Rule
  - Reflects the values and priorities of the community
  - Is flexible for changes in the future

Conclusions

- Currently there are “hard boundaries” in multiple aspects of lung allocation that create inequities in access
- A continuous distribution framework attempts to smooth these hard boundaries while still maintaining efficiency in the lung allocation system
- A composite allocation score allows the system to consider multiple factors in lung allocation and is flexible for changes in the future

Thank you!