

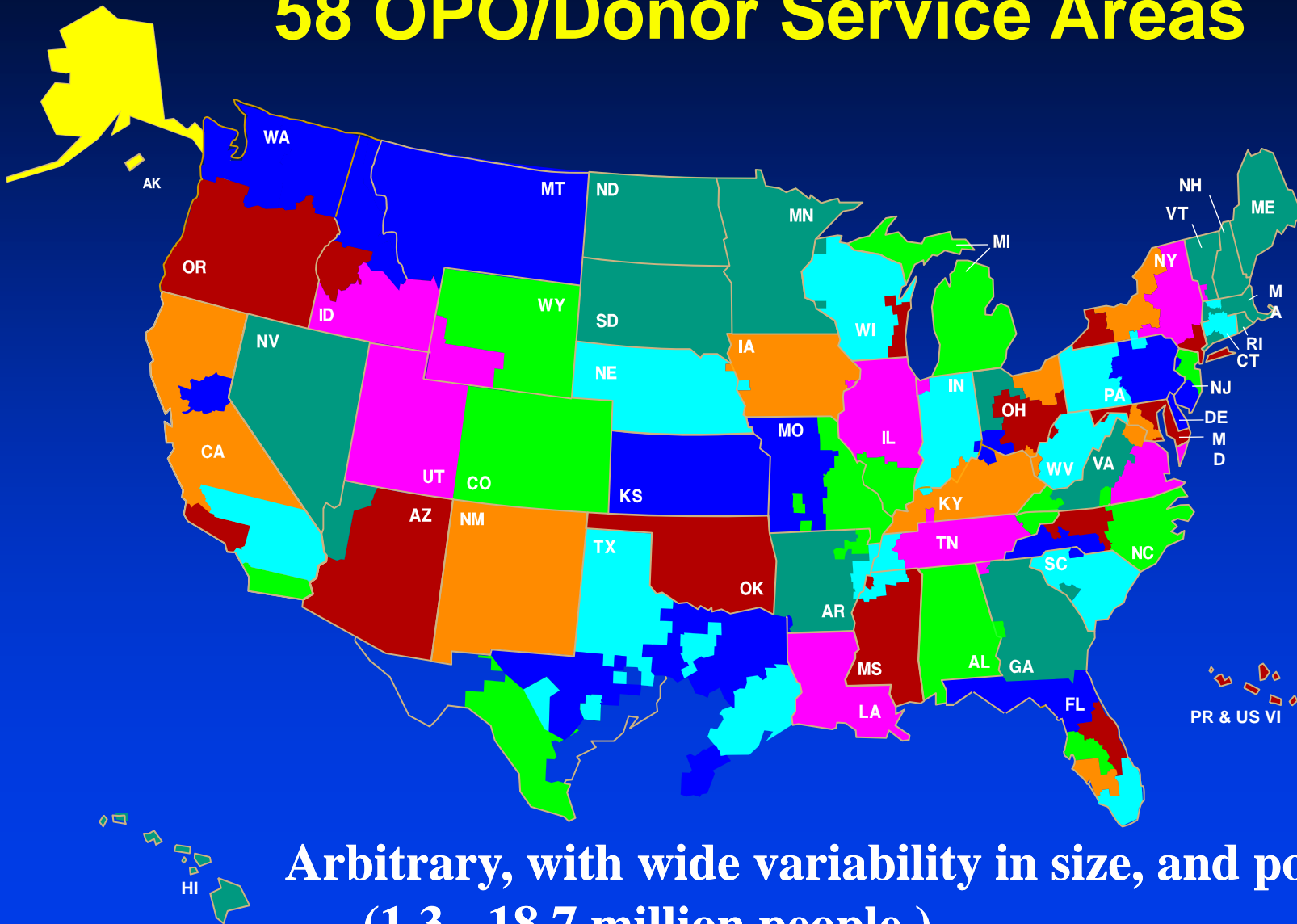
# **Concentric Circle Liver Distribution Models**

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**UNOS Liver Committee**

# Current Distribution Unit

## 58 OPO/Donor Service Areas



Arbitrary, with wide variability in size, and population  
(1.3 - 18.7 million people.)

# Background

- During last year's public comment period for broader sharing, multiple regions/individual public comments suggested looking instead at **concentric circle model**.
- This has been the long-standing model used in thoracic transplantation, modified in 2006 for hearts.

# HEART ALLOCATION STATUSES

Status	Adult candidates	Pediatric candidates
1A	<ul style="list-style-type: none"> <li>a) Mechanical circulatory support (MCS): VAD/30 days; TAH; IABP; ECMO;</li> <li>b) MCS with complications;</li> <li>c) Mechanical ventilation</li> <li>d) Continuous single high-dose or multiple IV inotropes with continuous hemodynamic monitoring</li> </ul>	<ul style="list-style-type: none"> <li>a) Ventilator;</li> <li>b) Mechanical assist device;</li> <li>c) Balloon pump;</li> <li>d) &lt;6 months with reactive pulmonary hypertension &gt;50% of systemic level;</li> <li>e) Single high-dose or multiple inotropes</li> </ul>
1B	<ul style="list-style-type: none"> <li>a) MCS beyond 30 days;</li> <li>b) Continuous IV inotropes</li> </ul>	<ul style="list-style-type: none"> <li>a) Single low-dose inotrope;</li> <li>b) &lt;6 months old;</li> <li>c) Growth failure</li> </ul>
2	All other active candidates	All other active candidates

# HEART DISTRIBUTION UNITS



# ALLOCATION ORDERING: Adult donors

- Local Status 1A
- Local Status 1B
- **Zone A Status 1A**
- **Zone A Status 1B**
- Local Status 2
- ~~Zone A Status 1A~~
- ~~Zone A Status 1B~~
- Zone B Status 1A
- Zone B Status 1B
- Zone A Status 2
- Zone B Status 2
- Zone C Status 1A
- Zone C Status 1B
- Zone C Status 2
- Zone D Status 1A
- Zone D Status 1B
- Zone D Status 2
- Zone E Status 1A
- Zone E Status 1B
- Zone E Status 2

# FOR DEATHS PER 100 PATIENT-YEARS ON THE WAITING LIST: Adult Candidates

Status*	Waiting era: 7/12/04-7/11/06				Waiting era: 7/12/06-7/11/08			
	# patients ever waiting	# of deaths**	Patient years (PY) at risk	Deaths/100 PY	# patients ever waiting	# of deaths**	Patient years (PY) at risk	Deaths/100 PY
STATUS 1A	2267	233	201.6	115.6	2713	205	270.5	75.8
STATUS 1B	3254	288	827.2	34.8	3748	217	857.5	25.3
STATUS 2	4936	268	4421.2	6.1	4359	222	3605.3	6.2
<b>ALL COMBINED</b>	<b>7730</b>	<b>811</b>	<b>5549.5</b>	<b>14.6</b>	<b>7621</b>	<b>664</b>	<b>4811.9</b>	<b>13.8</b>

\* Inactive (status 7) is combined with the previous active status

\*\* Deaths include those reported to the OPTN or to SSDMF while on waiting list or within 7 days of non-transplant removal.

# NUMBER OF HEART TRANSPLANTS PERFORMED

Transplant Era	Age group		<b><i>TOTAL</i></b>
	Adult	Pediatric	
Pre-policy: 7/12/05-7/11/06	1902	324	<b><i>2226</i></b>
Post-policy year 1: 7/12/06-7/11/07	1887	322	<b><i>2209</i></b>
Post-policy year 2: 7/12/07-7/11/08	1820	331	<b><i>2151</i></b>

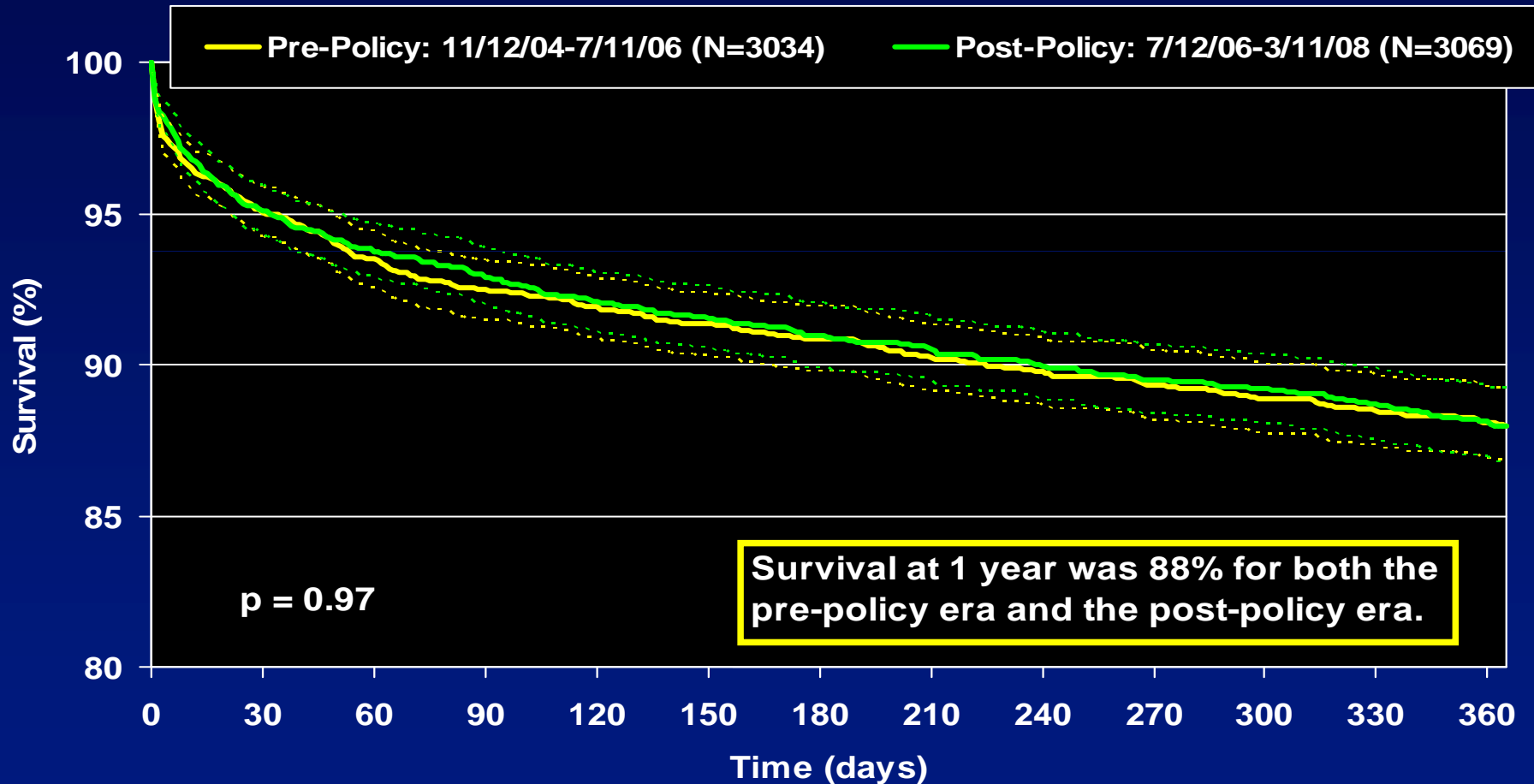


# ISCHEMIA TIME BY ERA FOR ADULT RECIPIENTS

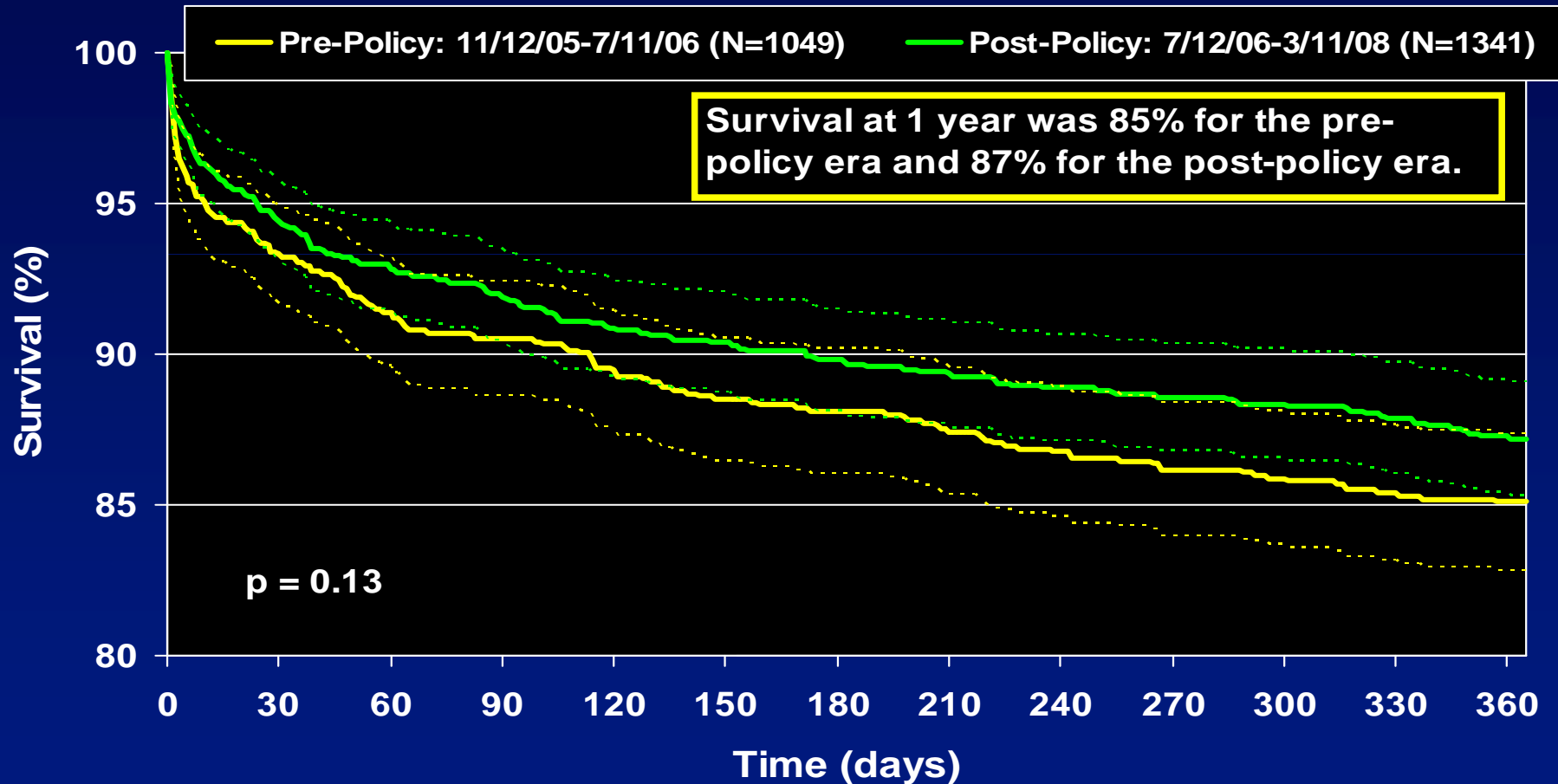
Era	Number TXed	N with ischemia time	Median (minutes)	5 <sup>th</sup> and 95 <sup>th</sup> %-iles
Pre-policy: 7/12/05-7/11/06	1902	1786	192	94, 293
Post-policy year 1: 7/12/06-7/11/07	1887	1775	201	98, 302
Post-policy year 2: 7/12/07-7/11/08	1820	1755	199	100, 300
Post-policy partial year 3: 7/12/08-3/11/09	1154	1076	197	97, 308

# SURVIVAL WITHIN 1 YEAR:

Adult recipients: All statuses combined



# SURVIVAL WITHIN 1 YEAR: Adult recipients: Status 1A at transplant



# CONCLUSIONS

- **The policy modification appears to be meeting its goals:**
  - **Waiting list mortality has declined for adult candidates.**
  - **A larger percentage of transplants are being performed in urgent candidates.**
  - **Post-transplant survival has not been adversely affected.**

# Liver Concentric Circle Model:

- Using LSAM, the SRTR modeled a system using concentric circles for distribution units for **all** adult and pediatric donors.
- Additional runs were performed with sharing only for MELD > upper thresholds of 35, 32, 29, 25, and 22.

# Methods

- **Study Population**
  - Data from listed candidates and available donor organs from **1/1/2006 to 12/31/2006** were included
  - Analytical Approach
  - LSAM was used to compare concentric circles for sharing above various MELD/PELD thresholds versus current. Results= average of 10 separate runs.
- **Endpoints:**
  - deaths (pre and post)
  - median distance traveled



1 nm=1.15 mi

○ = 250 nm



1 nm=1.15 mi

○ = 500 nm



# Concentric Circles for Adult Deceased Donor Livers—

## Current System

**Regional – Status 1A/1B**

**Local – MELD/PELD  $\geq$  15**

**Regional – MELD/PELD  $\geq$  15**

**Local – MELD/PELD  $<$  15**

**Regional – MELD/PELD  $<$  15**

**National – Status 1A**

**National – Status 1B**

**National – MELD/PELD**

# **Concentric Circles for Adult Deceased Donor Livers— *February 2010***

**Concentric 250: 35 (29, 25, 22)**

**0-250 NM – Status 1A then 1B**

**0-250 NM – MELD/PELD  $\geq$  35 (29, 25, 22)**

**250-500 NM – Status 1A then 1B**

**0-250 NM – MELD/PELD 15-34 (29, 25, 22)**

**250-500 NM – MELD/PELD  $\geq$  35 (29, 25, 22)**

**0-250 NM – MELD/PELD  $<$  15**

**500-1,000 NM – Status 1A then 1B**

**250-500 NM – MELD/PELD 15-34 (29, 25, 22)**

**500-1,000 NM – MELD/PELD  $\geq$  35 (29, 25, 22)**

**250-500 NM – MELD/PELD  $<$  15**

**1,000+ NM – Status 1A/1B**

**500-1,000 NM – MELD/PELD  $<$  35 (29, 25, 22)**

**1,000+ NM – MELD/PELD**

## Concentric Circles: *March 2010*

Con250 15-35 (32, 29, 25, 22)

0-250 NM Status 1A

250-500 NM Status 1A

0-250 NM Status 1B

250-500 NM Status 1B

0-250 NM MELD/PELD  $\geq 35$  (32, 29, 25, 22)

250-500 NM MELD/PELD  $\geq 35$  (32, 29, 25, 22)

0-250 NM MELD/PELD 15-34 (31, 28, 24, 21)

250-500 NM MELD/PELD 15-34 (31, 28, 24, 21)

500-1000 NM Status 1A

500-1000 NM Status 1B

500-1000 NM MELD/PELD  $\geq 15$

1000+ NM Status 1A

1000+ NM Status 1B

1000+ NM MELD/PELD  $\geq 15$

0-250 NM MELD/PELD  $< 15$

250-500 NM MELD/PELD  $< 15$

500-1000 NM MELD/PELD  $< 15$

1000+ NM MELD/PELD  $< 15$

# Concentric Circles for Adult DD Livers: *March*

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March Con250 15-35 (32, 29, 25, 22)

Status 1A, then 1B  
MELD/PELD  $\geq 35$  (29, 25, 22)  
– Status 1A, then 1B  
MELD/PELD 15-34 (29, 25, 22)  
– MELD/PELD  $\geq 35$  (29, 25, 22)  
MELD/PELD  $< 15$   
M – Status 1A  
M – Status 1B  
– MELD/PELD 15-34 (29, 25, 22)  
M – MELD/PELD  $\geq 35$  (29, 25, 22)  
– MELD/PELD  $< 15$   
– Status 1A  
– Status 1B  
M – MELD/PELD  $< 35$  (29, 25, 22)  
– MELD/PELD

0-250 NM Status 1A  
250-500 NM Status 1A  
0-250 NM Status 1B  
250-500 NM Status 1B  
0-250 NM MELD/PELD  $\geq 35$  (32, 29, 25, 22)  
250-500 NM MELD/PELD  $\geq 35$  (32, 29, 25, 22)  
0-250 NM MELD/PELD 15-34 (31, 28, 24, 21)  
250-500 NM MELD/PELD 15-34 (31, 28, 24, 21)  
500-1000 NM Status 1A  
500-1000 NM Status 1B  
500-1000 NM MELD/PELD  $\geq 15$   
1000+ NM Status 1A  
1000+ NM Status 1B  
1000+ NM MELD/PELD  $\geq 15$   
0-250 NM MELD/PELD  $< 15$   
250-500 NM MELD/PELD  $< 15$   
500-1000 NM MELD/PELD  $< 15$   
1000+ NM MELD/PELD  $< 15$

## Key differences Feb. to March:

Feb:

**small circle** for 1A, then 1B, then for MELD > 35 (*or other*).

**big circle** for 1A, then 1B.

back to the **small circle** for 15-35, then **big circle** >35(*other*), then to **small circle** for MELD <15.

March:

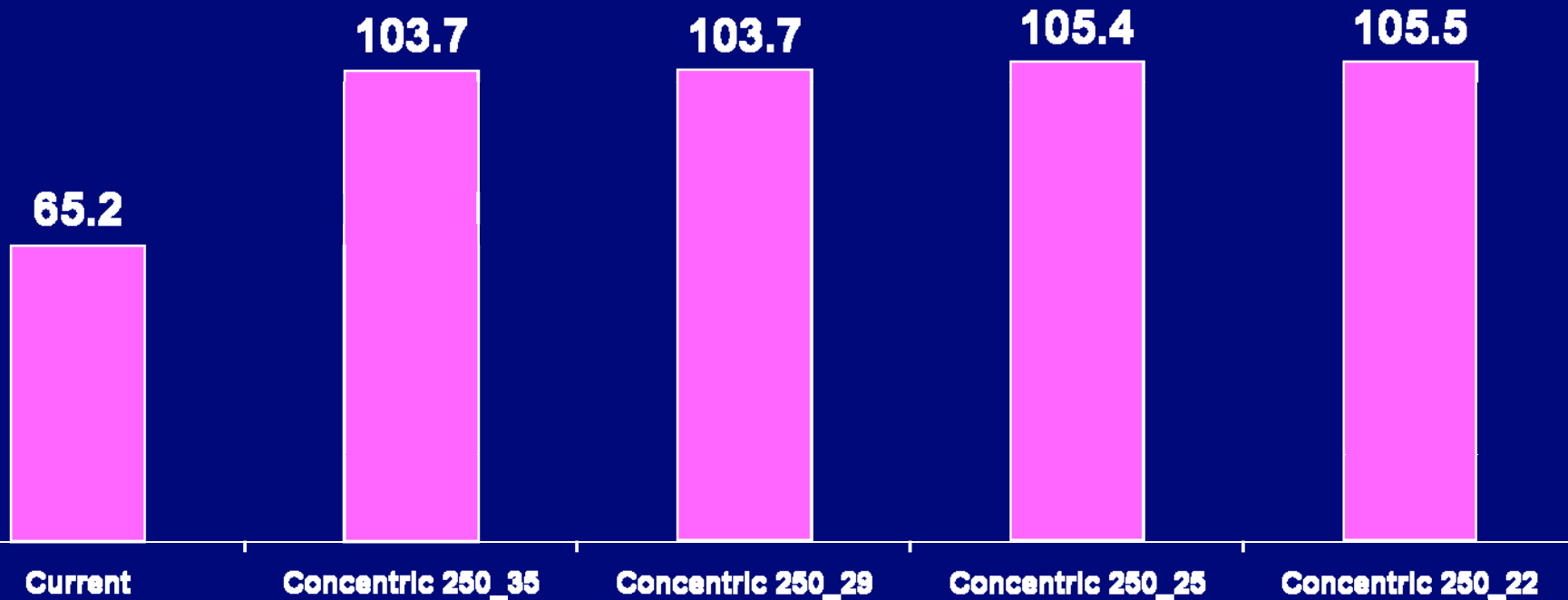
small circle 1A, **then big circle for 1A.**

small circle 1B, then big circle for 1B.

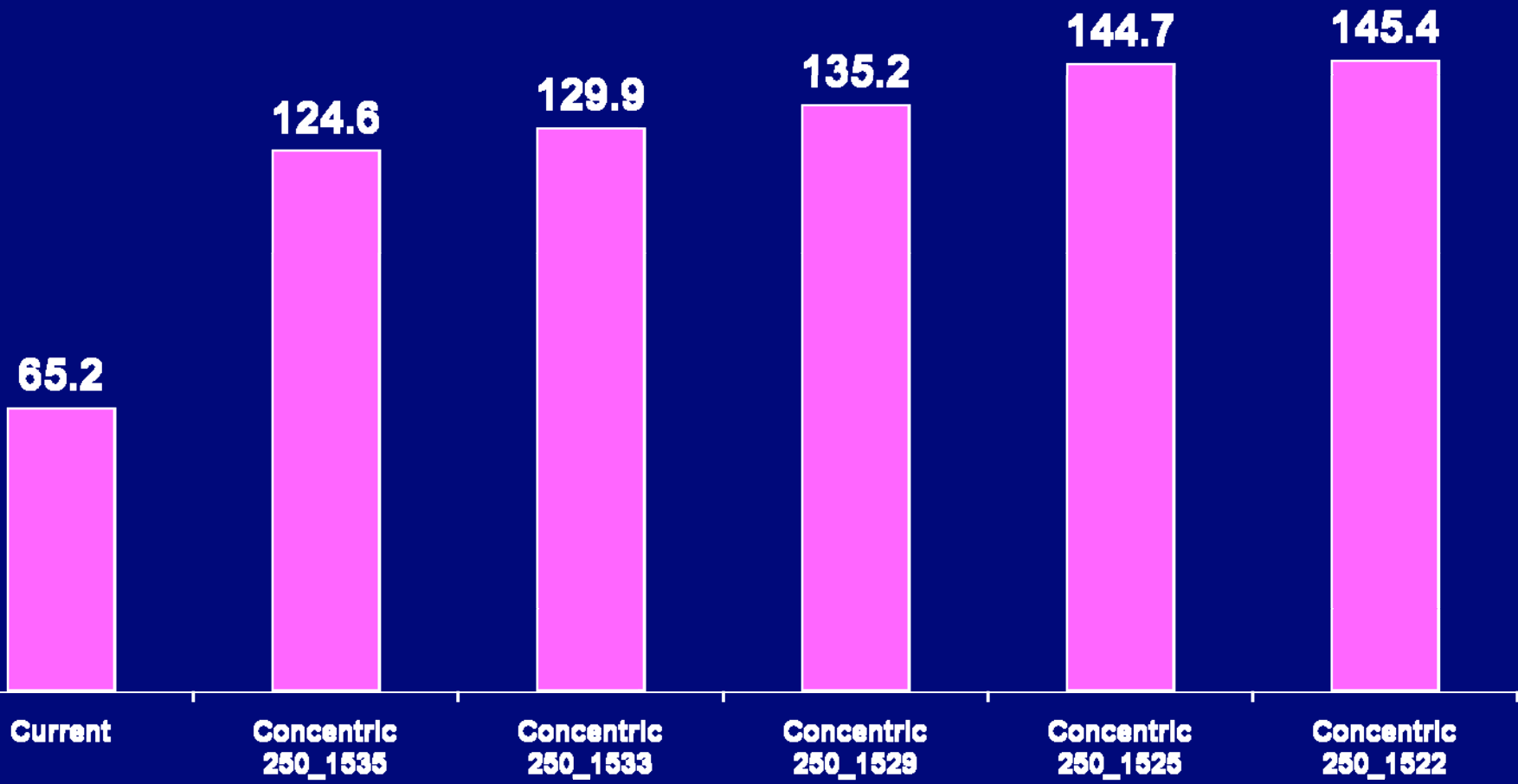
small circle >35 (*or other lower*), **big circle >35**

0-250 for 15-35, then 250-500 15-35, **then national before 0-150 for MELD <15.**

# Median Distance Between Donor Hospital and Transplant Center: *February*

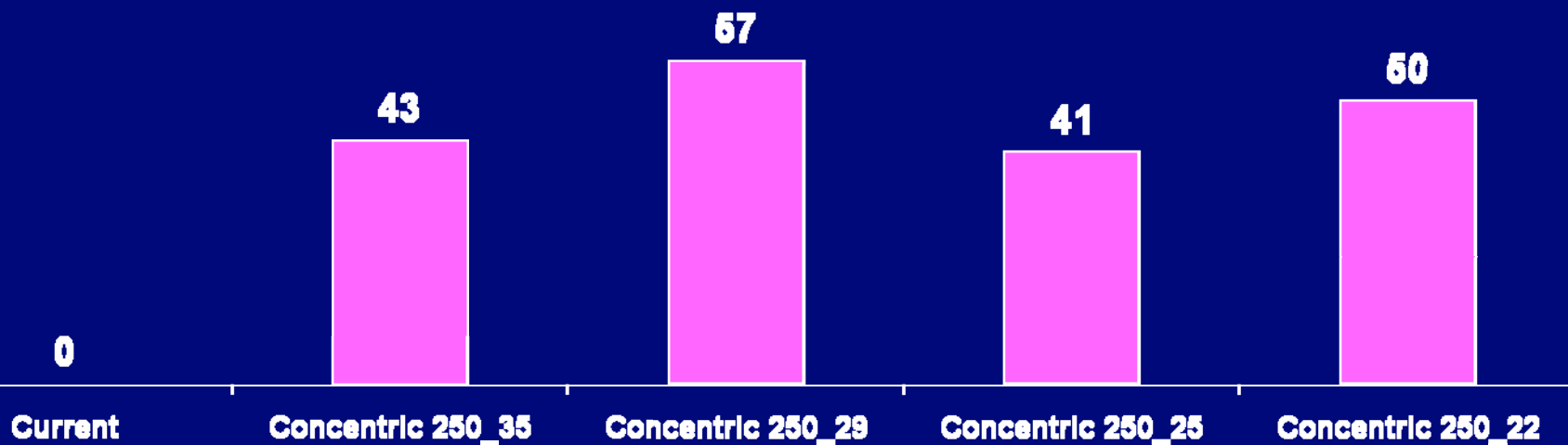


# Median Distance Between Donor Hospital and Transplant Center: *March*



*total increase 60-80 mi*

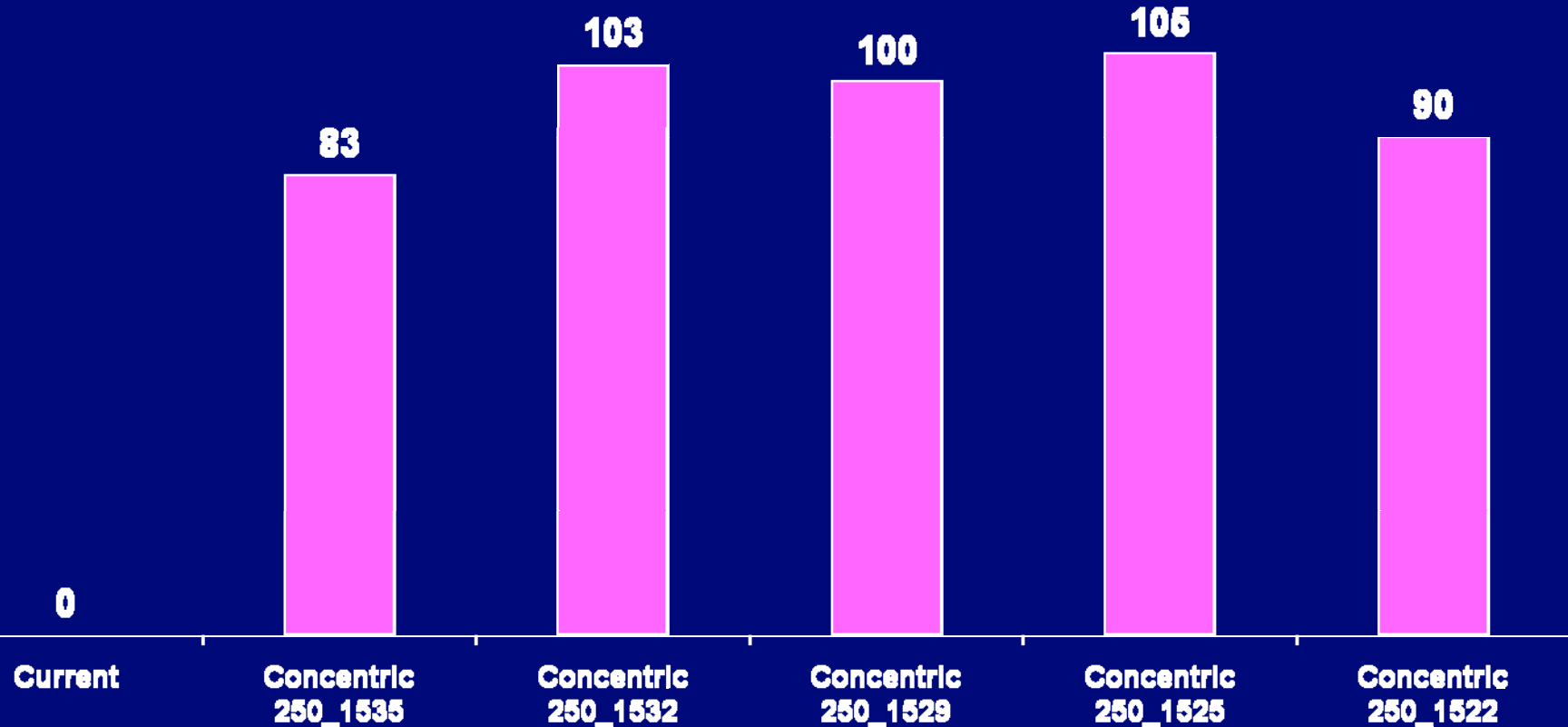
# Increase in Total Deaths (vs. Current) - *February*



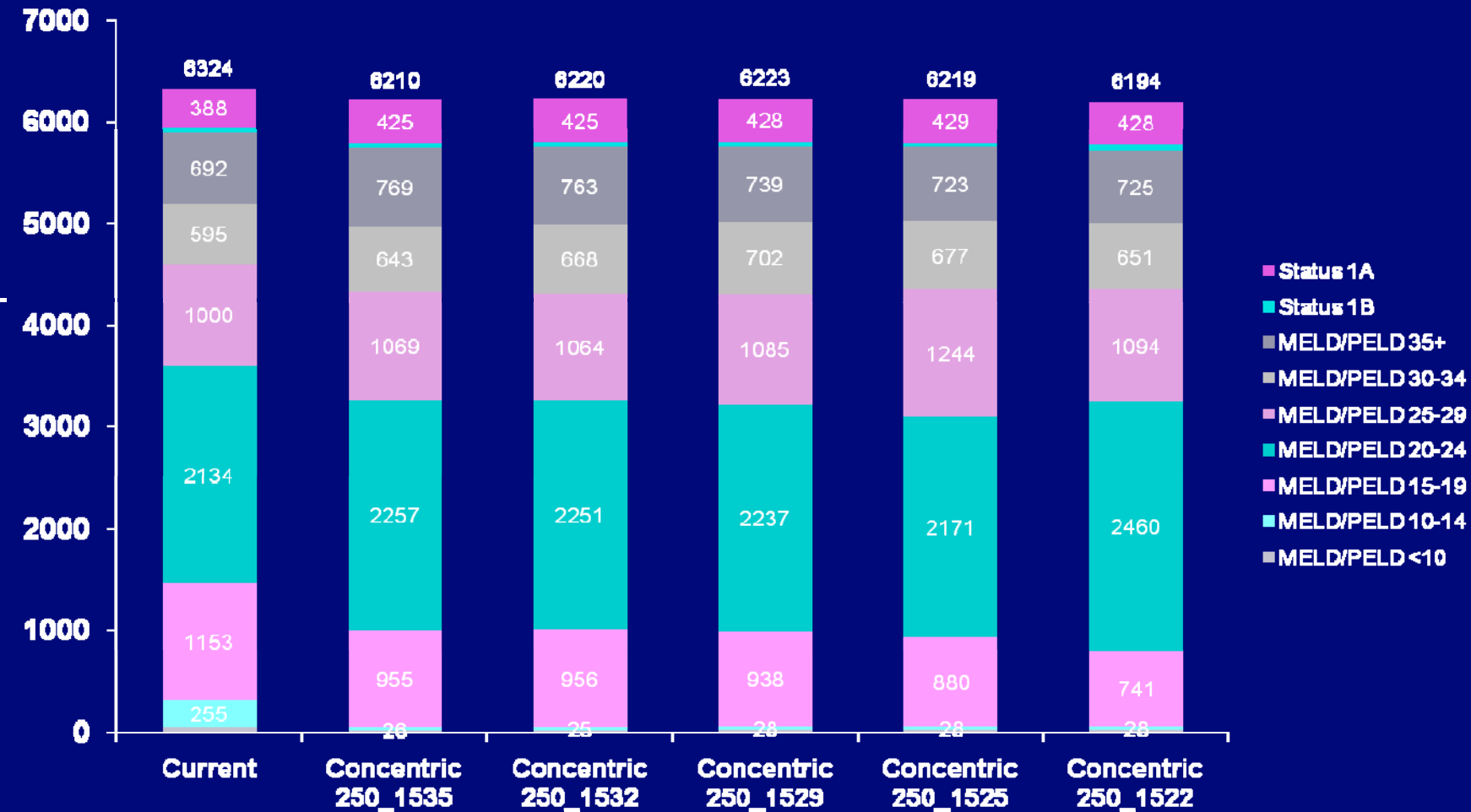


# Decrease in Total Deaths (vs. Current)-

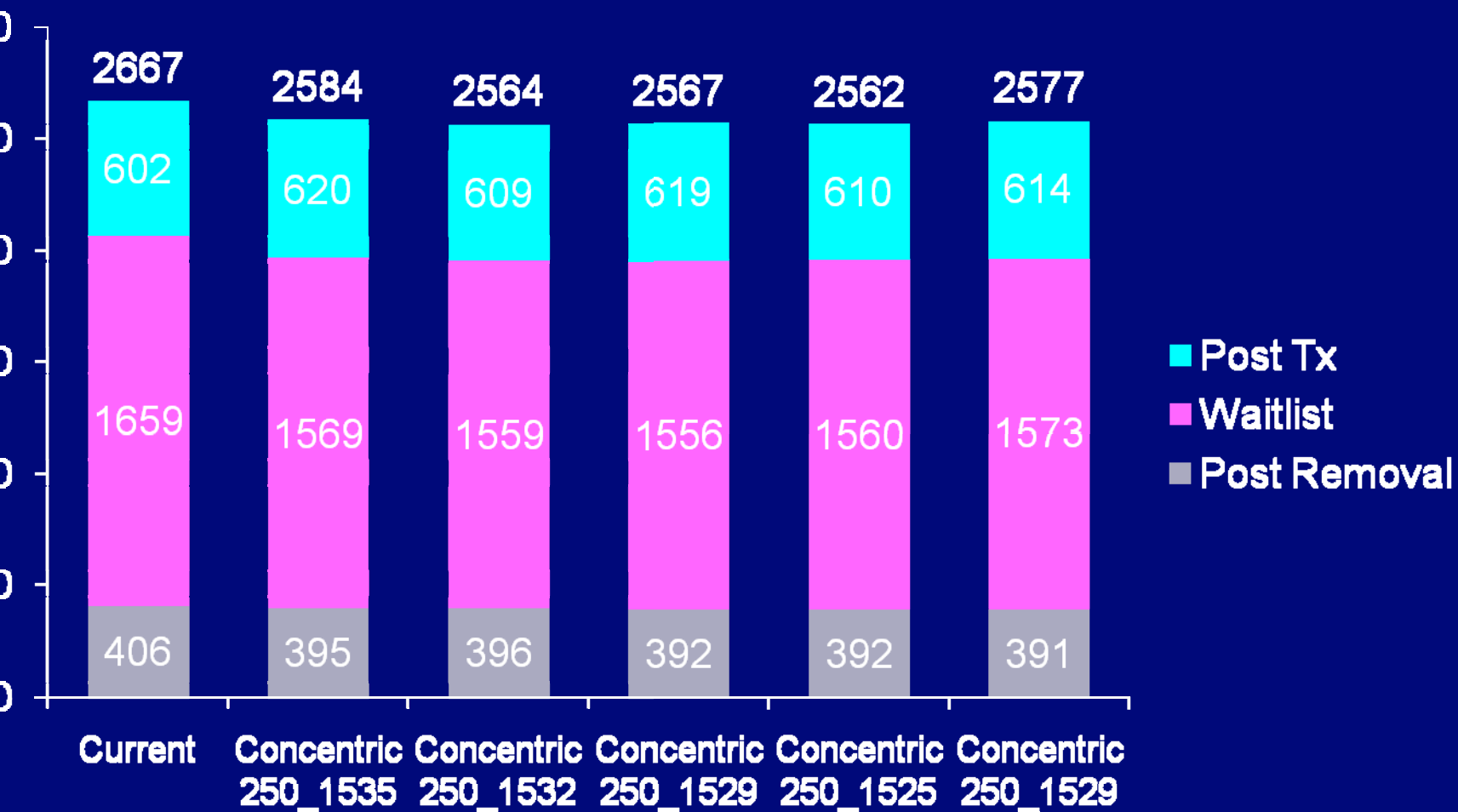
*March*



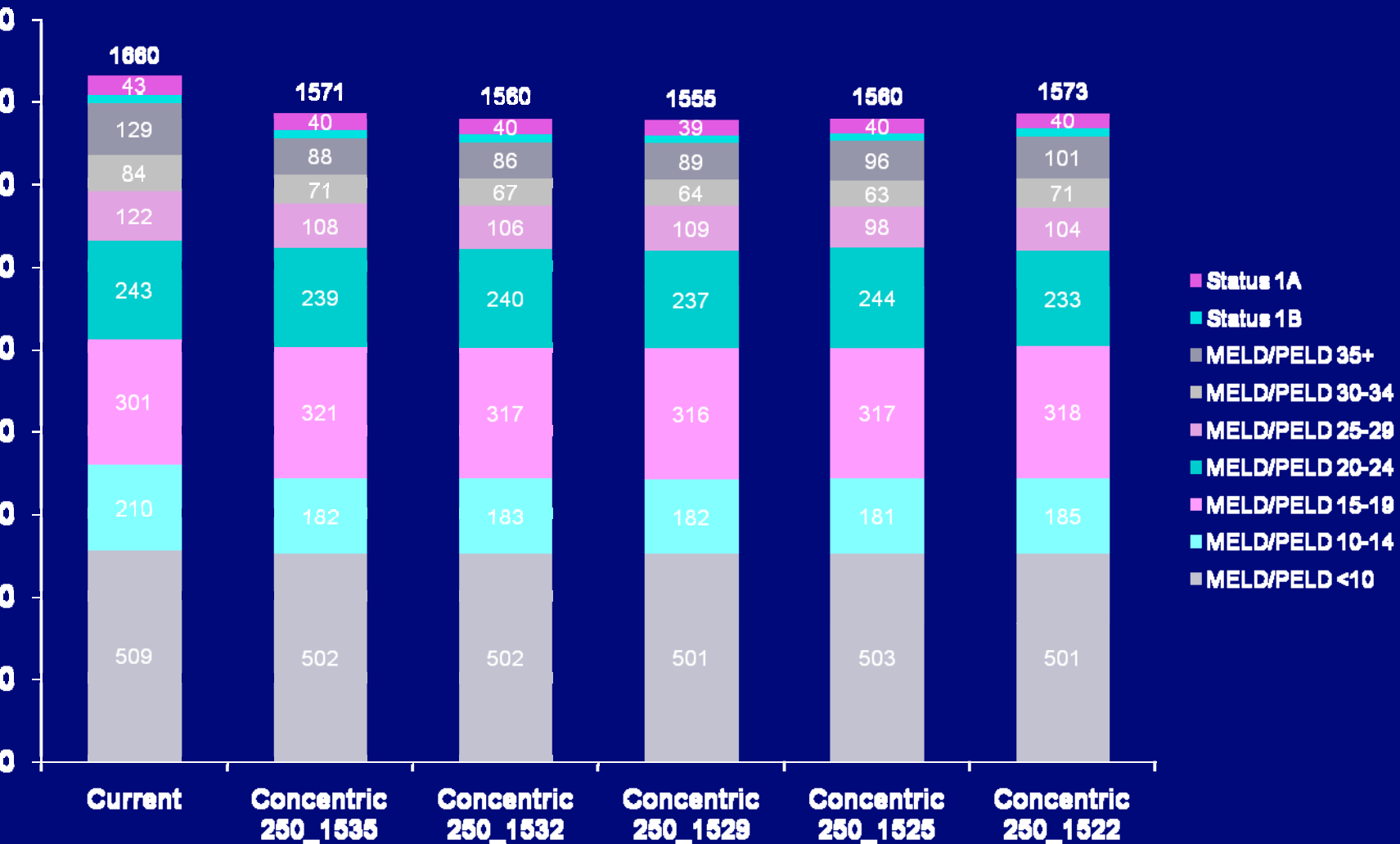
# Number of Transplants by MELD: *March*



# Number of Deaths by Type: *March*



# Number of WL Deaths by MELD- *March*



## Summary

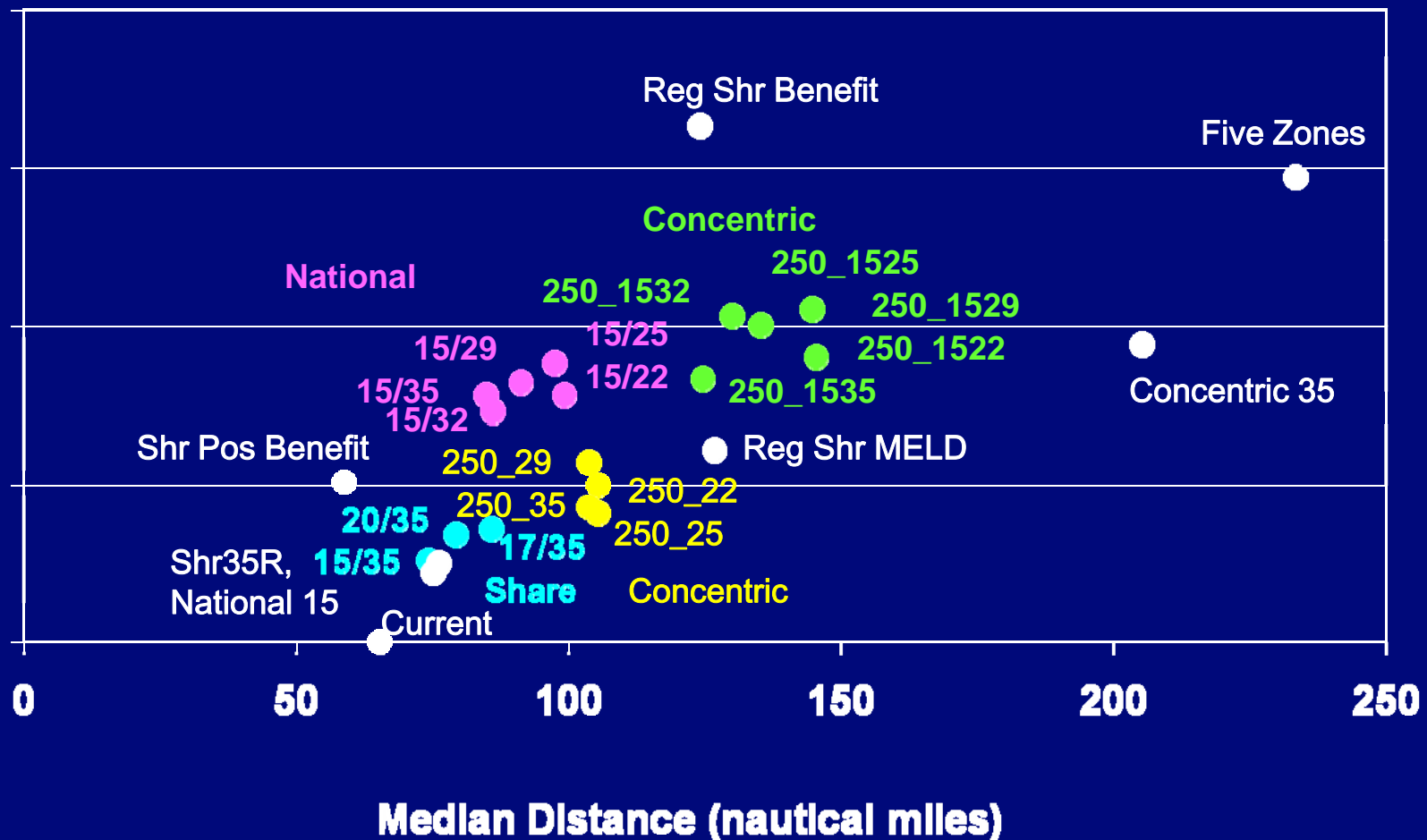
of the two tiered concentric circle systems resulted in higher median distances traveled vs. current.

distance increased as the MELD score for the lower threshold was reduced

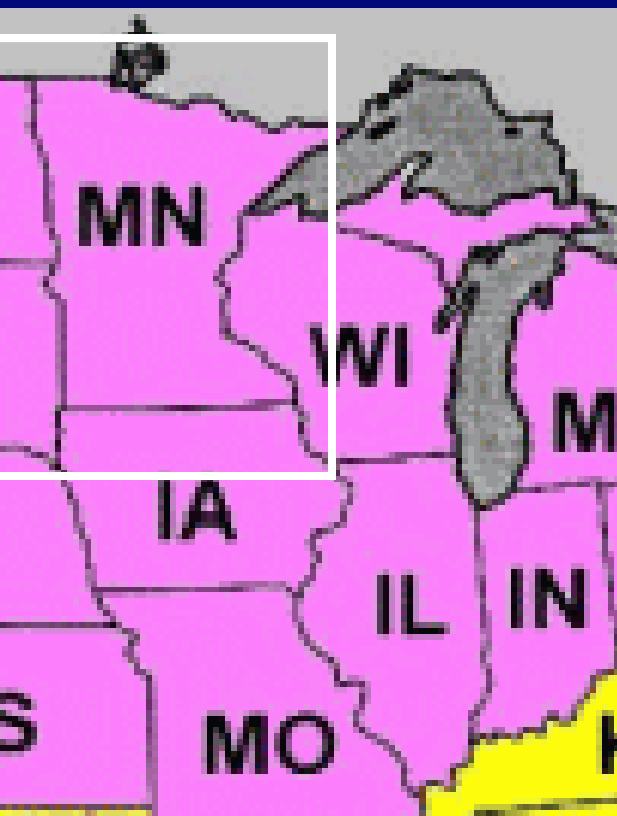
of the two tiered concentric circle systems resulted in lower total deaths compared to current allocation systems in the simulations.

The decrease in the number of deaths ranged from 3 to 105.

# Median Distance vs. Decrease in Total Deaths



## Cost estimates: Life Source (MNOP) 2007-2009



□ =MNOP (MN, ND, SD)

**Region 7**= MN,SD, ND, WI, IL

**2<sup>nd</sup> Tier** =IA, NE, KS, MO, MI, IN

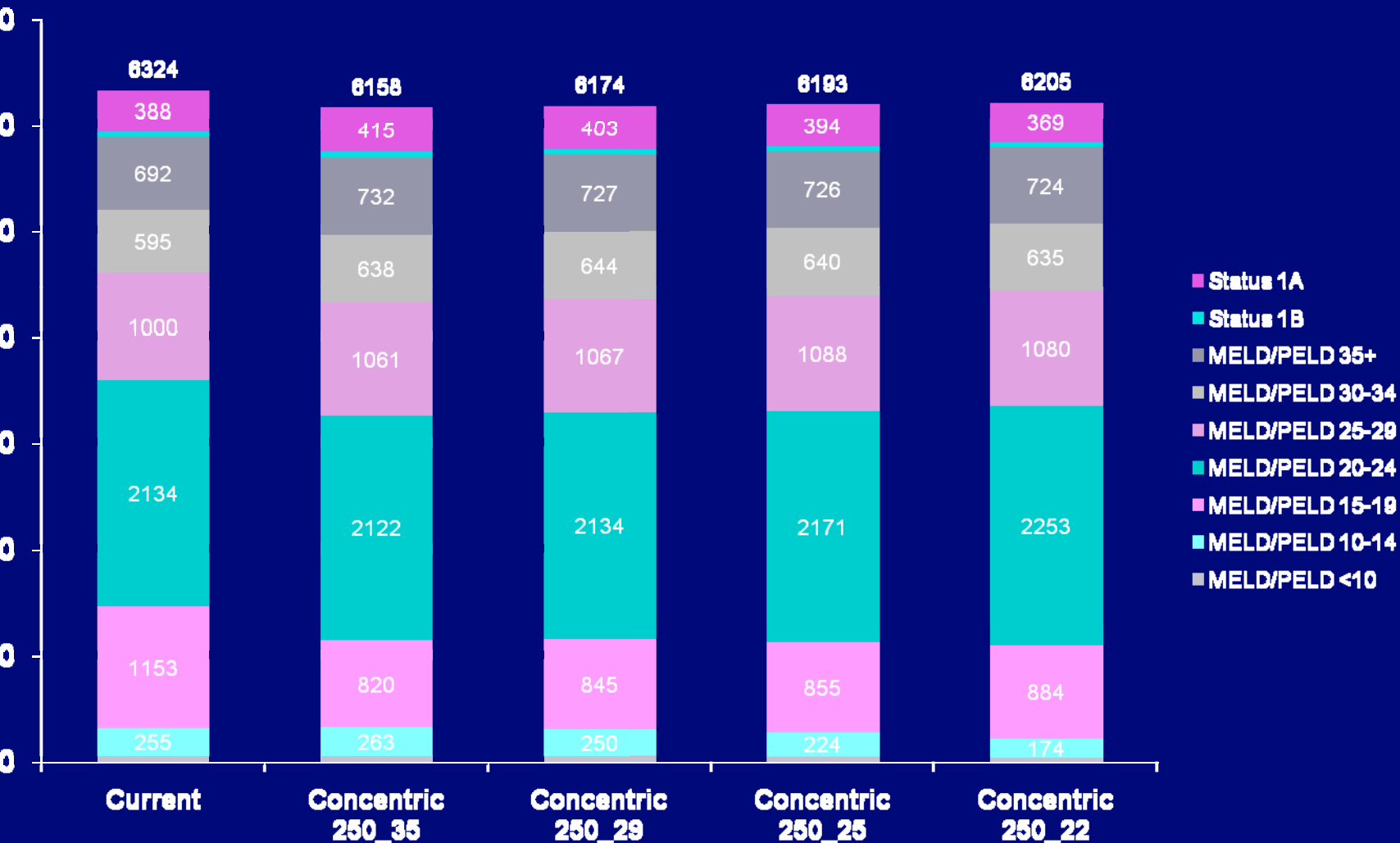
• Local (MNOP) flight= \$ 5,271 (n=520)

• Import region 7 flight= \$ 5,617 (n=52)

• Import 2<sup>nd</sup> tier= \$ 7,629 (n=22)

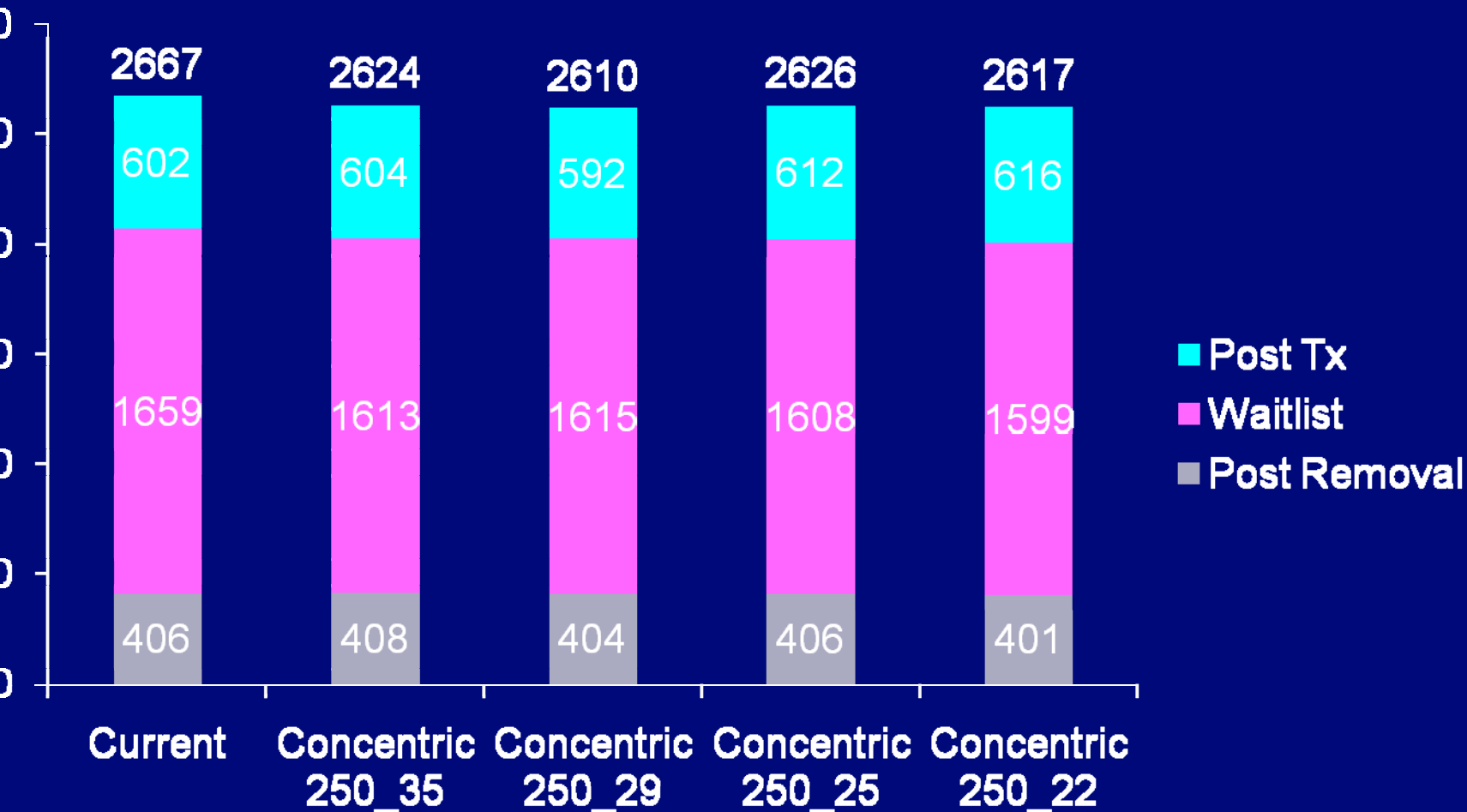
• Import national= \$ 13,273 (n=55)

# Number of Transplants by MELD: *Feb*





# Number of Deaths by Type: *Feb.*



# Number of WL Deaths by MELD- Feb.

