Impact of Publicly Reported Center Specific Analysis (CSA) on Patient Selection for Hematopoietic Stem Cell Transplantation
SC21-01
Center Specific Analysis Forum
October 18th, 2023
Objective

• Describe changes in patient selection behavior
  – “Changes to patient selection criteria” is most common corrective action (LeMaister et al.)

• Hypothesis: Centers will systematically transplant fewer patients with high risk of death at 1 year during the time period following a -1 report
Definitions

• Newly Below Expected OS Center (NBC)
  – A center receiving a -1 report while having 0 or +1 reports in the 2 years preceding the -1 report

• Control Center
  – A center performing “as predicted” (0) for each 6 year window
NBCs and Control Centers

Possible Y=0 years: 2012-2016

Y=-3   Y=-2   Y=-1   Y=0   Y=+1   Y=+2   Y=+3

CSA = 0 or +1  CSA = 0 or +1  CSA = -1

Newly Below Expected OS Centers

CSA = 0  CSA = 0  CSA = 0  CSA = 0  CSA = 0  CSA = 0

Control Centers

CSA results released in December of year 0, incorporating data from 3 prior years.
Measuring Change in Behavior

Possible Y=0 years: 2012-2016

Y=-3  Y=-2  Y=-1  Y=0  Y=+1  Y=+2  Y=+3

(center receives -1 rating in December)

Patients transplanted in these years represent the baseline behavior

Patients transplanted in these years represent the change in behavior in response to the -1 report
Hypothesis

• NBCs change their patient selection behavior to exclude patients at high risk of death @ 1 year during the 3 years following -1 report.
  – Higher predicted 1 year OS by CSA model
  – Lower proportion > 60 years
  – Lower proportion non-white race
  – Lower proportion HCT-CI > 3
  – Lower proportion with advanced disease
  – Lower proportion with myeloablative conditioning
  – Lower proportion with mismatched graft
  – Lower proportion with high comorbidity / low KPS
Methods

• Unit of analysis is at center level
• Post exposure changes were modeled, adjusting for center size and baseline proportions
• Due to multiple comparisons, we set threshold for significance at p=0.01
## Number of Centers

<table>
<thead>
<tr>
<th>Year of CSA report</th>
<th>NBC: Pre-exposure</th>
<th>NBC: Post-exposure</th>
<th>Control: Pre exposure</th>
<th>Control: Post-exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>4 (375)</td>
<td>4 (430)</td>
<td>35 (3931)</td>
<td>35 (4530)</td>
</tr>
<tr>
<td>2013</td>
<td>4 (264)</td>
<td>4 (288)</td>
<td>37 (4023)</td>
<td>37 (4492)</td>
</tr>
<tr>
<td>2014</td>
<td>5 (935)</td>
<td>5 (843)</td>
<td>43 (5011)</td>
<td>43 (5492)</td>
</tr>
<tr>
<td>2015</td>
<td>9 (2907)</td>
<td>9 (2500)</td>
<td>39 (4751)</td>
<td>39 (4939)</td>
</tr>
<tr>
<td>2016</td>
<td>2 (86)</td>
<td>2 (89)</td>
<td>41 (5264)</td>
<td>41 (5560)</td>
</tr>
</tbody>
</table>

All adult and combined adult/pediatric centers were included. Centers that closed in the 3 years after -1 report were excluded (11 centers).
### Difference in Change of Behavior
(postNBC – preNBC) – (postControl – preControl)

#### Table 1:

<table>
<thead>
<tr>
<th></th>
<th>Pre y0 proportion estimate (95% CI)</th>
<th>Change (Post-Pre) (95% CI)</th>
<th>Difference in Change (ΔNBC – ΔControl) (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed OS</td>
<td>NBCs 62.31% (60.73 - 63.90)</td>
<td>0.87% (-1.56 - 3.31)</td>
<td>-3.64% (-6.69 - -0.72)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Controls 67.49% (66.56 - 68.43)</td>
<td>4.52% (2.94 - 6.09)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Predicted OS</td>
<td>NBCs 65.87% (64.42 - 67.31)</td>
<td>3.08% (2.08 – 4.08)</td>
<td>-0.23% (-1.38 – 0.93)</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Controls 67.00% (65.98 - 68.02)</td>
<td>3.30% (2.73 – 3.88)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-white</td>
<td>NBCs 20.16% (15.14 – 25.19)</td>
<td>0.51% (-1.73 – 2.75)</td>
<td>-1.61% (-4.14 – 0.91)</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Controls 22.97% (19.28 – 26.66)</td>
<td>2.12% (0.96 - 3.28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCT-CI &gt;3</td>
<td>NBCs 50.99% (45.78 – 56.20)</td>
<td>8.03% (4.04 – 12.02)</td>
<td>+2.07% (-2.78 – 6.92)</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>Controls 46.43% (42.68 - 50.19)</td>
<td>5.96% (3.22 – 8.70)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60+ years</td>
<td>NBCs 33.12% (30.50 – 35.97)</td>
<td>5.83% (3.09 – 8.58)</td>
<td>-2.60% (-5.94 - 0.74)</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Controls 32.53% (30.64 – 34.42)</td>
<td>8.43% (6.45 – 10.42)</td>
<td></td>
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</tr>
<tr>
<td>Advanced Disease</td>
<td>NBCs 42.65% (39.95 – 45.35)</td>
<td>13.25% (9.94-16.57)</td>
<td>+4.12% (0.11 - 8.12)</td>
<td>0.04</td>
</tr>
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<td>Controls 40.76% (38.99 – 42.53)</td>
<td>9.14% (6.87 – 11.40)</td>
<td></td>
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<td>PB Graft</td>
<td>NBCs 77.15% (72.15 – 82.15)</td>
<td>-4.97% (-9.90 - -0.05)</td>
<td>-3.11% (-9.19 – 2.97)</td>
<td>0.31</td>
</tr>
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<td>Controls 84.80% (81.24 – 88.35)</td>
<td>-1.87% (-5.29 – 1.56)</td>
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<td>Non-MSD/MUD</td>
<td>NBCs 22.38% (19.02 – 25.74)</td>
<td>2.78% (0.80 – 6.35)</td>
<td>+1.12% (-3.25 – 5.50)</td>
<td>0.61</td>
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<td>NBCs 38.15% (32.01 – 44.28)</td>
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<td>KPS ≥90</td>
<td>NBCs 66.02% (58.64 – 73.41)</td>
<td>7.17 ( 4.81 – 9.53)</td>
<td>2.44% (-7.84 – 2.97)</td>
<td>0.37</td>
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<td>Controls 60.85% (55.59 – 66.11)</td>
<td>-4.74 (-7.36 – 2.12)</td>
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Table 1: Pre $y_0$ proportion estimate (95% CI) | Change (Post-Pre) (95% CI) | Difference in Change ($\Delta NBC$ – $\Delta Control$) (95% CI) | P value
--- | --- | --- | ---
non-MAC NBCs | 38.15% (32.01 – 44.28) | -4.11% (-10.30 – 2.07) | -9.12% (-16.69 – -1.55) | 0.02
Controls | 46.24% (41.80 – 50.69) | 5.01% (0.77 – 9.24) | | |

Graphical Representation

Change in % of patients transplanted

% non-MAC

10%

0%

-10%

Pre $y_0$  Post $y_0$

$\Delta NBC$

$\Delta Control$

+5.01%

-4.12%

-9.12%

p=0.02
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**Graphical Representation**

**Predicted Overall Survival**

- Change in % of patients transplanted
  - 10% Pre y₀
  - +3.30% Post y₀
  - +3.08%
  - ΔNBC
  - ΔControl
  - -0.23%
  - P=0.70

**Observed Overall Survival**

- 10% Pre y₀
  - +4.52%
  - ΔNBC
  - ΔControl
  - +0.87%
  - p=0.02

- 0% Post y₀
  - -3.64%
Graphical Representations

Figure 1:

Predicted Overall Survival

- Change in % of patients transplanted
  - Pre $y_0$:
    - 0% 
    - +3.08%
  - Post $y_0$:
    - 0% 
    - +3.30%

Observed Overall Survival

- % HCT-CI > 3
  - Pre $y_0$:
    - 0% 
    - +5.96%
  - Post $y_0$:
    - 0% 
    - +8.03%

- % 60+ years old
  - Pre $y_0$:
    - 0% 
    - -4.97%
  - Post $y_0$:
    - 0% 
    - -3.11%

- % adv. disease
  - Pre $y_0$:
    - 0% 
    - +0.87%
  - Post $y_0$:
    - 0% 
    - +4.12%

- % KPS ≥ 90
  - Pre $y_0$:
    - 0% 
    - +9.14%
  - Post $y_0$:
    - 0% 
    - -7.17%

% non-white

- ∆ NBC
  - Pre $y_0$:
    - 0% 
    - +0.51%
  - Post $y_0$:
    - 0% 
    - +2.12%

% non-MSD/MUD

- ∆ NBC
  - Pre $y_0$:
    - 0% 
    - +1.65%
  - Post $y_0$:
    - 0% 
    - +1.12%

% non-MAC

- ∆ NBC
  - Pre $y_0$:
    - 0% 
    - -4.12%
  - Post $y_0$:
    - 0% 
    - -9.12%

Difference in differences = $\Delta NBC - \Delta Control$
Interpretation

• After accounting for changes over time in the transplant field, we find no notable differences in patient selection behavior in centers immediately following a -1 CSA report.

• The predicted survival did not significantly change, suggesting a similar patient population in the post -1 report time period vs pre -1 report time period.

• Observed overall survival did increase at NBCs, though less than at controls.