Using R to Analyze Healthcare Cost of Older Patients Using Personal Emergency Response Service

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² Philips team - Mariana Simons, Jorn op den Buijs, Linda Schertzer, Allison Orenstein
Retrospective Analyses of Patients Utilizing the Philips Lifeline PERS at Partners Healthcare at Home

- The proportion of older people is increasing.
- Goal is to promote independent living and decrease cost.
- Lifeline PERS tracks the types and outcomes of all incidents.

**Objectives:** Analyze healthcare expenditure

**Patient Sample:** 3,335 patients identified from Partners Healthcare and Philips Lifeline

**Data Sources:** A combination of Partner’s EHR data and Lifeline PERS data
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Healthcare Cost Analysis - CMS Cost Acuity Pyramid

% patients | % total cost | average cost per patient
---|---|---
T 5% | 50% | $70,000
M 6-50% | 45% | $8,300
B 51-100% | 5% | $400

Healthcare Costs Increased Over the Study Period

<table>
<thead>
<tr>
<th>Cost</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-segment (5%)</td>
<td>$8.0 M (45%)</td>
<td>$10.1 M (44%)</td>
<td>$9.9 M (42%)</td>
<td>$12.1 M (42%)</td>
<td>$12.9 M (39%)</td>
</tr>
<tr>
<td>M-segment (45%)</td>
<td>$9.1 M (51%)</td>
<td>$12.0 M (53%)</td>
<td>$12.6 M (54%)</td>
<td>$15.7 M (55%)</td>
<td>$18.9 M (57%)</td>
</tr>
<tr>
<td>B-segment (50%)</td>
<td>$0.6 M (4%)</td>
<td>$0.8 M (3%)</td>
<td>$0.9 M (4%)</td>
<td>$1.0 M (3%)</td>
<td>$1.2 M (4%)</td>
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<tr>
<td>Total population</td>
<td>$17.7 M (100%)</td>
<td>$22.9 M (100%)</td>
<td>$23.4 M (100%)</td>
<td>$28.8 M (100%)</td>
<td>$33.0 M (100%)</td>
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<td># patients</td>
<td>2,150</td>
<td>2,176</td>
<td>2,177</td>
<td>2,223</td>
<td>2,206</td>
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Legend: The linear regression lines are the solid colored lines and the shadowed areas are the confidence intervals as a measure of uncertainty.
Healthcare Costs Increased Over the Study Period

![Graph showing healthcare cost increase over the study period.](image)

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p=0.003
p=0.002
p=0.008
p=0.003
Patients Flow through the Segments from year to year

What % of patients in T-, M- and B-segments move between the segments yearly?

T 5%
M 6-50%
B 51-100%

FY FY+1
Patients and Cost Flow through the Segments

Markov Model

Transition matrix

<table>
<thead>
<tr>
<th>FYtoFY+1</th>
<th>T seg</th>
<th>M seg</th>
<th>B seg</th>
</tr>
</thead>
<tbody>
<tr>
<td>T seg</td>
<td>0.24</td>
<td>0.54</td>
<td>0.22</td>
</tr>
<tr>
<td>M seg</td>
<td>0.05</td>
<td>0.55</td>
<td>0.40</td>
</tr>
<tr>
<td>B seg</td>
<td>0.02</td>
<td>0.29</td>
<td>0.69</td>
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Patients and Cost Flow through the Segments

Results

B-segment
M-segment
T-segment

*averaged over FY11, FY12, FY13, FY14, FY15

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<th>Fiscal Year</th>
<th>FY14</th>
<th>FY15</th>
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<td>B-seg FY14</td>
<td>$15.7 M</td>
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Cost Flow FY14 - FY15
Patients and Cost Flow through the Segments

Results

![Diagram showing patient flow and cost flow through B, M, and T segments.](image)

*Average over FY11, FY12, FY13, FY14, FY15*
Patients and Cost Flow through the Segments

Moves up/down through cost acuity pyramid

MoveDown 22%
MoveNo 60%
MoveUp 18%

* - averaged over {FY11-12, FY12-13, FY13-14, FY14-15}

Cost Flow FY14 -> FY15

- MoveDown: Pts: 493 (22%) Cost: -86% $14.5 M
- MoveNo: Pts: 1327 (60%) Cost: +18% $14.8 M
- MoveUp: Pts: 403 (18%) Cost: +672% $13.9 M

Fiscal Year

FY14 FY15 FY14 FY15 FY14 FY15

$2 M $12.5 M $1.8 M
Patients and Cost Flow through the Segments

Moves up/down through cost acuity pyramid

* - averaged over [FY11-12, FY12-13, FY13-14, FY14-15]
Conclusions and Next Steps

• While most healthcare organizations target interventions at the most expensive patients (T-segment), this study uncovers opportunities for cost savings by monitoring patients in the lower segments of the cost acuity pyramid who are moving up.

• Ongoing clinical trial of CareSage – a data analytics engine that leverages Philips Lifeline medical alert data and Partners intervention protocols to identify patients at risk of ED visits.
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Thank you