LEARNING AND RELATED TRANSFORMATIONAL PERFORMANCE IMPROVEMENT ADOPTION AND IMPACT IN U.S. HOSPITALS

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OUTLINE

• Introductory Remarks
• Why Lean?
• National Survey
  - Methods
  - Results
• Impact on Hospital Costs, Financial Performance and Quality of Care
• Summary and Next Steps

LEAN HEALTHCARE RESEARCH SYMPOSIUM
CHICAGO, ILLINOIS
JUNE 13, 2018
THE U.S. CHALLENGE

High Cost Uneven Quality Healthcare System

• 18% GDP
• Lower Quartile on many OECD Health Statistics

High Variability Healthcare System

RECENT DEVELOPMENTS INCREASING PRESSURE FOR CHANGE

• Affordable Care Act

• Move Away from Fee-For-Service Payment to Value-Based Payment

• Creation of New Delivery Models
  - Accountable Care Organizations (ACOs)
  - Patient Centered Medical Homes (PCMH)
  - “Hospitals at Home”
“Not using re-engineering processes to improve care is…the most dysfunctional and perverse outcome for care delivery in this country that is created by the way we buy care.”

George Halvorson, 2018
Former President and CEO, Kaiser Permanente

“All other countries make re-engineering their basic processes a fundamental strategy and all the well run companies in other industries make process improvement and re-engineering a highly valuable organizational strength and capability.”

George Halvorson, 2018
Former President and CEO, Kaiser Permanente
IS A NEW WAY OF LEADING AND MANAGING HEALTHCARE ORGANIZATIONS NEEDED?

LEAN

An Overall Management / Operating System That Uses a Continuous Improvement Culture That Empowers Front Line Workers (Nurses, Physicians, Support Staff) to Solve Problems and Eliminate Waste by Standardizing Work to Improve the Value of Care Delivered to Patients.

CENTRAL THESIS

The Greater the Degree of Lean Implementation,
The Better Hospital Performance (Cost and Quality)

METHODS

• National Survey of 4500 Hospitals
• Acute Care Medical and Pediatric General Hospitals
• Survey Questions Based on Comprehensive Literature Review of Lean Philosophy, Principles, and Practices
• Pilot Testing
• 20 Minutes Online
• N = 1222 Hospitals (27% Response Rate)
• Small but Statistically Significant Differences by Ownership, Teaching Hospitals, Region, and Bed Size
BASIC RESULTS

• 69.3% Report Doing Lean, Lean Plus Six Sigma, or Robust Process Improvement

• Adjusted Adoption Rate 61.6%

• Only 12.6% (N = 102) at a Mature Hospital-Wide Stage

PRIMARY PERFORMANCE IMPROVEMENT APPROACH

<table>
<thead>
<tr>
<th>Approach</th>
<th>Percentage</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lean without Six Sigma</td>
<td>26.4%</td>
<td>217</td>
</tr>
<tr>
<td>Lean Six Sigma Combined</td>
<td>11.4%</td>
<td>94</td>
</tr>
<tr>
<td>Robust Process Improvement</td>
<td>22.5%</td>
<td>185</td>
</tr>
<tr>
<td>Other Approaches</td>
<td>39.7%</td>
<td>325</td>
</tr>
</tbody>
</table>
**Approach to Beginning Lean Implementation**

- Some elements hospital-wide: 36.9% (n = 296)
- Some elements in a small number of departments: 40.6% (n = 326)
- Some elements in a single department: 6.0% (n = 48)
- Comprehensive DMS hospital-wide: 11.3% (n = 91)
- Comprehensive DMS in a small number of departments: 3.6% (n = 29)
- Comprehensive DMS in a single department: 1.6% (n = 13)

**Descriptive Statistics on Study Variables**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiated Lean with a Model Cell</td>
<td>Yes</td>
<td>542</td>
</tr>
<tr>
<td>Have a Central Improvement Team</td>
<td>Yes</td>
<td>581</td>
</tr>
<tr>
<td>Ever Used an Outside Consultant</td>
<td>Yes</td>
<td>542</td>
</tr>
<tr>
<td>Have a True North Vision</td>
<td>Yes</td>
<td>451</td>
</tr>
</tbody>
</table>
MOST FREQUENT TOOLS USED

• Daily Huddles
• PDSA Cycles
• Visual Management
• Standard Work Processes
• Analysis Tools—Scatter Plots, Pareto Charts, etc.

MOST FREQUENTLY MENTIONED UNITS USING LEAN

• Emergency Department
• Medical/Surgery/Nursing Unit
• Operating Room
• Executive Leadership
• Laboratory
**LEAN COMPOSITE SCALES**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>mean (SD); range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Lean Leadership Commitment Index</td>
<td>772</td>
<td>5.3 (2.4); 0-8</td>
</tr>
<tr>
<td>Daily Management System Index</td>
<td>752</td>
<td>5.7 (2.3); 0-9</td>
</tr>
<tr>
<td>Education and Training Index</td>
<td>735</td>
<td>1.9 (0.9); 0-4</td>
</tr>
<tr>
<td>Self-reported Performance Index</td>
<td>731</td>
<td>9.1 (4.0); 0-16</td>
</tr>
</tbody>
</table>

**LEAN LEADERSHIP COMMITMENT INDEX ITEMS (STRONGLY DISAGREE TO STRONGLY AGREE) CRONBACH ALPHA=0.81**

- Reason for using lean is instilled and widely shared
- The outcomes desired are clear, widely understood, and shared
- Strong employee commitment to invest time and other resources to make it work
- Initiatives selected to result in early successes and learnings are then disseminated
- Hospital leaders set benchmarks to assess progress
LEAN LEADERSHIP COMMITMENT INDEX ITEMS (STRONGLY DISAGREE TO STRONGLY AGREE) CRONBACH ALPHA=0.81

- Hospitals use staff time, communication and information technology systems to reinforce the LEAN initiative
- LEAN has a sponsor/champion and team members who demonstrate visible, active support of LEAN
- Hospital leaders have made an explicit commitment to patient-centered care

BACKGROUND CHARACTERISTICS AND COMPARISON WITH LEAN IMPLEMENTATION MEASURES AND SELF-REPORTED PERFORMANCE

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Number of years doing Lean n = 774</th>
<th>Overall Lean leadership commitment index n = 768</th>
<th>Daily management system index n = 748</th>
<th>Education and training scale n = 731</th>
<th>Self-reported performance index n = 727</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Public</td>
<td>4.6 (3.5)</td>
<td>4.8 (2.5)</td>
<td>4.9 (2.6)</td>
<td>1.8 (0.9)</td>
<td>7.6 (4.1)</td>
</tr>
<tr>
<td>b. Not-for-profit</td>
<td>5.4 (3.6)</td>
<td>5.4 (2.4)</td>
<td>5.8 (2.2)</td>
<td>1.9 (0.9)</td>
<td>9.4 (3.9)</td>
</tr>
<tr>
<td>c. Investor-owned</td>
<td>3.7 (4.1)</td>
<td>6.3 (1.8)</td>
<td>6.0 (2.0)</td>
<td>2.1 (0.9)</td>
<td>8.9 (4.1)</td>
</tr>
</tbody>
</table>

F = 6.14* a < b; b > c F = 6.31* a < b; a < c F = 10.75† a < b; a < c F = 1.81 F = 11.73† a < b

<table>
<thead>
<tr>
<th>Member of a system or network?</th>
<th>Number of years doing Lean n = 774</th>
<th>Overall Lean leadership commitment index n = 768</th>
<th>Daily management system index n = 748</th>
<th>Education and training scale n = 731</th>
<th>Self-reported performance index n = 727</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>5.4 (3.6)</td>
<td>5.4 (2.3)</td>
<td>5.8 (2.3)</td>
<td>2.0 (0.9)</td>
<td>9.4 (3.9)</td>
</tr>
<tr>
<td>No</td>
<td>4.6 (3.6)</td>
<td>5.2 (2.4)</td>
<td>5.3 (2.4)</td>
<td>1.8 (0.8)</td>
<td>7.8 (3.9)</td>
</tr>
</tbody>
</table>

F = 6.14* a < b; b > c F = 0.24 F = 3.99‡ a < b; a < c F = 1.13 F = 4.44‡ a < b; a < c

<table>
<thead>
<tr>
<th>Bed size</th>
<th>Number of years doing Lean n = 774</th>
<th>Overall Lean leadership commitment index n = 768</th>
<th>Daily management system index n = 748</th>
<th>Education and training scale n = 731</th>
<th>Self-reported performance index n = 727</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 1-99 beds</td>
<td>4.3 (3.2)</td>
<td>5.4 (2.3)</td>
<td>5.4 (2.4)</td>
<td>2.0 (1.0)</td>
<td>8.5 (4.0)</td>
</tr>
<tr>
<td>b. 100-399 beds</td>
<td>5.5 (3.7)</td>
<td>5.3 (2.5)</td>
<td>5.9 (2.2)</td>
<td>1.9 (0.8)</td>
<td>9.4 (3.9)</td>
</tr>
<tr>
<td>c. 400 or more beds</td>
<td>6.1 (4.0)</td>
<td>5.3 (2.3)</td>
<td>5.7 (2.4)</td>
<td>1.8 (0.8)</td>
<td>9.5 (4.2)</td>
</tr>
</tbody>
</table>

F = 14.61* a < b; a < c F = 0.24 F = 3.99‡ a < b; a < c F = 1.13 F = 4.44‡ a < b; a < c

Results are presented as mean (SD), and test statistic. Significant F and t values are boldfaced. Significant (p<.05) post-hoc comparisons (Tukey's Honest Significant Difference method) are listed under significant overall F-statistics. † p<.001; * p<.01; ‡ p<.05 ‡ None of the post-hoc pairwise comparisons reached significance.
BACKGROUND CHARACTERISTICS AND COMPARISON WITH SELF-REPORTED MATURITY

Regression model results – Self-reported performance improvement (n = 766)

<table>
<thead>
<tr>
<th>Predictor</th>
<th>b</th>
<th>95% CI [LL, UL]</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>1.07*</td>
<td>[-0.04, 2.18]</td>
</tr>
<tr>
<td>System or network member: Yes</td>
<td>0.79*</td>
<td>[0.17, 1.42]</td>
</tr>
<tr>
<td>Self-reported maturity: Expanding to other units and getting traction throughout the hospital</td>
<td>0.91*</td>
<td>[0.07, 1.74]</td>
</tr>
<tr>
<td>Self-reported maturity: Have become a mature transformational performance improvement hospital</td>
<td>1.50†</td>
<td>[0.29, 2.71]</td>
</tr>
<tr>
<td>Number of units doing Lean</td>
<td>0.17†</td>
<td>[0.13, 0.21]</td>
</tr>
<tr>
<td>Number of years doing Lean</td>
<td>0.11†</td>
<td>[0.04, 0.18]</td>
</tr>
<tr>
<td>Overall Lean leadership commitment index</td>
<td>0.22†</td>
<td>[0.09, 0.35]</td>
</tr>
<tr>
<td>Daily management system index</td>
<td>0.20†</td>
<td>[0.06, 0.33]</td>
</tr>
<tr>
<td>Education and training scale</td>
<td>0.38†</td>
<td>[0.09, 0.66]</td>
</tr>
</tbody>
</table>

Fit $R^2 = .410†$ [95% CI [.35, .44]]

* p < .05; † p < .01. A significant b-weight indicates the semi-partial correlation is also significant. b represents unstandardized regression weights. LL and UL indicate the lower and upper limits of a confidence interval, respectively.

SIGNIFICANT ASSOCIATIONS WITH SELF-REPORTED PERFORMANCE IMPLEMENTATION

Regression model results – Self-reported performance improvement (n = 766)
**Most Frequently Reported Performance Achievements**

- Elimination of waste in two or more processes or departments
- Improved employee engagement in their work
- Increased throughput in the emergency department
- Reduced expenditures in two or more departments

**What is Your Biggest Challenge in Implementing Lean?**

- Lack of sufficient time
- Lack of sufficient resources
- Changing the culture
- Lack of physician buy-in
- Too many competing priorities
ANALYSIS OF RELATIONSHIP WITH INDEPENDENT “OBJECTIVE” PERFORMANCE MEASURES

METHODS

• Compared 2015 outcomes for hospitals who reported starting lean by the end of 2014 to those who did not

• Once 2018 performance data is available, we will be able to more fully examine variation by extent of lean implementation using our 2017 survey data

• Multivariable linear regression, with multiple imputation in cases with 3 or fewer missing variables (n = 1134-1135 across models)
**REGRESSION MODEL SPECIFICATION**

\[ y_i = a + b_1 x_1 + b_2 x_2 + e_1 \]

\( y_i \) = Medicare spending per beneficiary; EBITDA Margin; Adjusted inpatient expense per discharge; Adjusted operating profit margin; 30-day risk adjusted mortality index; Death rate in low mortality diagnosis related groups; Pressure ulcer rate; Death rate for surgical patients with serious treatable conditions; 30-day unplanned readmission rate; HCAHPs score

\( b_1 x_1 \) = Hospital started doing lean by end of 2014

\( b_2 x_2 \) = Ownership; Member of a system or network; Core-based statistical area type; Member of Council of Teaching Hospitals; Bed size; Market concentration; Percent Medicaid discharges; Primary care physician/specialty ratio

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**IMPACT OF LEAN (BY 2014) ON 2015 QUALITY MEASURES**

Regression coefficients, controlling for organizational and market characteristics

- 30-day risk adjusted mortality index (%)
- Death rate in low mortality diagnosis related groups (Z-score)
- Pressure ulcer rate (Z-score)
- Death rate for surgical patients with serious treatable conditions (Z-score)
- 30-day unplanned readmission rate (%)

Quality measures were taken from CMS Hospital Compare and AHRQ Quality Indicator data.
IMPACT OF LEAN (BY 2014) ON 2015 PATIENT SATISFACTION
Regression coefficients, controlling for organizational and market characteristics

HCAHPS score was taken from CMS Hospital Compare data.

IMPACT OF LEAN (BY 2014) ON 2015 EFFICIENCY MEASURES
Regression coefficients, controlling for organizational and market characteristics

Efficiency measures were taken from Medicare Cost Report data.
**SUMMARY**

- Majority of U.S hospitals are doing some LEAN or related transformational improvement approaches
- A relatively small number are “mature”—spread throughout the organization with some depth
- It takes time—2 to 5 years—to begin to take hold; longer to spread more widely

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...Cont’d

**SUMMARY**

- Top leadership commitment, daily management system and training are key to standardize work
- Encouraging results—hospitals doing lean have better cost and quality performance on key indicators than those not doing LEAN
**FUTURE RESEARCH**

- Drill Down—Emergency Department Lean Implementation and Performance Results
- Focused Analysis on Public Hospital Performance
- Role of Finance, Human Resources and Information Technology in Transformational Performance Improvement
- Updated Performance Data and Analysis 2016, 2017, 2018
- Current Publication


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- **IBM WATSON TRUVEN ANALYTICS**
- **CATALYSIS**
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- **LEAN ENTERPRISE INSTITUTE**
- **RONA CONSULTING GROUP - MOSS-ADAMS**
THANK YOU

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YOUR QUESTIONS