Lean Performance Indicators and Facilitators of Outcomes in U.S. Public Hospitals

University of California, Berkeley
Center for Lean Engagement & Research (CLEAR)

6th Annual Lean in Healthcare
Research Symposium

CLEAR
Center for Lean Engagement & Research in Healthcare

Tyler Roey, Dorothy Hung, PhD, Thomas Rundall, PhD, Pierre-Luc Fournier, PhD, Athena Zhong, Stephen Shortell, PhD

Previous Research on Lean Adoption & Implementation

- Lean and public hospital relationship
- Effects of Lean adoption
  - Decreased expenses and improved financial performance
- Various Lean implementations

Hypothesis 1:

U.S. public hospitals that **adopted Lean** or related approaches are associated with better public hospital performance on *financial*, *quality*, *and patient outcomes* as compared with public hospitals that have not adopted Lean, controlling for organizational and market factors.

Hypothesis 2:

The **extent of Lean implementation** in U.S. public hospitals that reported adopting Lean or related approaches is significantly associated with improved *hospital performance on select outcomes*, controlling for length of time of Lean adoption, organizational, and market factors.

Methods & Variables

- National Survey of Lean/ Transformational Performance Improvement
  - Tool for hospital performance mesures
- Adoption and extent of Lean implementation
  - Quality of care
  - Patient reported experience
  - Efficiency/ financial viability
- Control Variabes from AHA Annual Survey

Variables

Dependent / Outcome Variables:

-30-day risk adjusted mortality index
-Adjusted inpatient expense per discharge
-EBITDA margin
-Severity adjusted geometric length of stay
-HCAHPS Score
-30-day readmission rates
-Patients who left ED without being seen
-PSI 02 death rate in low mortality DRGs
-Composite: Appropriate use of medical imaging
-Composite: Patient safety
-Composite: Timeliness of care

Control (Organizational, Market):

-Region (Midwest, Northeast, South, West)
-Core based Statistical Area Type (metropolitan, micropolitan, rural)
-Bed size (1-99 beds, 100-399 beds, 400+ beds)
-Market Concentration (unconcentrated, moderately concentrated, highly concentrated)
-Percent Medicaid discharges
-Member of Council of teaching hospitals
-System Member

Independent / Predictors of outcomes:

-Lean adoption
-Number of years with Lean
-Number of units with Lean
-Lean Education and Training Index (range: 0-4)
-Leadership Commitment Index (range: 0-8)
-Daily management system: C-suite (9-item index)
-Daily management system: Managers (9-item index)

Regression Analysis 1 - Lean Adoption and Hospital Performance Measures

Dependent Variable (N=280 Public Hospitals)	b for Lean Adoption	p-value
30-day risk adjusted mortality index	0.062	0.324
Adjusted inpatient expense per discharge	-0.203	0.045
EBITDA margin	0.114	0.055
Severity adjusted geometric length of stay	0.006	0.928
HCAHPS score	0.116	0.072
30-day readmission rates	-0.053	0.427
Patients left without being seen	0.024	0.668
Death rate in low mortality DRGs	-0.064	0.360
Composite: Appropriate use of medical imaging	0.168	0.006
Composite: Patient safety	0.074	0.133
Composite: Timeliness of care	0.097	0.007

Results: Regression Analysis 1

- Improved efficiency/financial viability
  - Decreased adjusted inpatient expense per discharge
  - Increased EBITDA margin
  - Increased Composite: Timeliness of care
- No significant association with quality of care
  - Focus on clinically-orientated quality outcomes
- Consistency with prior research
  - EBITDA & HCAHPS

Regression Analysis 2 - Extent of Lean Implementation and Hospital Performance Measures

Dependent Variable (N=280 Public Hospitals with Lean)	b for Number of years (p-value)	b for Number of Lean Units (p-value)	b for Education and Training (p-value)	b for Leadership Commitment (p-value)	b for DMS: C-suite (p-value)	b for DMS: Managers (p-value)
Adjusted inpatient Expense	0.001 (0.994)	-0.145 (0.396)	-0.165 (0.025)	-0.080 (0.568)	0.131 (0.429)	-0.100 (0.586)
HCAHPS Score	0.084 (0.385)	0.303 (0.002)	-0.129 (0.183)	0.054 (0.594)	0.237 (0.022)	0.076 (0.532)
EBITDA margin	0.168 (0.867)	0.243 (0.049)	0.120 (0.304)	0.038 (0.750)	0.286 (0.042)	0.260 (0.050)
Composite: Appropriate use of medical imaging	0.249 (0.011)	-0.097 (0.433)	0.058 (0.588)	0.243 (0.031)	-0.095 (0.477)	0.038 (0.780)
Composite: Timeliness of care	0.214 (0.041)	-0.090 (0.452)	-0.105 (0.307)	0.251 (0.021)	-0.198 (0.124)	-0.043 (0.742)

Results

- Partial support towards second hypothesis
- Extent of implementation plays critical role in performance measures
  - Importance of senior leadership engagement
- Establishing a culture through clinical staff education and training

Limitations

- Methods of NSL Survey distribution and responses
- Lack of information from IBM health database
- Quality of implementation
    - Call for research assessing the extent of implementation

Discussion

- Level of commitment among hospital leaders plays a major role in Lean success

- In Public hospitals, < ½ of overall performance indicators showed significant associations with lean adoption or implementation

  - Financial measures (inpatient expense per discharge, EBIDTA margin)

  - Patient experience (HCAHPS ratings)

  - Quality of care (Utilization: appropriate imaging, Operations: timeliness of care)

- Leadership that fosters a culture of staff engagement and improvement in US public hospitals can benefit patient care in the safety net

Thank you!

"Improved Lean efforts starting with upper management employees can facilitate reform efforts in the healthcare system which can result in more extensive impacts on public hospital performance in the US."

We welcome your questions and