Center for Advanced Manufacturing & Lean Systems

UTSA THE UNIVERSITY OF TEXAS AT SAN ANTONIO

Value Stream Mapping: Applied to health care systems – Background & Case Studies

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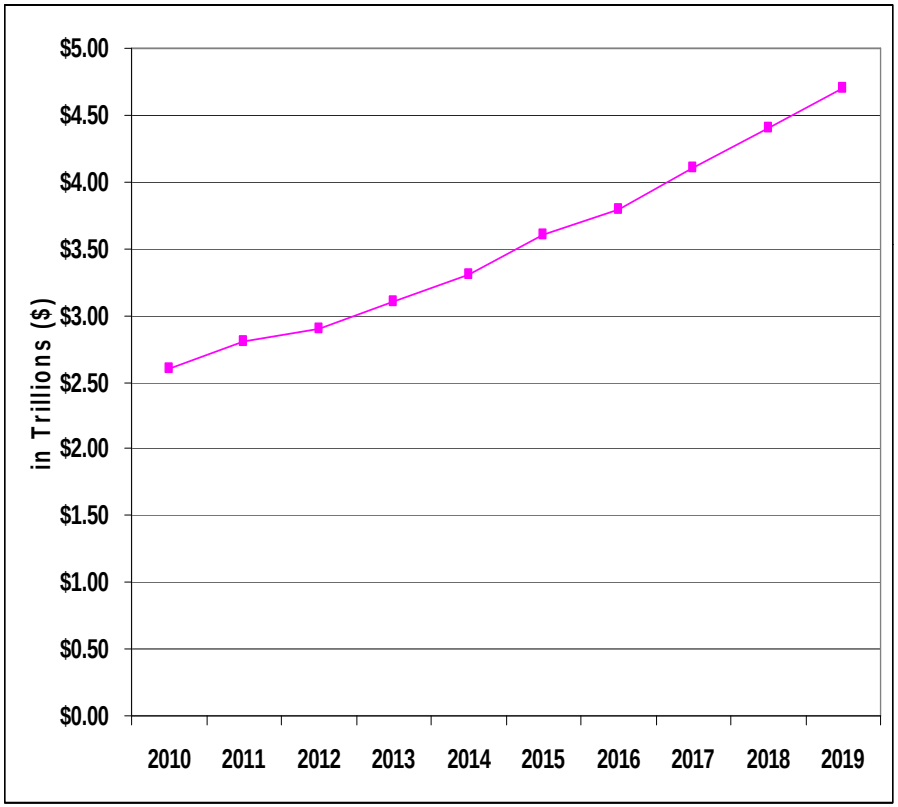
Agenda

- Background
- Overview of Value Stream Mapping (VSM)
- Objective
- Methodology
- Results/Findings
- Conclusions
- Future Research
- References

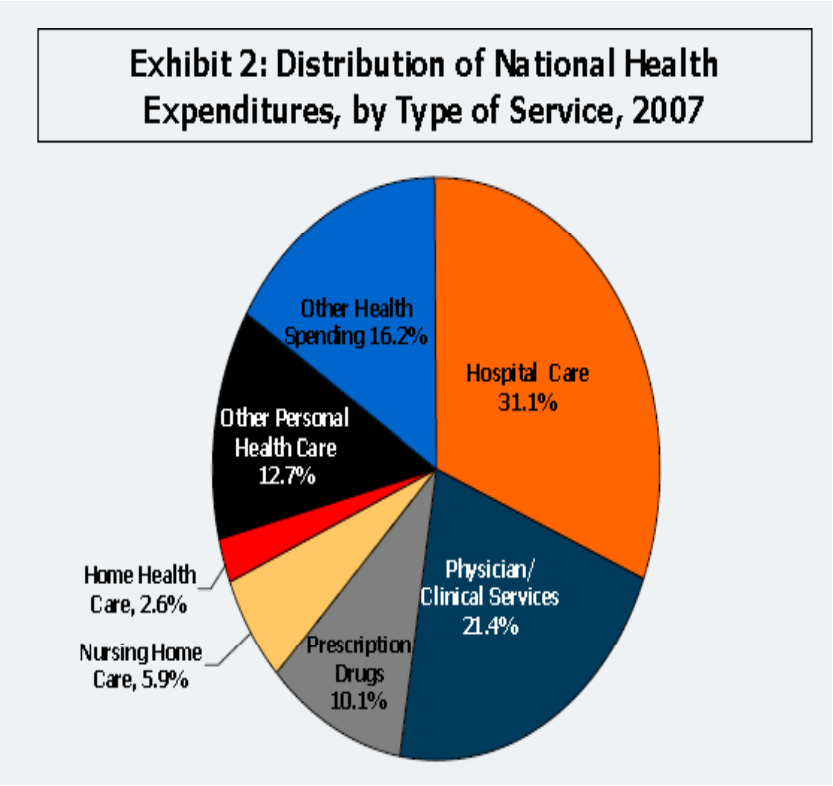
Background: Why lean in healthcare?

Budget Projection



Foster, S.R. and K.S. Heffler. *Updated and Extended National Health Expenditure Projections, 2010-2019*. 2009 06-29-2009

Expenditure Type



Foundation, K.F. *Trends in Health Care Costs and Spending*. Kaiser Family Foundation 2009.

Why lean in healthcare?

- 12% of Emergency Department (ED) patients are admitted to hospital
- 7 out of 10 are seen in 4 hours
- 2 % leave without being seen
- Work load, Stress or Fatigue among health professionals (74%)
- Too little time spent with patients (70%)
- Too few nurses (69%)

Study by CDC

Eller, A., *Rapid Assessment and Disposition: Applying LEAN in the Emergency Department.* Journal for Healthcare Quality, 2009. **31**(3): p. 17-22

Value Stream Mapping (VSM)

A simple tool to ***visualize the flow of value streams and waste***

- Identify **value-added steps** in your processes from the customer's point of view
- Visualize **information and material flow**
- Focus on process improvements
- Get everyone on the same page with a common vision of the **current state** and the **future state** of operations

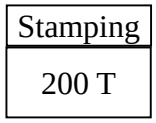
VSM: Typical Performance Metrics

- Emphasis on ***Time-based Performance***:
  - Cycle Time
  - Lead Time
  - etc…
- Other ***Add-on Indicators***:
  - Cost
  - Patient safety
  - Quality
  - Patient wait times
  - Customer satisfaction, etc…

Common VSM Icons

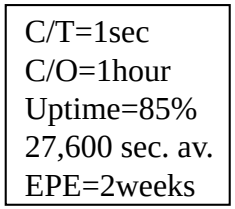
Rother and Shook (2003). *Learning to See*, The Lean Enterprise Institute.

Material Flow



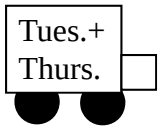
Process

Outside Sources



Data Box

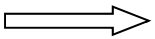
Inventory

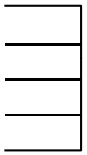


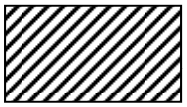
Truck Shipment

First-In-First-Out Sequence Flow


Push Arrow


Finished Goods to Customer

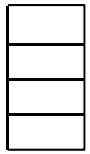

Supermarket


Supermarket Parts


Physical Pull/Withdrawal

General


Operator


Buffer or Safety Stock

Kaizen Burst

Information Flow

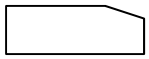

Manual Information Flow


Electronic Information Flow

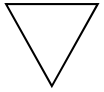
Schedule

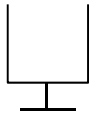

Informal Visual Control

Load Leveling Box


Production Kanban


Withdrawal Kanban


Signal Kanban


Kanban Post


Sequenced-Pull Ball

Objective

- Examine how VSM can be successfully used to:
  - Visualize waste
  - Reduce cost
  - Improve quality in the health care

Methodology

- Examine the literature related to healthcare and VSM
- Classify the articles based on:
  - the methodology used,
  - the area of application of VSM, and
  - the metrics used to measure the success

Results/Findings

Methodology	Application	Metrics	Reference
VSM	Hip fracture patients	Door-to-theatre (DT) time, admission into trauma beds, pre- and post-operative medical assessment	Chakrabarti, et al. (2009)
Time VSM	Ambulatory triage desk (Emergency Department)	Time of patient arrival to first staff contact; nursing evaluation; wait times; and arrival until room placement time	Kaale, et al. (2005)
VSM	Emergency Department	% of patients ranking the overall care as "Very Good", average monthly expenses per patient per month, average number of patient visits per month	Dickson, et al. (2009 a, 2009 b)
VSM	Emergency Department	Average Length of Stay, % Patients left without being seen	Eller, A. (2009)
VSM + Lean	Emergency Department Rural Health Care Hospital (99 bed)	Average Time Searching for Supplies, Average Time of Discharge Process	Snyder and McDermott (2009)
VSM	Physician's Clinic Obstetrics/Gynecology (OB), Family Practice, and Internal Medicine	Reduce staff stress level, improve overall performance	Lummus, et al. (2006)
VSM	Medication delivery system errors	Cost of human resource ($/yr)	Mazur and Chen (2008)
VSM	Reduce wait times in the Emergency Department	Overall Patient Satisfaction scores, Accuracy of triage nurse to predict discharge, time to see physician, length of stay	Ng, et al. (2010)
VSM	Computerized Physician Order Entry system	Net Present Value	Kocakulah and Upson (2005)

Results/Findings

Methodology	Application	Metrics	Reference
VSM +Lean tools	Histology Lab Workflow	Turn around time and errors	Buesa (2009)
VSM +Lean tools	Prescription renewal handling by application	Reduction of processing time	Hummer and Daccarett (2009)
VSM	Laboratory, Emergency Department, Surgery department, house keeping	Patient Satisfaction, Cost Savings, Time to prepare a room	Serrano and Slunecka (2006)
VSM + Lean Tools	Emergency Department – Flinders Medical Care Australia	% Wait time, % acute separations that were unplanned readmissions, Length of stay for medical patients admitted as emergency cases, Number of notification of serious medicolegal adverse events to its insurers.	Ben-Tovim, et al. (2008)
Process Map + Six Sigma (LeanSigma)	Pharmaceutical Industry	Cycle times of synthesis, compound analysis and purification	Andersson, et al. (2009)
Process Map + Kaizen + LeanSigma	Imaging Department – Mexico	Increase patient satisfaction	Garcia-Porres, et al. (2008), García-Porres and Ortiz-Posadas (2009)
VSM + Lean	Canadian Health care Provides	Wait times, Patient Safety, Culture change and Quality	Fine, et al. (2009)
VSM + Lean + 5S	Blood Transfusion Establishments - France	Quality and Safety of Blood Products	Bertholey, et al. (2009)

Key Decision Points of Lean Deployment

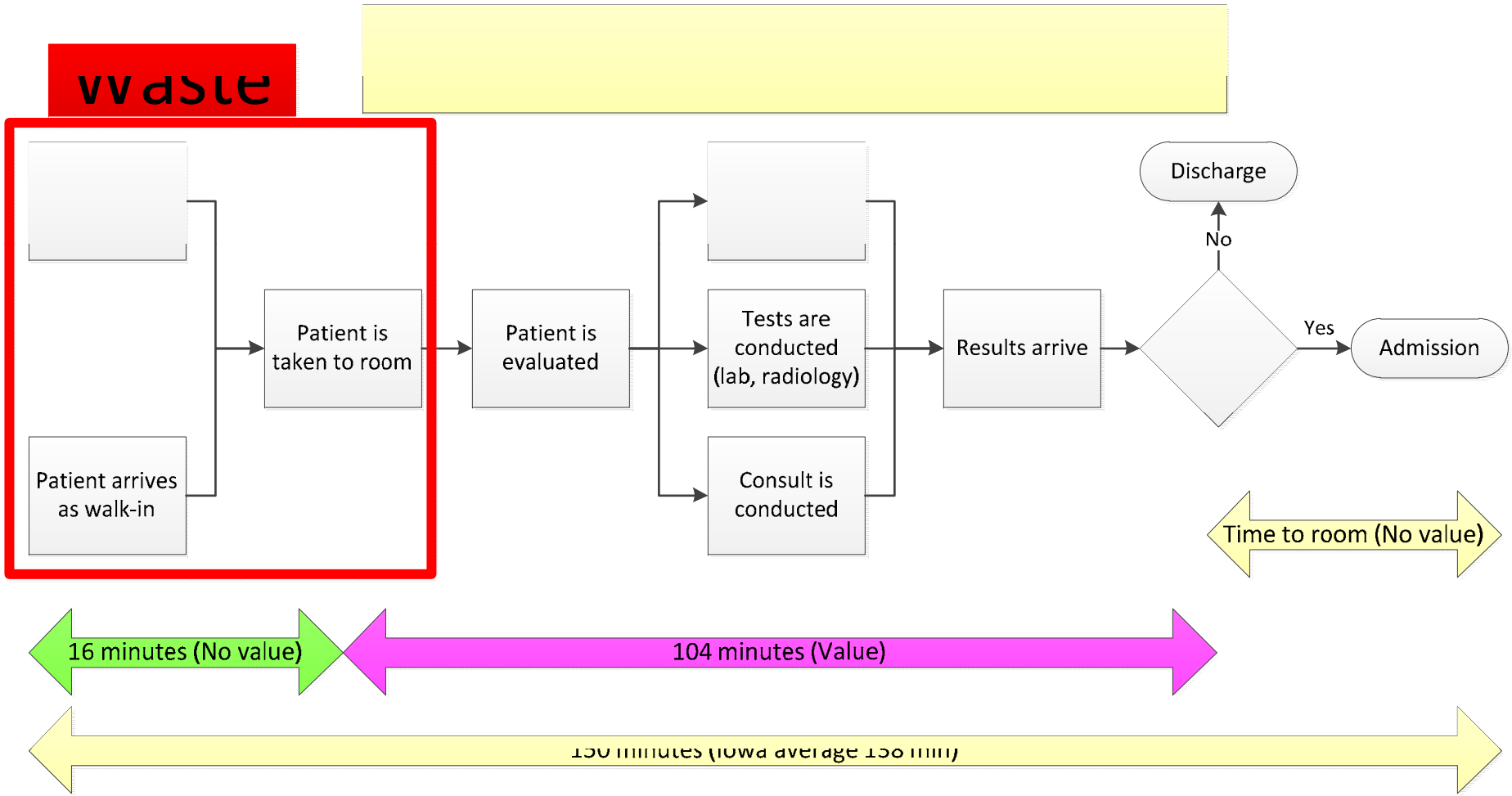
Hospital	Who Led the Change?	Who Drove Work?	How Was Knowledge or Expertise Acquired?	Crisis of Lever	First Value Stream Mapping	First Win	Objective
HDGH	EVP	LEA(R)N coordinator	Training, consultant	ED in newspaper	Portering	ED	Reduce ED wait times
UHN	PMO senior manager	PMO	Hire consultant	CEO's transformation agenda leveraged to introduce lean	Bullet rounds (GIM)	ED-GIM	Reduce ED wait times
St. Joseph's	Former VP, now CEO	Manager of access services	Consultant	VP challenge	ED admit and discharge processes	ED-GIM	Improve patient safety
FHHR	CEO, QI	Lean expert	Hire consultant	Provincial government brought CEO to see Lean at VMMC	ED flow	ED	Change in culture
NYGH	VP	Lean deployment leader chaired Flow Steering Committee	Hire consultant	SARS outbreak and subsequent leadership transformation	ED-GIM	ED-GIM	Move patient safety and quality agenda

CEO = chief executive officer; ED = emergency department; EVP = executive vice-president; FHHR = Five Hills Health Region; GIM = general internal medicine; HDGH = Hotel-Dieu Grace Hospital; NYGH = North York General Hospital; PMO = project management office; SARS = severe acute respiratory syndrome; QI = quality improvement; UHN = University Health Network; VMMC = Virginia Mason Medical Center; VP = vice-president

Fine, B. A., B. Golden, et al. (2009). "Leading Lean: A Canadian Healthcare Leader's Guide." Healthcare Quarterly **12**(3): 32-41.

VSM – Visualize Waste

Example of VSM in Emergency Room



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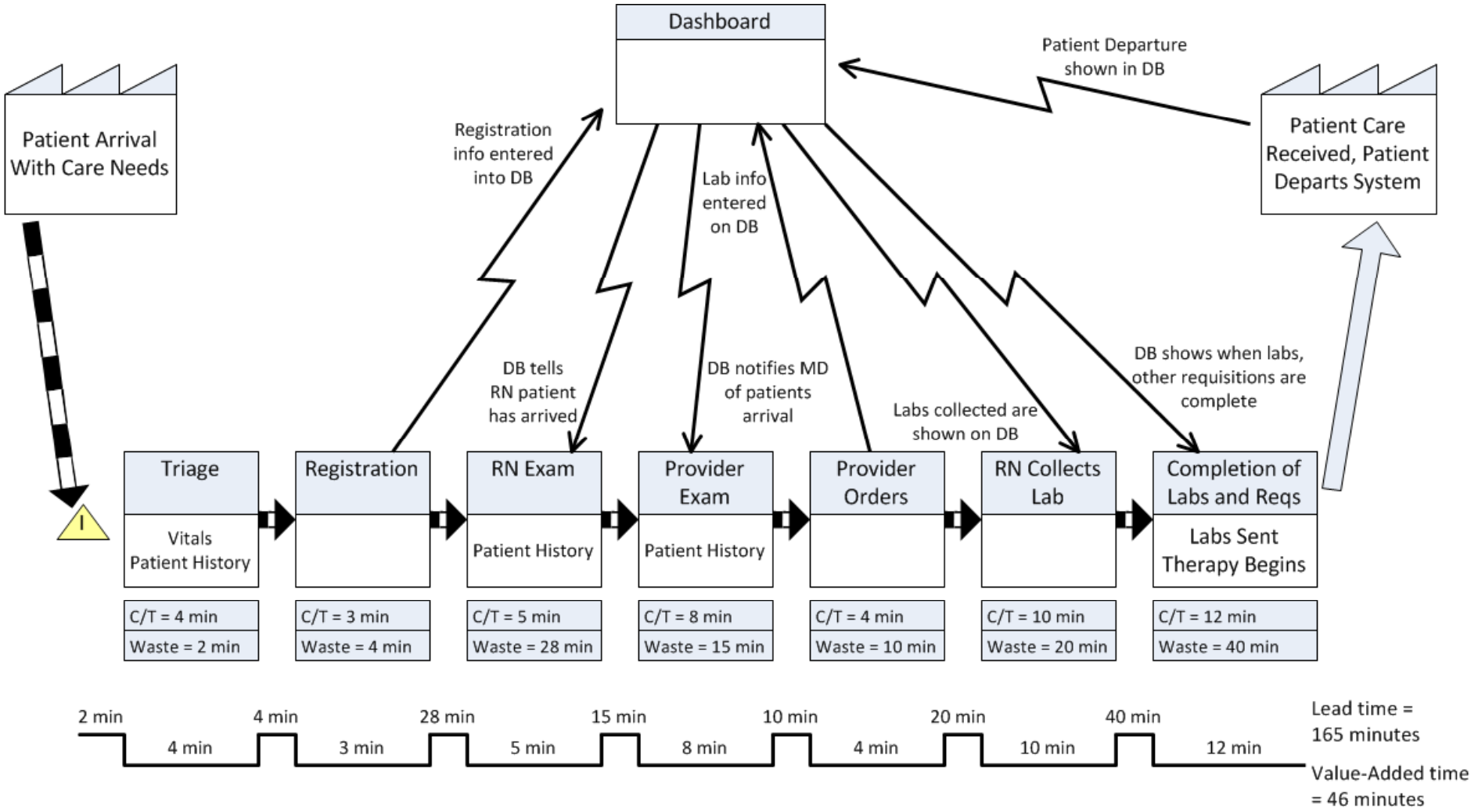
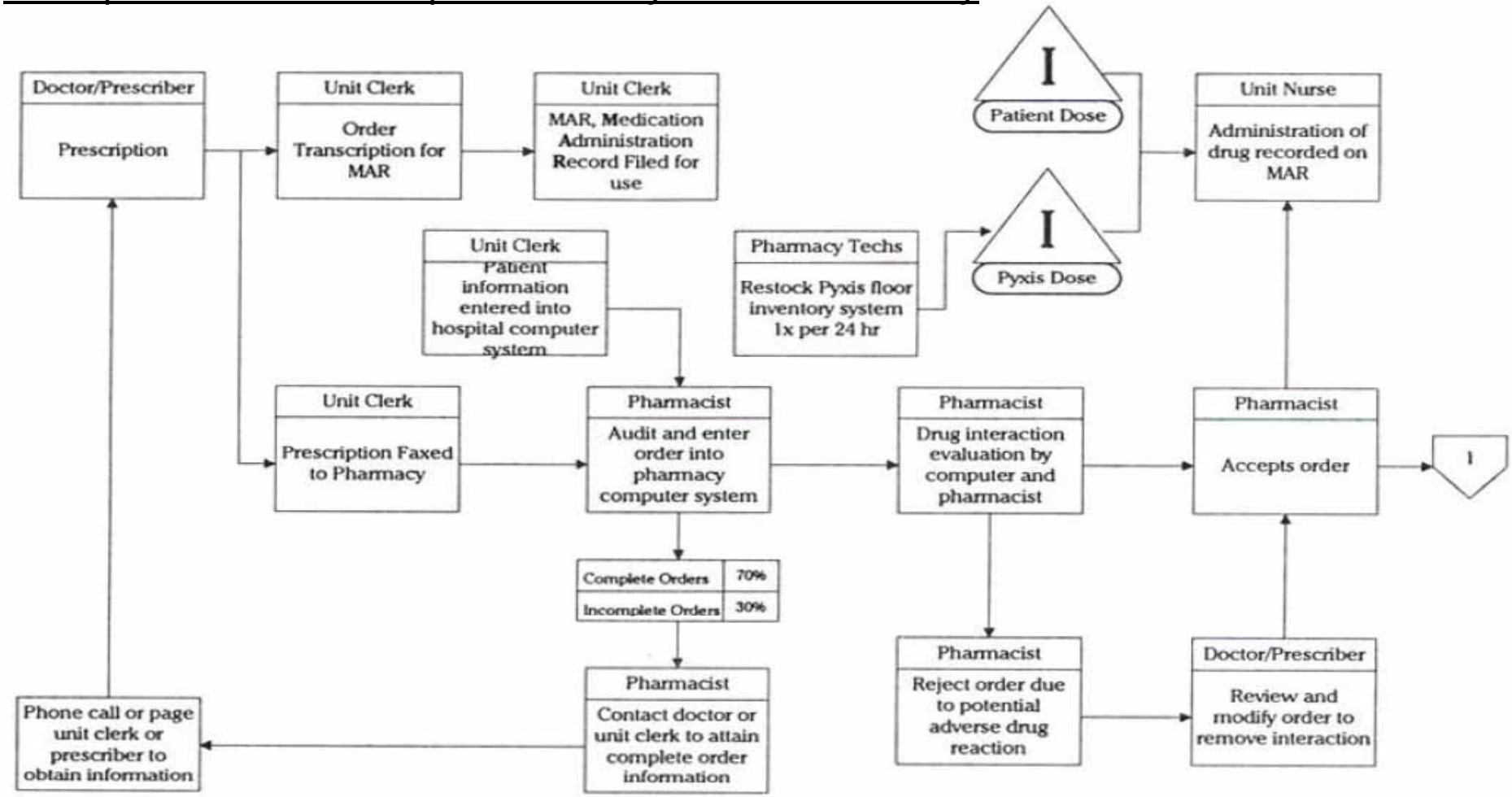


Dickson, E. W., S. Singh, et al. (2009). "Application of Lean Manufacturing Techniques in the Emergency Department." The Journal of Emergency Medicine **37**(2): 177-182.

VSM – Reduce Cost

Current Sate

Example of VSM in Computerized Physician Order Entry

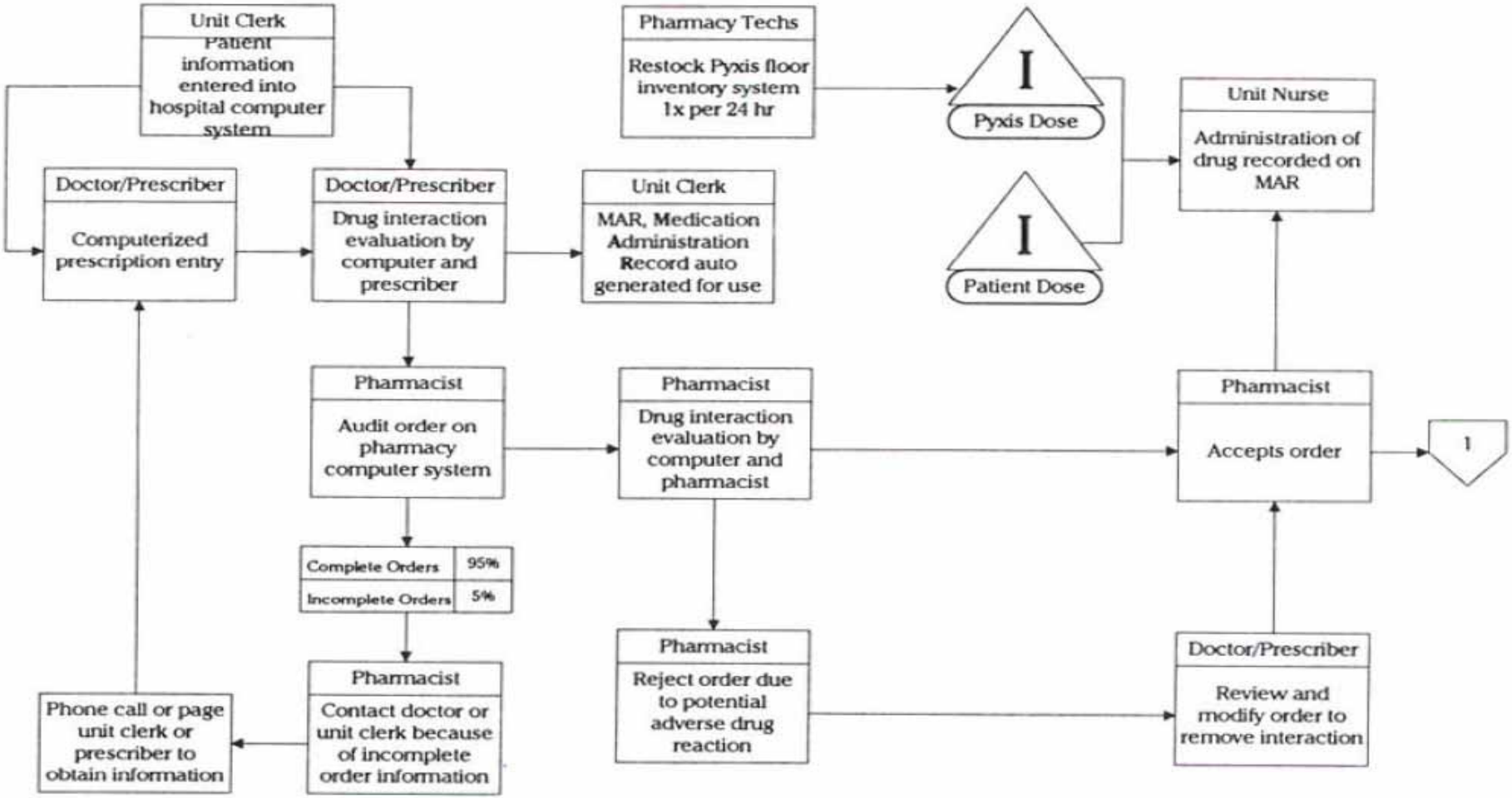


Kocakulah, M.C. and J. Upson, *Cost analysis of computerized physician order entry using value stream analysis: a case study.* Research in Healthcare Financial Management, 2005. **10**(1): p. 13(13)

VSM – Reduce Cost

Future Sate

Example of VSM in Computerized Physician Order Entry



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VSM – Reduce Cost

Example of VSM in Computerized Physician Order Entry

PROJECTED REDUCTION IN MEDICATION ERRORS

Error Category	*Period 1*	*Expected Reductions*	*Projected Levels*
Illegible orders	111	78%	25
Incomplete orders	161	71%	47
Incorrect orders	323	46%	174
Drug therapy problems	245	9%	224
ADR Totals	568		398

PROJECT RETURNS ANALYSIS

Capital Costs	$1,900,000
Interest Rate (Prime + 3%)	7.5%
Cost Reductions	
13 FTE positions @ $40K each	$520,000
170 ADR's @ $800 each	$135,686
Total Reductions per year	$655,686
Added Costs	
IT & MIS support costs	$500,000
Net Cost Savings (Loss)	**$155,686**
5 Year NPV	($1,270,112)
5 Year IRR	-24%

ADR COST SAVINGS ESTIMATE

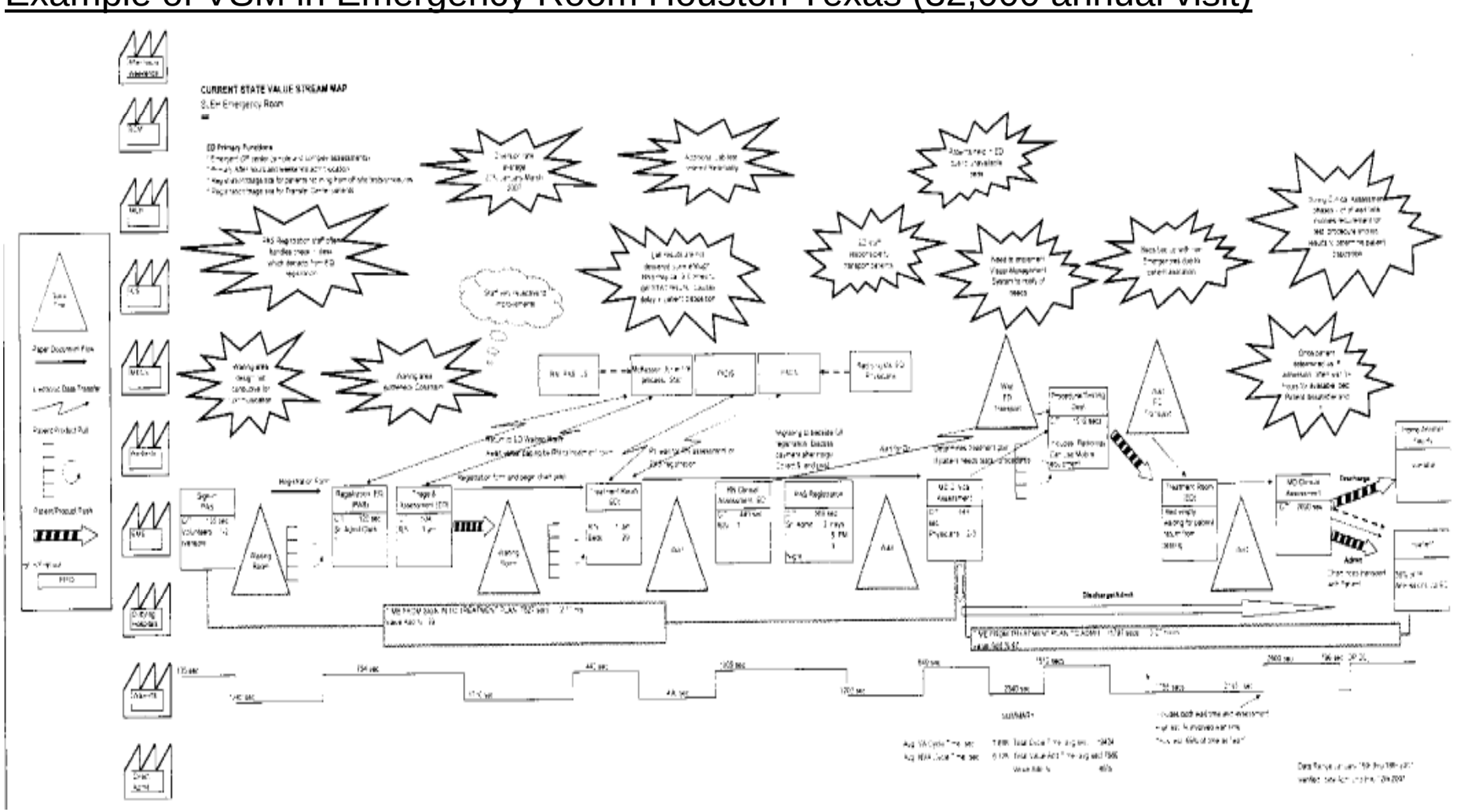
		ADR COST ESTIMATES		
Pre-CPOE ADR Errors	568			
Post-CPOE ADR Errors	398	*1*	*2*	*3*
Reduction in ADR Errors	170	**$800**	$2,000	$4,685
Total Cost Estimate		**$135,686**	$339,216	$794,613

Kocakulah, M.C. and J. Upson, *Cost analysis of computerized physician order entry using value stream analysis: a case study.* Research in Healthcare Financial Management, 2005. **10**(1): p. 13(13)

VSM – Improve Quality

Current Sate

Example of VSM in Emergency Room Houston Texas (32,000 annual visit)

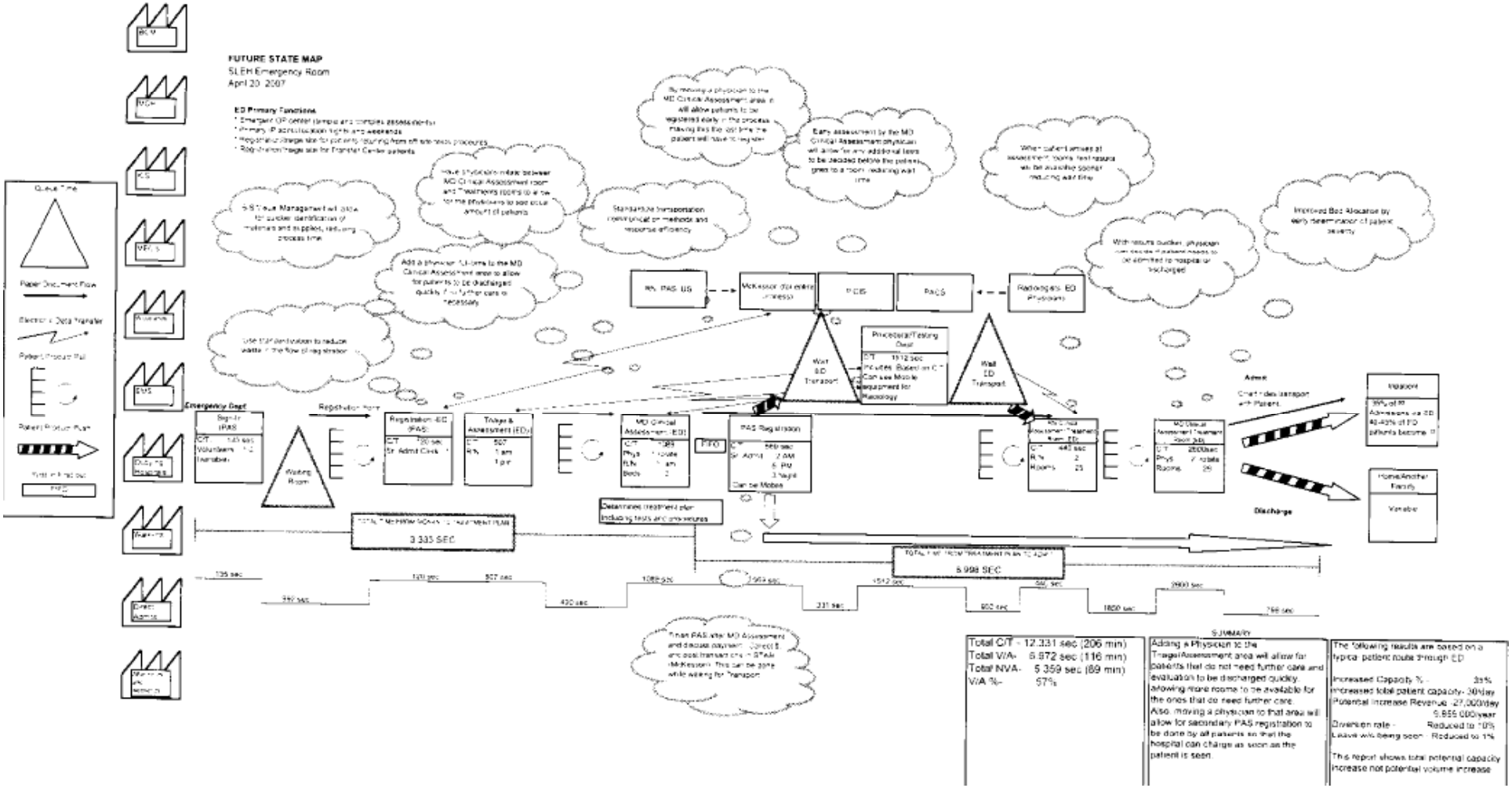


Eller, A., *Rapid Assessment and Disposition: Applying LEAN in the Emergency Department.* Journal for Healthcare Quality, 2009. **31**(3): p. 17-22

VSM – Improve Quality

Future Sate

Example of VSM in Emergency Room Houston Texas (32,000 annual visit)



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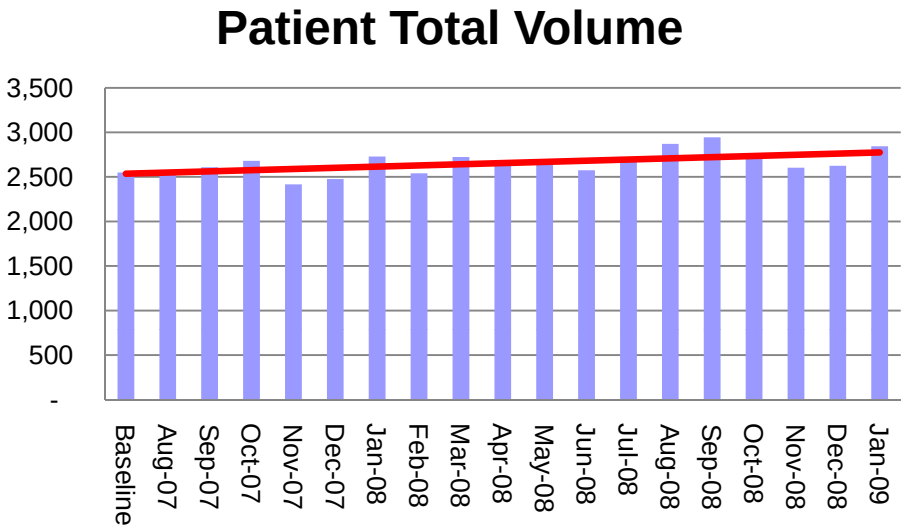
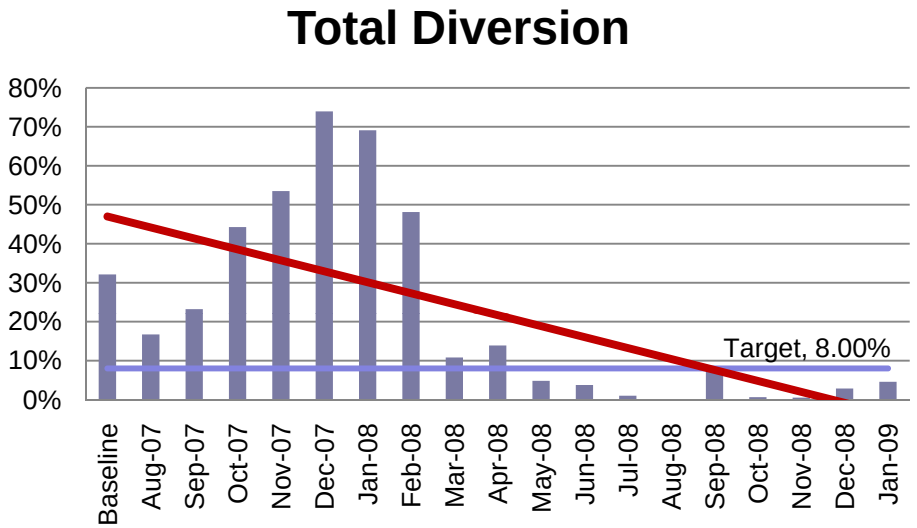
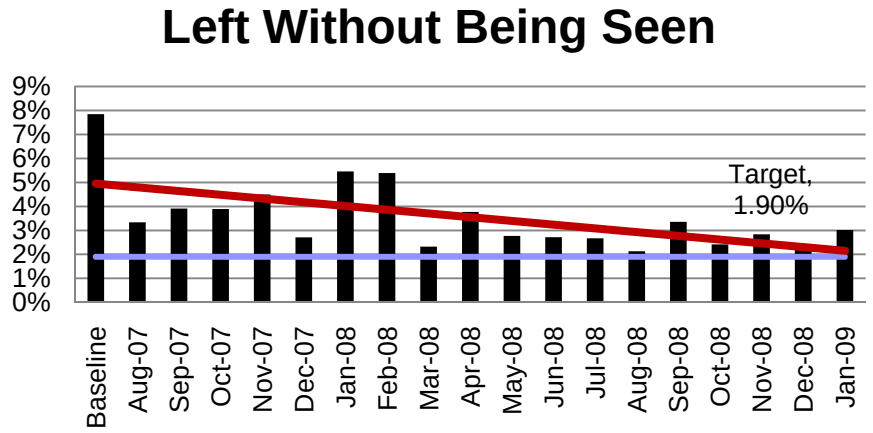
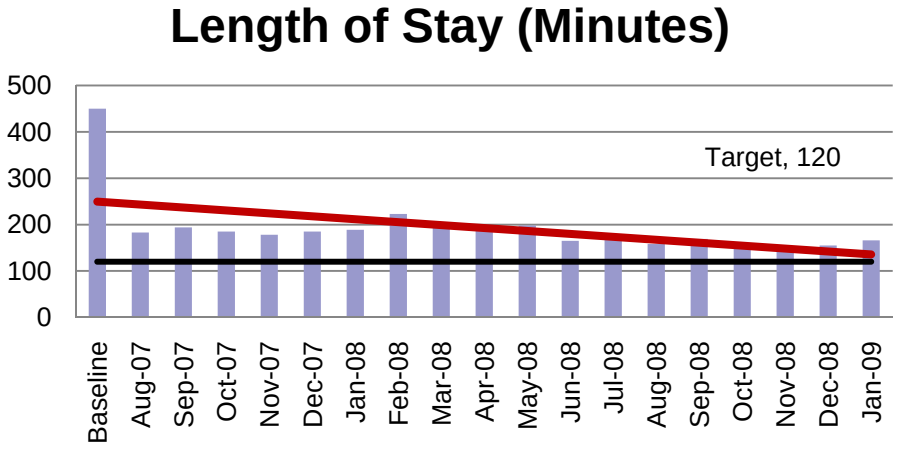
VSM – Improve Quality

Example of VSM in Emergency Room Houston Texas (32,000 annual visit)



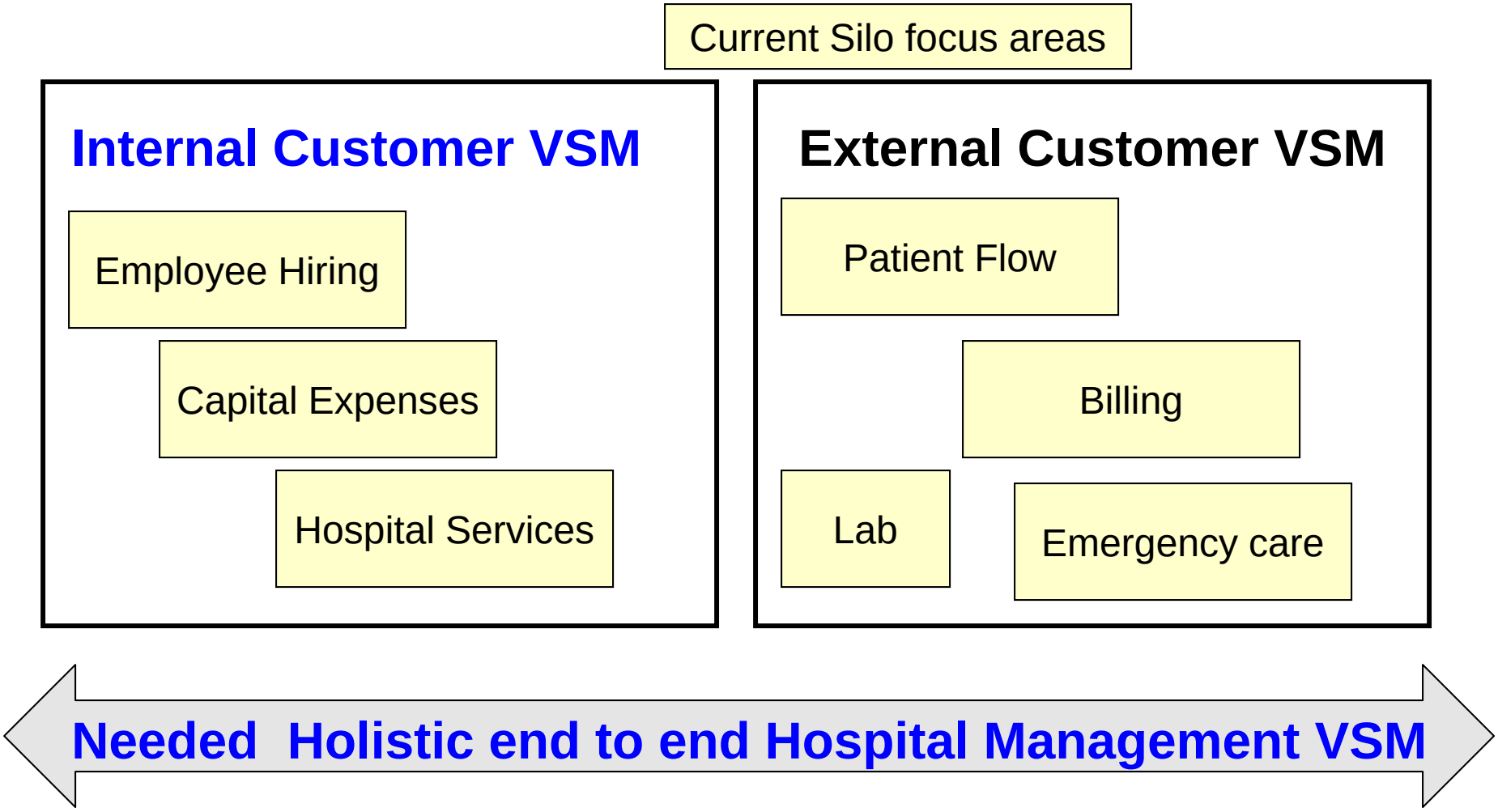






Eller, A., *Rapid Assessment and Disposition: Applying LEAN in the Emergency Department.* Journal for Healthcare Quality, 2009. **31**(3): p. 17-22

Gap in Literature



Conclusions

- Various examples were shown to demonstrate that VSM can be used to successfully in healthcare to
  - Visualize waste
  - Reduce cost
  - Improve quality

Future Research

- Complete internal operations of hospital VSM (employee hiring to retention)
- Complete patient care and billing VSM
- Establish an end-to-end VSM
  - Focusing on all aspects of hospital management:
    - Internal hiring,
    - Purchasing,
    - Patient care, and
    - Patient billing

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Questions?