

# Academy of Architecture for Health On-line Professional Development

## LEAN Concepts

## Drive Healthcare Architecture Planning and Design

## Health Care 101 Series

10, October, 2017

2:00 pm – 3:00 pm ET

1:00 pm – 2:00 pm CT

12:00 am – 1:00 pm MT

11:00 am – 12:00 pm PT

### Presenter

**Rudy Santacroce, PE, CLSSBB, PMP, DSHS**  
Callison/RTKL

### Moderator

**John Kreidich, AIA, CHC, LEED AP B+C**  
McCarthy Building Companies

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# Health Care 101 Series

The Academy's multi-channel on-line approach provides emerging professionals, journeymen, and master professionals with convenient and economical opportunities to develop their chosen area of interest.

The HC 101 Series sessions are tailored to provide budding healthcare design professionals with conceptual and practical primer-level knowledge.

Series topics include: Master planning; Programming; Ambulatory care; Clinical support services; Emergency; ICI-acute care; Imaging; Long-term care; Maternal care; Mental health; Surgery.

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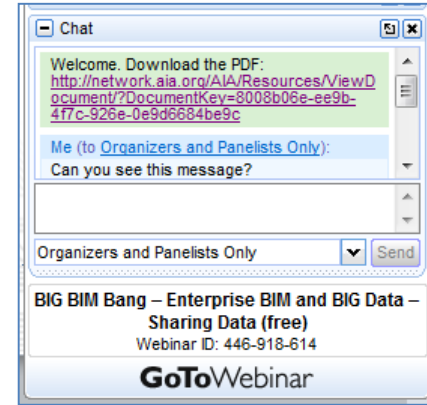
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Content-related questions will be answered during the Q&A portion at the end as time allows.

Tech support questions will be answered by AIA staff promptly.



# LEAN Concepts Drive Healthcare Architecture Planning and Design

## Presenter



Rudy Santacroce, PE, CLSSBB, PMP, DSHS  
Callison/RTKL



# LEAN CONCEPTS DRIVE HEALTHCARE ARCHITECTURE PLANNING AND DESIGN

ACADEMY OF ARCHITECTURE FOR HEALTH  
10 OCTOBER 2017

Rudy Santacroce, PE, CLSSBB, PMP, DSHS

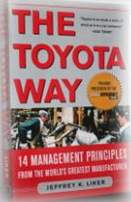
# LEARNING OBJECTIVES

- Understand the **components and history of Lean**
- Understand **Lean as an emerging science** as applied to US healthcare
- **Review a case study** of Lean's application to the design process of renovating a Neuro ICU
- Demonstrate how Lean principles can be **applied to the architecture design process** prior to programing and schematics



# LEAN AND SIX-SIGMA VERNACULAR

PERFORMANCE IMPROVEMENT



Lean  
Eliminates Waste

Six-Sigma  
Eliminates Variation



Faster

Consistent

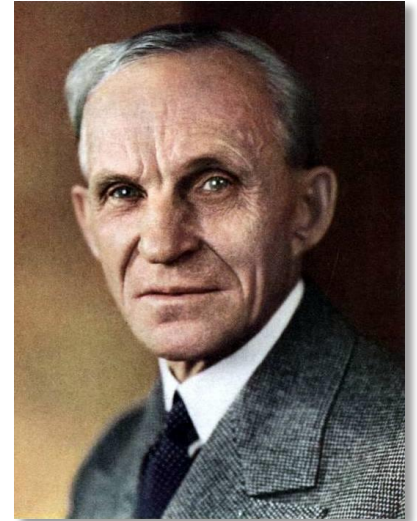
Achieves Simplicity

Achieves Stability

REDUCED COSTS, IMPROVED QUALITY

# EARLY 20<sup>TH</sup> CENTURY

- **Henry Ford focused on waste** while developing his mass assembly manufacturing system
- Ford's **success has startled the country**, almost the world, financially, industrially, mechanically
- Ford's early success, however, was **not sustainable**
- What Ford accomplished represented the "special case" **rather than a robust lean solution**
- His methods were **built for a steady-state environment** and did not respond well to uncertain, dynamic business decisions and the need for innovation
- **Significant decline in efficiency** when company forced to introduce the follow-on to the Model-T



# POST WWII AMERICA

- Ford's mass production system **failed to incorporate the notion of "pull production"** and thus often suffered from over-production.
- However, post WWII brought a tremendous **period of economic growth to the US** and with it the return of prosperity
- The number of **automobiles produced annually quadrupled** between 1946 and 1955
- A housing boom, stimulated in part by easily affordable mortgages for returning servicemen, fueled the expansion
- Across the world however, Post War economies were very low and *the need for innovation was born...*





# ORIGINS OF LEAN

- Concept derived from manufacturing systems
- **Taiichi Ohno**, engineer for Toyota, drew heavily on the work of **W. Edwards Deming** and the writings of **Henry Ford**
- Traveled to the United States to witness Ford's assembly line; not impressed
- While shopping in a supermarket they observed the simple idea of an automatic drink re-supplier; when the customer wants a drink, he takes one, and another replaces it...



# ORIGINS OF LEAN

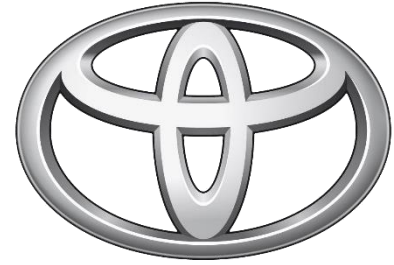
- 30+ years Taiichi Ohno sought to eliminate waste within Toyota
- Basic concepts became pillars of Toyota Production System:
  - **Jidoka:** Stopping production at every defect ensuring absolute quality
  - **JIT:** Just in time reduces in-process inventory and its associated costs



## Toyota Production System (TPS):

*The Toyota Production System strives for perfection by providing a defect free product, one request at a time when wanted and needed, safely and with no waste.*

# EARLY LEAN ADOPTERS



**TOYOTA**



**CONSTRUCTION  
PRODUCTS**

**FedEx**



**Bell**  
**Helicopter**  
A Textron Company



**JOHN DEERE**

**CALLISON RTKL**  
A DESIGN CONSULTANCY OF ARCADIS



# HEALTHCARE TODAY IN THE US...

## DESCRIPTIVE STATISTICS

- Largest single industry in the world
- **\$9,990/person/yr** on US health care (2015-CMS), **17.8% of GDP in 2016**
- Expenses increasing at 4 - 10% annually
- Major pressure to become more efficient and provide higher quality care; **Health Care Reform in the US.**



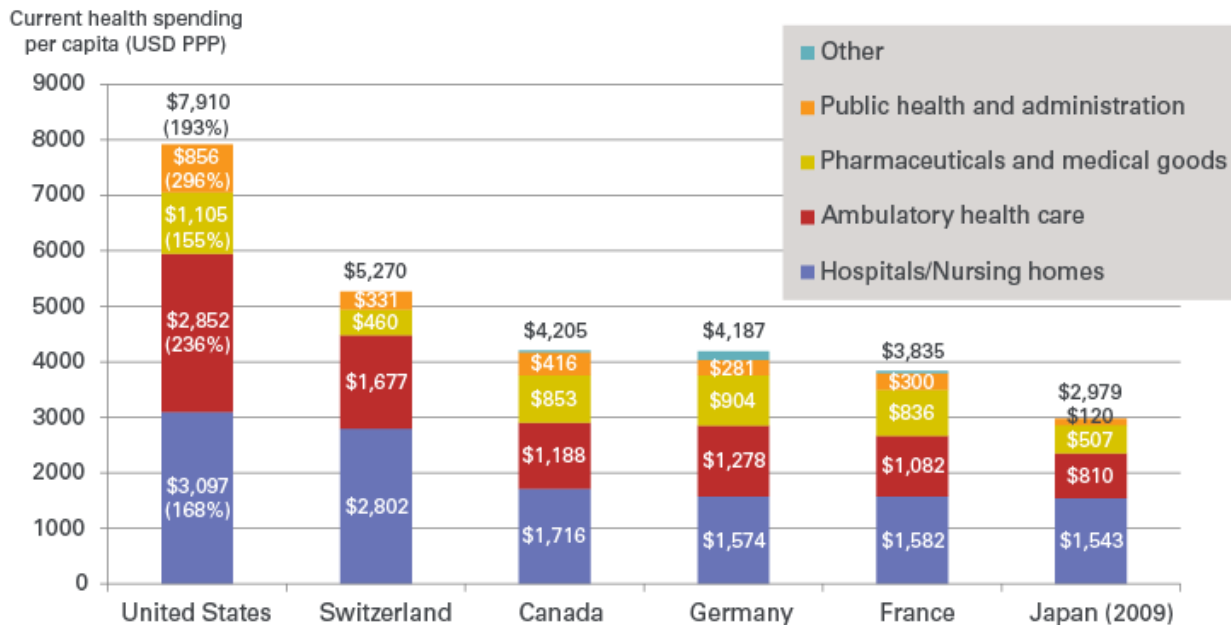
## COSTS OF POOR QUALITY

- Estimated **35%** of all healthcare costs = waste
- Duplication, non-value add, redundancies
- Medical errors, adverse events, preventable deaths, process defects
- **GOAL:** Do more with existing resources – safer, with increased productivity, shorter TAT

# HEALTHCARE SPENDING

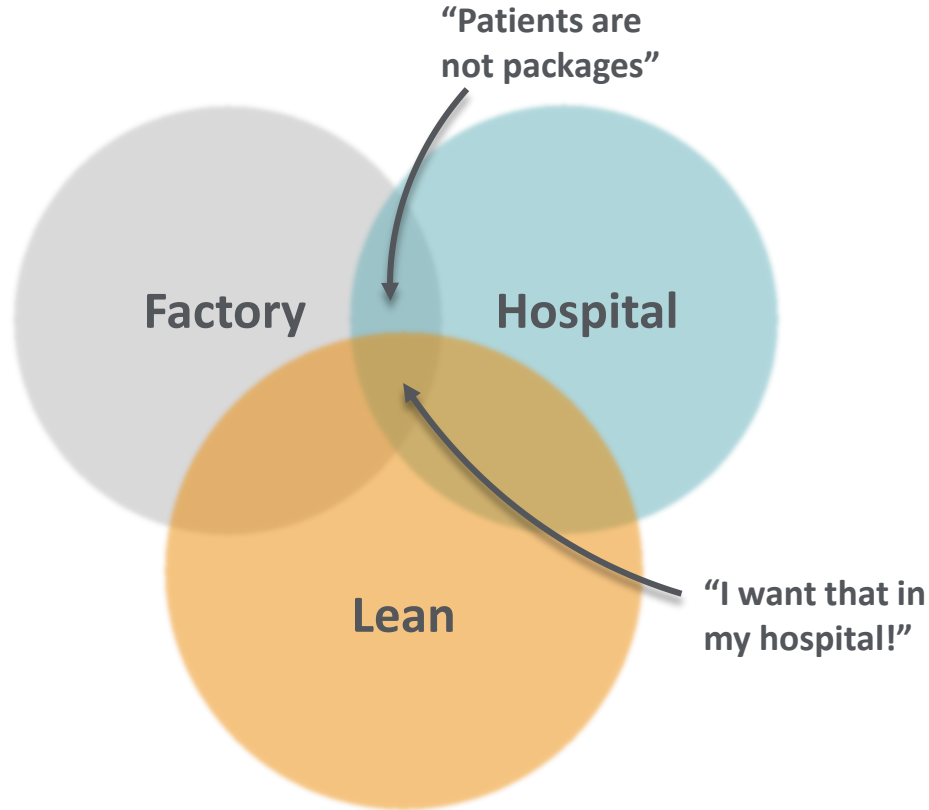
US health spending is much greater for all categories of care, particularly for ambulatory care and administration cost

2010 (or latest year available)



Note: Health spending excludes investments. The percentages in the US bar indicate how much more the US spends per category compared with the average of the five other OECD countries.  
Source: OECD Health Data 2012.

# LEAN THINKING APPLIED IN HEALTHCARE



# CORE TENET

“ *Toyota revolutionized our expectations of production; Federal Express revolutionized our expectations of service;*

*Processes that once took days or hours to complete are now measured in minutes and seconds. The challenge is to revolutionize our expectations of health care: to design a continuous flow of work for clinicians and a seamless experience of care for our patients.* ”

**Donald M. Berwick, MD**

Former President and CEO

Institute for Healthcare Improvement

# CORE TENET

## LEAN thinking, simply put, means using less to do more

- LEAN is not a cost-reduction program, but a management strategy applicable to all organizations focusing on improving processes
- Core idea: **determine the value** of any process by distinguishing value-added from non-value-added steps...
- ...eliminate the waste (*muda* in Japanese) so ultimately every step adds value

# LEAN Principles for Healthcare

- ts and
- se activities
- nts and families
- LOW** smoothly
- products and
- 
- CALLISONRTKL**  
A DESIGN CONSULTANCY OF ARCADIS

# KEY COMPONENTS

## Defining Waste: TIMWOODS

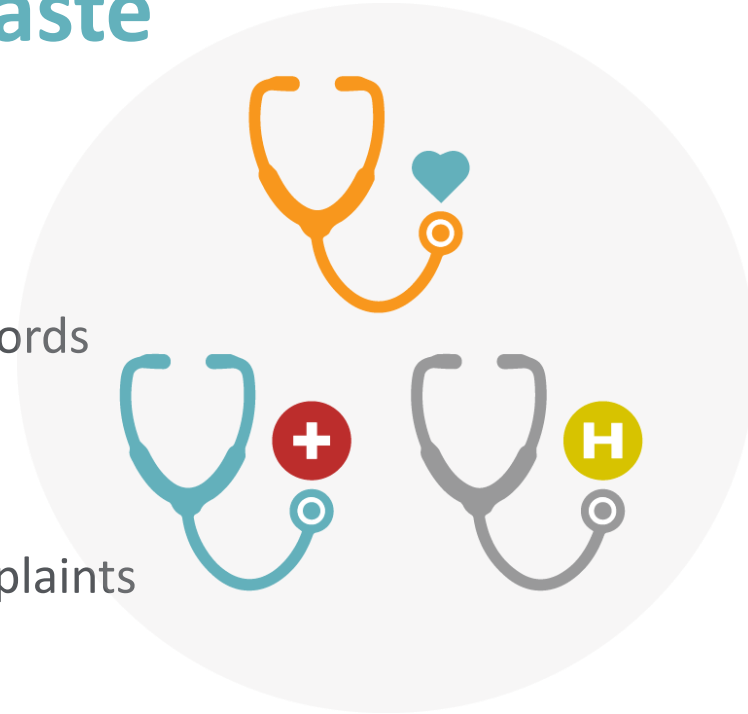
1. **TRANSPORTATION:** Movement not value-added
2. **INVENTORY:** Storing excess inventory
3. **MOTION:** Wasted walking/movement (ergonomics)
4. **WAITING:** Idle time for employees and equipment
5. **OVER-PROCESSING:** Doing more work than necessary
6. **OVER-PRODUCTION:** Producing more, sooner, faster than required
7. **DEFECTS:** Errors and/or rework; handoffs
8. **SKILLS:** Under utilizing capabilities



# KEY COMPONENTS

## Examples of Healthcare Waste

1. **Redundant capture** of patient information
2. **Excess supplies stored in multiple locations**
3. **Excess time** spent looking for charts and records
4. **Patient waiting** rooms
5. **Excess time** waiting for ancillaries
6. **Excess time** spent dealing with service complaints





# LEAN TOOLS

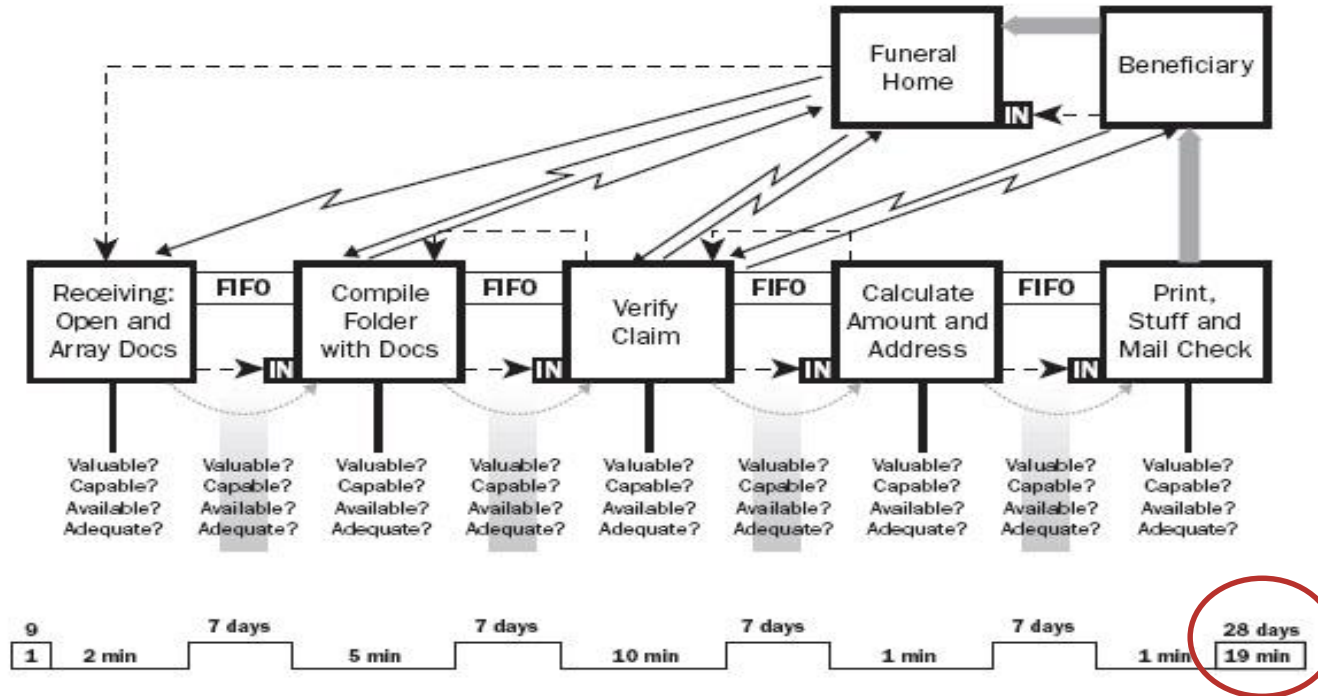
## Value Stream Map (VSM)

- Flows a product or service from beginning to end: **visual representation of process**
- Encompasses all **value add and non-value-added actions** required to bring product to the customer
- VSM results in **improved process flow** for a product/service while optimizing inventory and floor space

# LEAN TOOLS

## Value Stream Map (VSM)

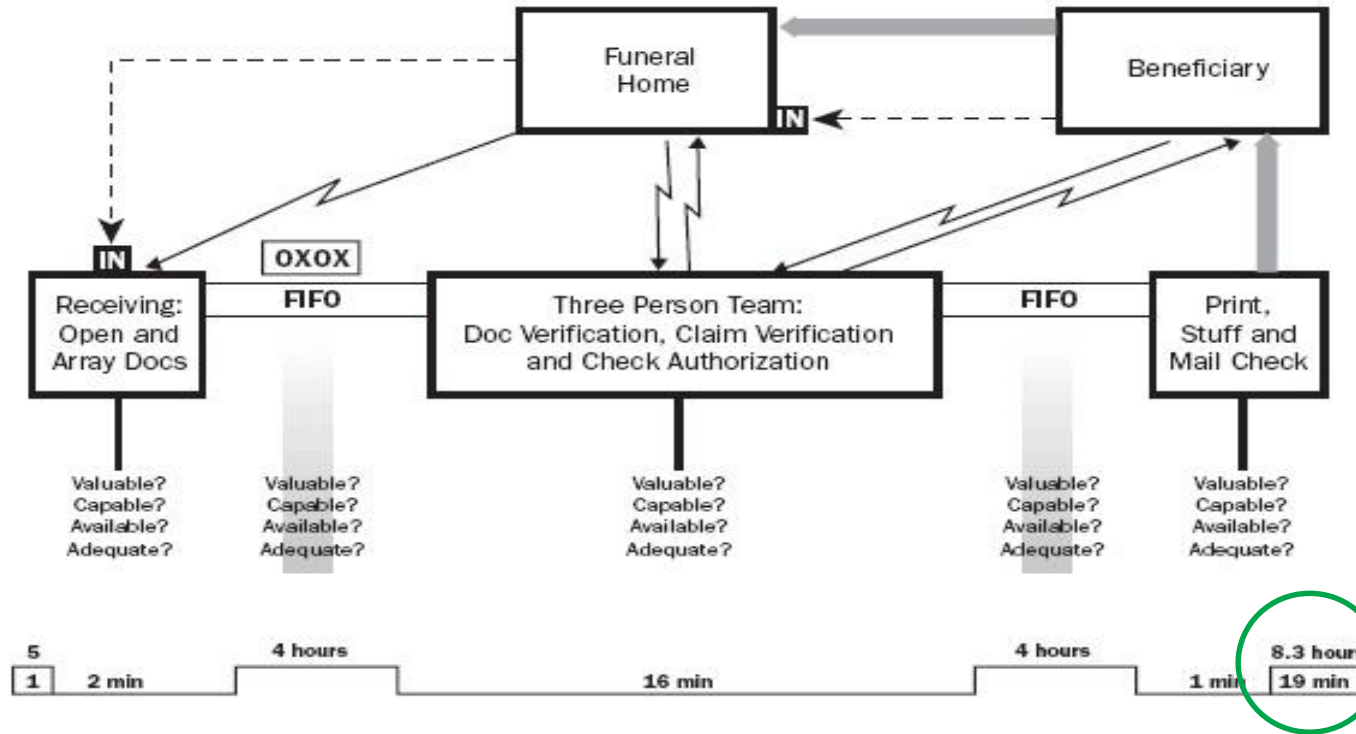
### Insurance Claim Processing: Current Process



# LEAN TOOLS

## Value Stream Map (VSM)

Insurance Claim Processing: Future State



# LEAN TOOLS

## Kaizen (Continuous Improvement)

- Focused on SPECIFIC problem solving events achieving gradual, orderly, and continuous improvement
- A Kaizen Event is a carefully planned, well structured team-based activity focused on solving problems in a process
- The Event is customer-driven and is based on a **plan, do, check, act** approach to problem solving and achieving continuous improvement
- Events are intensive three- or four-day workshops that analyzes a process and implements change; individual roles, responsibilities or expectations are outlined at end

# LEAN TOOLS

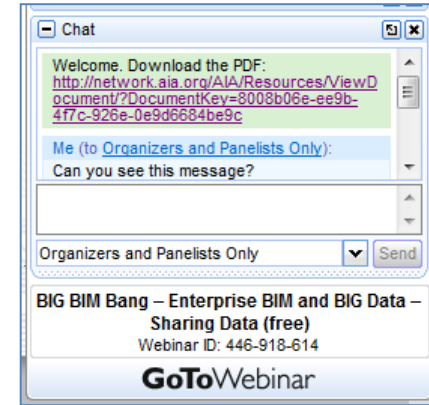
## Kaizen (Continuous Improvement)

- Kaizen events rely on **teamwork and building relationships**
- **All involved in the process** should be invited to participate
- **Time and dedication** from stakeholders, facilitators, and the team are essential
- **Display results** to “hold the gains” and keep staff motivated
- The event is a **worthwhile and valuable** process in today’s dynamic healthcare environment



# Upcoming Break for Questions and Comments

Submit a question to the moderator via the chat box.





# CASE STUDY

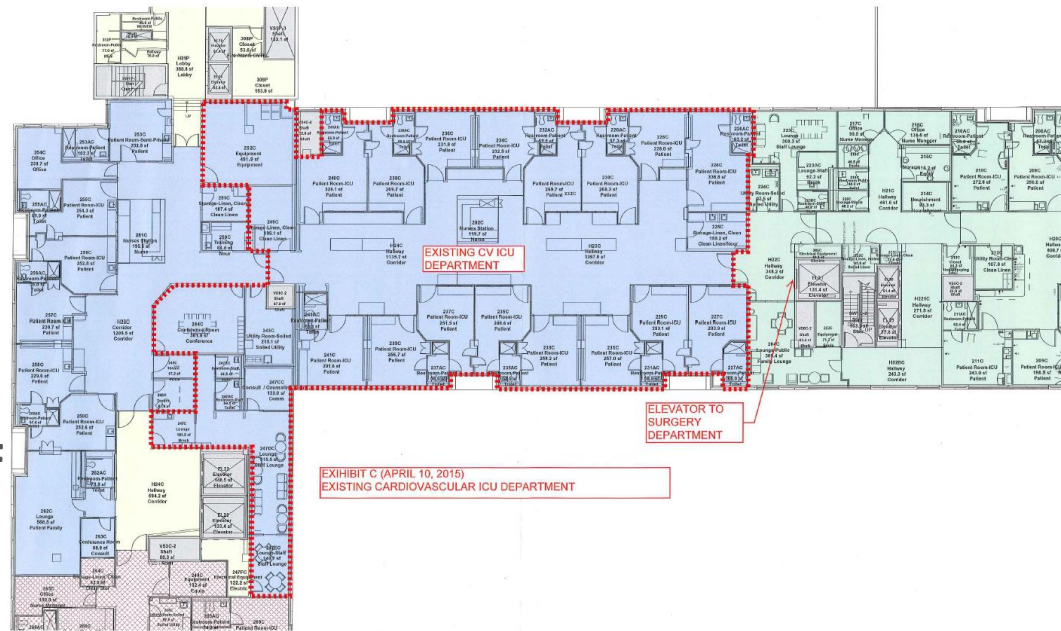
*LEAN PROCESS IMPROVEMENT ENHANCES ICU WORKFLOW*



# PROJECT BACKGROUND

## Key Points

- 2016 Neuro ICU renovation
- Current ICU split unit, N and S
- Goal was to combine in a centralized space [see diagram]
- Project scope **10000 SGSF**
  - Patient Care Zone: **4500 NSF**
  - Pt Care Support Zone: **1000 NSF**
  - Public Zone: **500 NSF**
  - Grossing factor: **1.44**





# METHODOLOGY

## 1. Establish the Vision

- Common project vision goes beyond project scope, time, and cost
- Begins with the establishment of a cross-functional design team encompassing **upstream and downstream workflow functions:**

Peri-operative director • Nursing director/manager • OR manager • Neuro coordinator  
Med/surg nurses • Ancillary services • Facilities development • Hospital administration

- Team visioning session developed the **project's goals and guiding principles**
  - *How do you want your staff to describe the experience at the new ICU?*
  - *What is the one thing you would change in your current ICU space?*
  - *What is the one thing about the current ICU that we should preserve?*
  - *Describe a current barrier in your ICU that prevents you from delivering outstanding patient care?*

# METHODOLOGY

## 2. Develop Current Workflow

- Walk through **current state operations** and discuss **desired future state** workflow
- Cross-functional design team **maps workflow** for one patient on North and South ICU wing
- Developed a **common operational picture** and work is seen through each other's perspective

*Admit / transfer*

*Environmental / trash removal*

*POC testing – iSTAT*

*Equipment storage and retrieval*

*EVS*

*Family flow*

*Nutrition services*

*Intensivist*

*Lab*

*Linen*

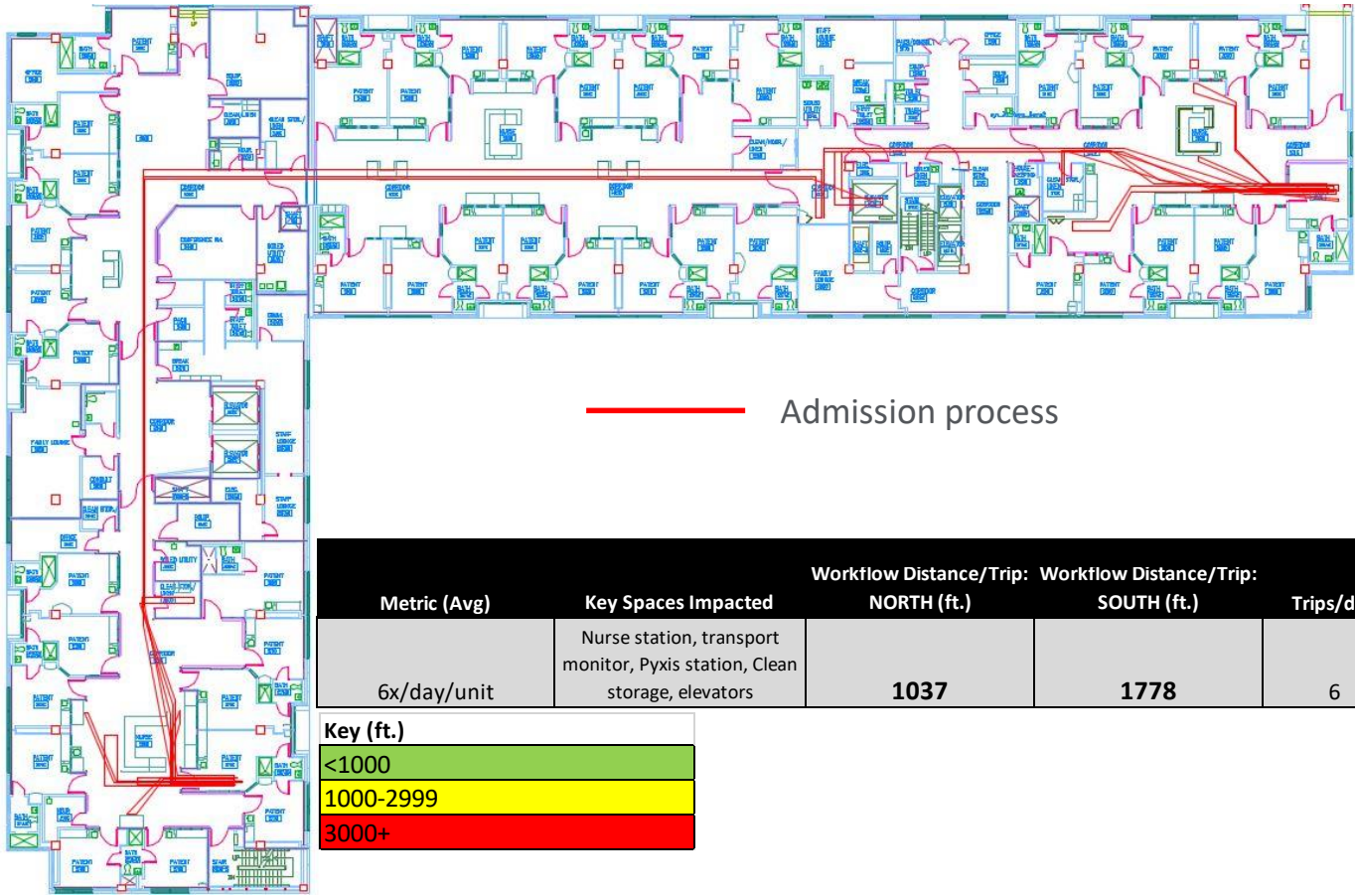
*Pharmacy*

*Physician*

*Respiratory*

*Supplies*

# METHODOLOGY

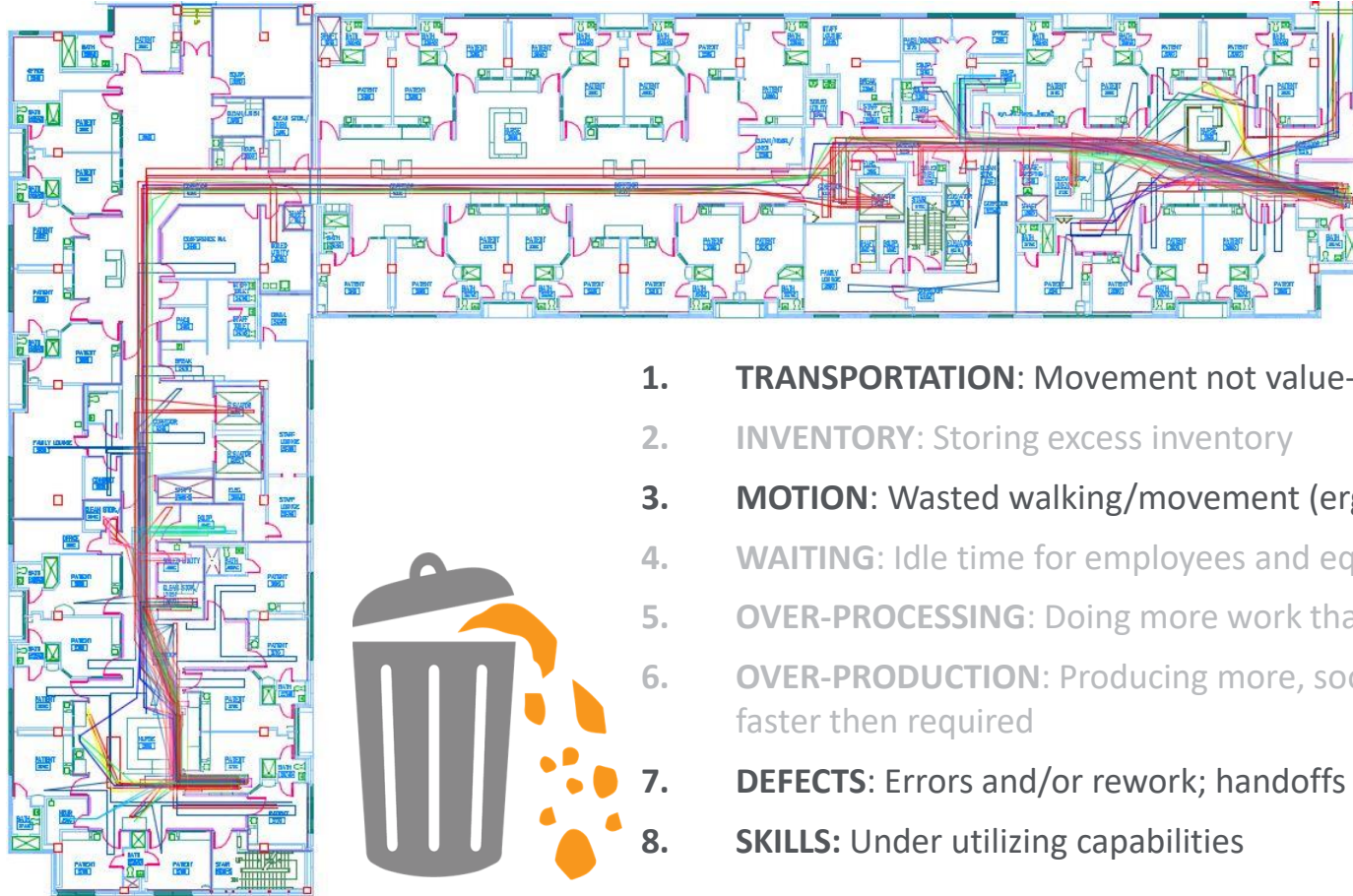


Admission process

Metric (Avg)	Key Spaces Impacted	Workflow Distance/Trip:		Trips/day	Total Distance Traveled/Day (ft.)	
		NORTH (ft.)	SOUTH (ft.)		North	South
6x/day/unit	Nurse station, transport monitor, Pyxis station, Clean storage, elevators	1037	1778	6	6222	10668

Key (ft.)
<1000
1000-2999
3000+

# METHODOLOGY



1. **TRANSPORTATION:** Movement not value-added
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# METHODOLOGY

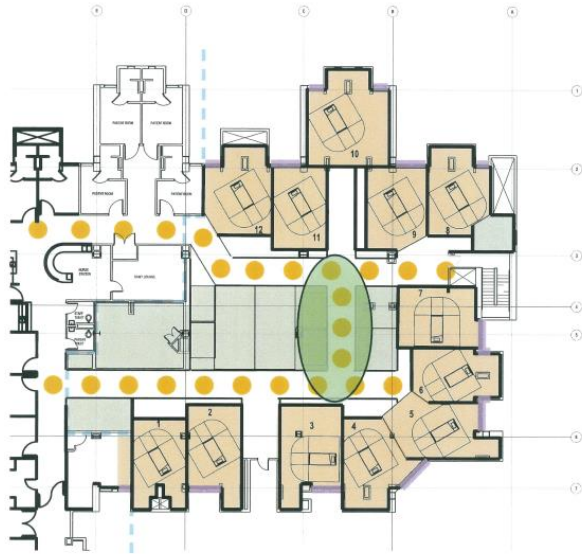
Swedish Cherry Hill ICU Current Workflow							
Workflow	Metric (Avg)	Key Spaces Impacted	Workflow Distance/Trip:		Trips/day	Total Distance Traveled/Day (ft.)	
			NORTH (ft.)	SOUTH (ft.)		North	South
Admit Process	6x/day/unit	Nurse station, transport monitor, Pyxis station, Clean storage, elevators	1037	1778	6	6222	10668
Nursing: Trash & Red Bag	13x/day/unit	Supply room, dirty linen, red bag waste	538	337	13	6994	4381
Equipment: iStat (point of care)	4x/shift/patient	iStat/glucometer station	165	157	8	1320	1256
Equipment: Storage	4x/shift/patient	Equipment storage	455	391	8	3640	3128
EVS	1x/day/room	EVS cart storage area, supply room, dirty linen, red bag waste, housekeeping storage	1170	874	1	1170	874
Family	1x/shift/patient	Nurse station, family room, toilet	776	1511	2	1552	3022
Floor Transfer	0.5x/shift/patient	Clean storage, equipment	1253	902	1	1253	902
Food Services	1.5x/day/patient	Nursing station, nutrition	234	147	1.5	351	220.5
Intensivist	2.5x/shift/patient	Nurse station	657	707	5	3285	3535
ARNP	2.5x/day/patient	Nurse station	657	707	2.5	1642.5	1767.5
Labs (tube system)	1x/shift/patient	Nurse station, tube system	269	726	2	538	1452
Linen	3x/day/patient	Soiled linen, clean storage	375	306	3	1125	918
Pharmacy (Pyxis)	10x/shift/patient	Pyxis station	130	116	20	2600	2320
Physician	1.5x/shift/patient	Nurse station	81	133	3	243	399
Respiratory: Prep	2x/day/patient	Nurse station, equipment room, work area	528	641	2	1056	1282
Respiratory: Transport to MRI/CT	3x/day/unit	Nurse station, bed boards, equipment	1088	976	3	3264	2928
Nursing: Transport to MRI/CT	6x/day/unit	Transport elevators to CT and MRI	1088	976	6	6528	5856
Supplies (from supply room)	12x/day/patient	Supply room	216	139	12	2592	1668

Key (ft.)

<1000
1000-2999
3000+

# METHODOLOGY

## 3. Lean the Operations



Floor Plan, East Tower, 2nd Floor - Block Diagram V1  
N.T.S.

aprx 9,800sf



Floor Plan, East Tower, 2nd Floor - Block Diagram V2  
N.T.S.

aprx 9,800sf

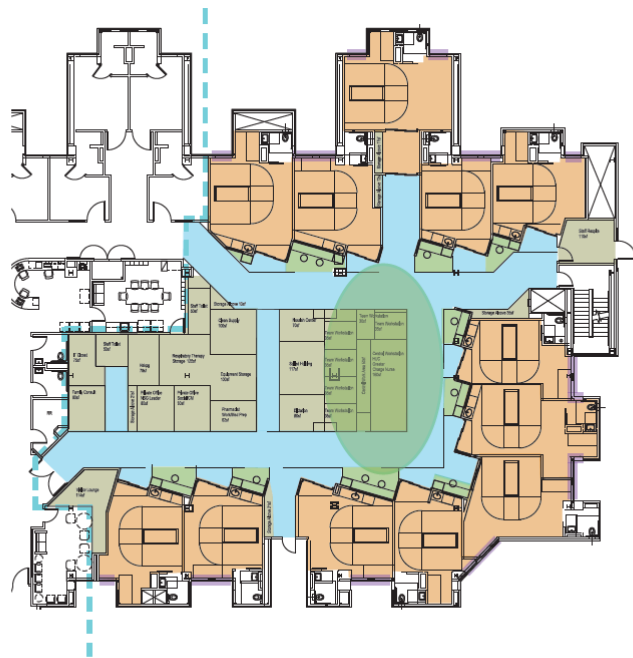
- New Circulation
- Boundary Line
- Patient Room
- Support Zone
- Care Team Zone
- Compliant Window





# METHODOLOGY

## 4. Incorporate into Design



### TOP 5 PRIORITIES

- o Clean
- o Organization and Storage Space
- o Staff and Team Communication
- o Wayfinding
- o Headwall Attributes and Connectivity

### TOP 5 WORK FLOW FIXES

- o Transport to MRI/CT
- o Admit Process
- o Nursing: Trash and Red Bag
- o Equipment Storage
- o Intensivist

- Boundary Line
- New Circulation
- Patient Room
- Support Zone
- Care Team Zone
- Compliant Window

### Design Impact

*examples*



*Reduce excess transport & motion*

Admission process: **82%**

EVS + red bag disposal: **55%**

Equipment storage workflow: **52%**



# METHODOLOGY

## 4. Incorporate into Design

Traditional Design Process	Lean-Led Design Process
<b>Design</b> is the focus	<b>Process is the focus:</b> adding value for patient/staff/family
Starts with <b>budget &amp; programing</b>	Starts with <b>observations</b> of operational processes
User groups are comprised of <b>staff leaders</b> within a department	<b>Value-stream focused teams</b> including key stakeholders involved <b>across the whole process</b> of delivering the service to the patient; <i><b>informs the programming process</b></i>
Each user group provides <b>feedback to design questions</b> about their department	Multidisciplinary consensus based, <b>future state processes drive design</b>
Floor plan adjusted to <b>accommodate existing operations</b> or leader intent	Operational design and schematic floor plan used to <b>validate value stream</b> , optimize future improvements



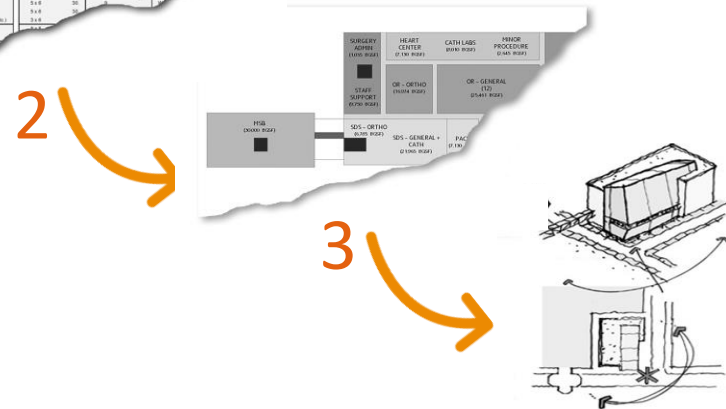
## 4. Incorporate into Design

```

graph LR
    subgraph PRE-OPERATIVE
        1[Schedule] --> 2[Pre-Registration]
        2 --> 3[Arrival on Campus]
        3 --> 4[Pre-Procedure]
    end
    subgraph INTRA-OPERATIVE
        4 --> 5[Cardiac Catheterization]
        4 --> 6[Cardiac Surgery]
        4 --> 7[Orthopedic & Neurological]
        4 --> 8[General Surgery]
        4 --> 9[Gastro-Intestinal]
    end
    subgraph POST-OPERATIVE
        5 --> 10[Critical Care Unit]
        6 --> 10
        7 --> 11[Stage 1 Recovery]
        8 --> 11
        9 --> 11
        10 --> 12[Stage 2 Recovery]
        11 --> 12
        12 --> 13[Inpatient Unit]
        13 --> 14[Discharge]
    end

```

- [illegible]





# CONCLUSION

## Lean applied to healthcare planning and operations

- More **operational flexibility**
- **Reduced length of stay (LOS)** for patients
- **Consistent** processes or service delivery
- **Reduced space** required
- Improvement in **quality of care**
- Reduction in **operating costs**

# LEARN MORE

## For more information

- Society for Health Systems

<http://www.iise.org/SHS>

- American Society for Quality

<https://asq.org/>

- Institute of Industrial and Systems Engineers [training link]

<http://www.iise.org/TrainingCenter/CourseCategories.aspx?id=36380&grp=LSS>

# CONTACT



**Rudy Santacroce, PE, CLSSBB, PMP, DSHS**  
Vice President, Operational Excellence  
[Rudy.Santacroce@crtkl.com](mailto:Rudy.Santacroce@crtkl.com)  
214.468.7532

# Time for Questions and Comments



## Moderator

John Kreidich, AIA, CHC, LEED AP B+C  
McCarthy Building Companies

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## Upcoming Webinars\*

Date	Series	Topic
11/07	Masters Studio Series	Generative Design for Healthcare Planning
12/12	HC 101 Series	Trends in Medical Planning, Part1: Following the Thread
02/13	Case Study Series	UC Davis - Getting to Net Zero

\*Dates and topics are subject to change

Visit [www.aia.org/aah](http://www.aia.org/aah) for more information and to register.