Application of Lean to Healthcare Processes:

A Complex System Perspective

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Talk Outline

- **Part I: Lean and Healthcare**
  - Healthcare – a complex system of processes behaving badly
  - Lean – a method for process improvement
  - Some local lean successes in healthcare
- **Part II: Effects of Variability and Complexity**
  - Participatory and Computer simulations
  - Impact on application of lean to healthcare
  - Conclusions and paths forward

Imperatives – United States

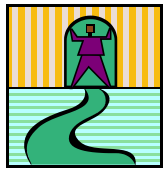
Cost

- Over 16% of GDP spent in healthcare expenses (2007)
- 117% increase in worker insurance premiums, 99 to 08
- 119% increase in employer insurance premiums, 99 to 08
- US spends 75% more on healthcare than G-5 countries (2006)

Quality

- 44,000 - 98,000 deaths attributed to medical errors (1999)
- 32% of patients report medical mistake, medication error or lab error in past two years (2007)
- 12-79% gap between delivered vs recommended care (2003)

Access

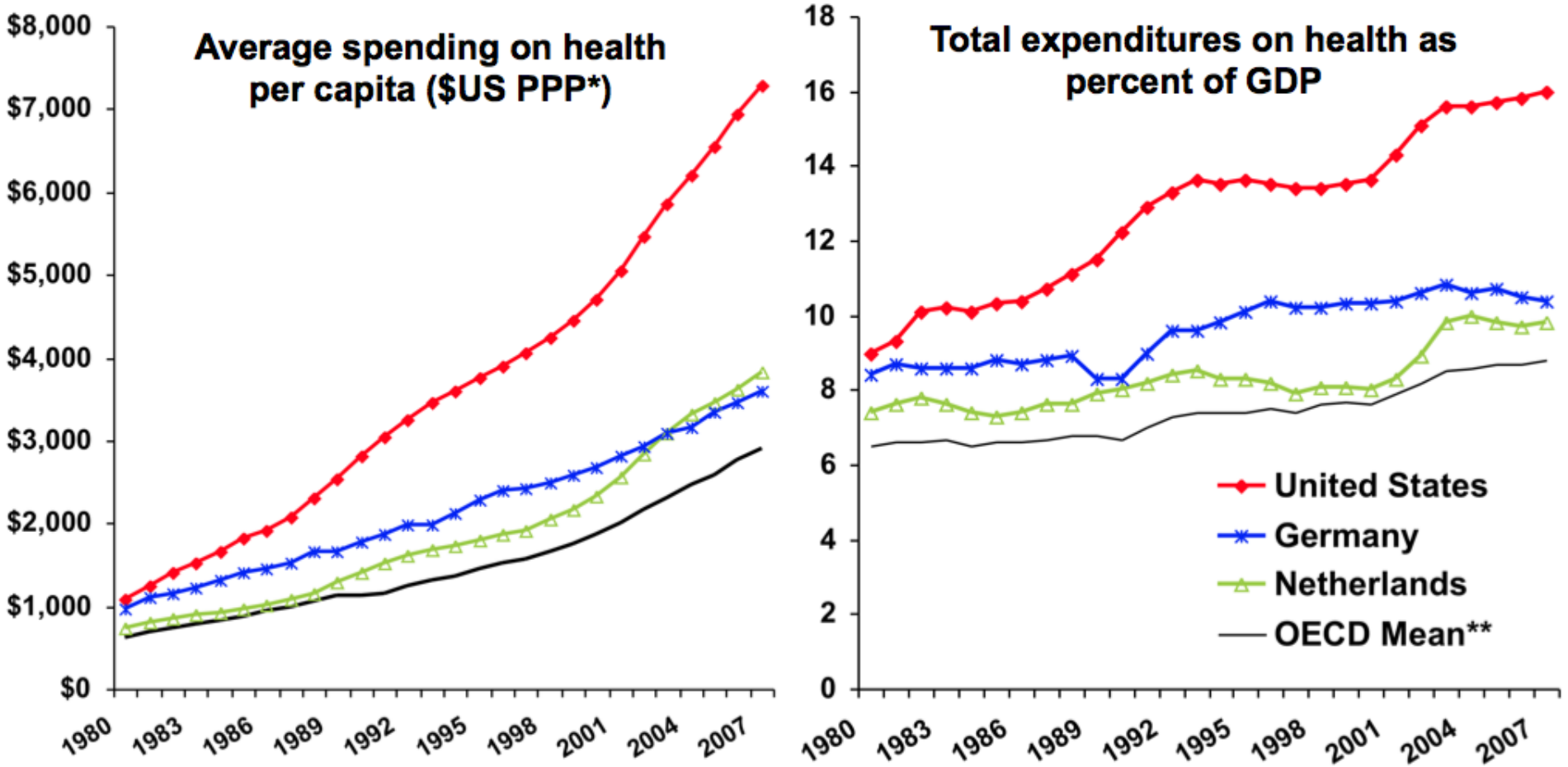


- 45 million Americans are uninsured
- Individuals over 65 expected to increase over 50% by 2020
- Fragmented provider network, IT systems, insurance, etc.
- 40% of patients not treated or medicated due to cost (2004)

Trouble

- 60% of doctors would not recommend career to young people
- 50% of ED caregiver time spent on paperwork (2001)
- 315,250 shortage of RNs predicted for 2015

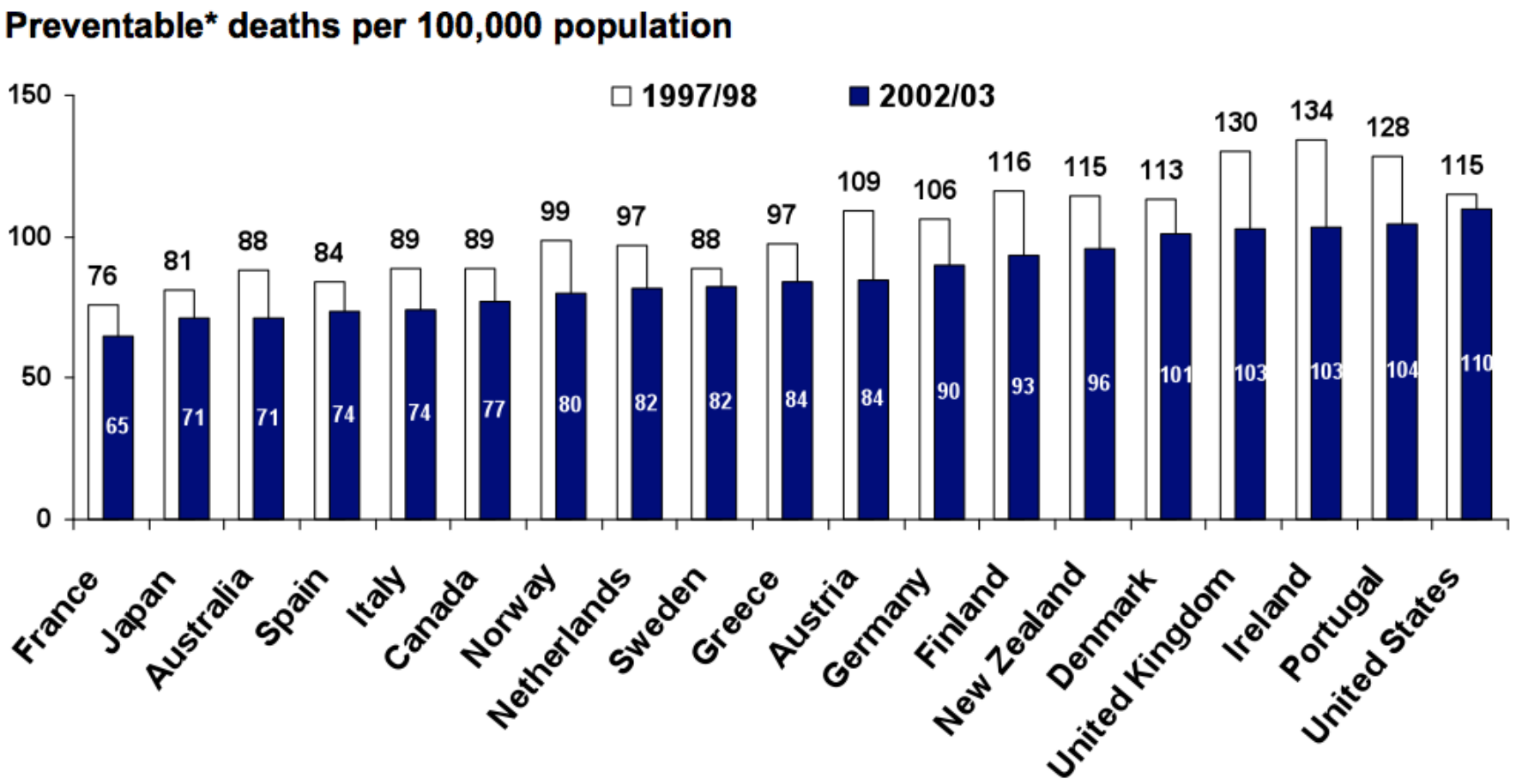
Comparison of Spending



* PPP=Purchasing Power Parity. ** All 30 OECD countries except U.S.
Source: OECD Health Data 2009, Version 06/20/09.

As reported by Eric Dickson, MD
LAI Lean Academy Jan. 2011

Comparison of Results



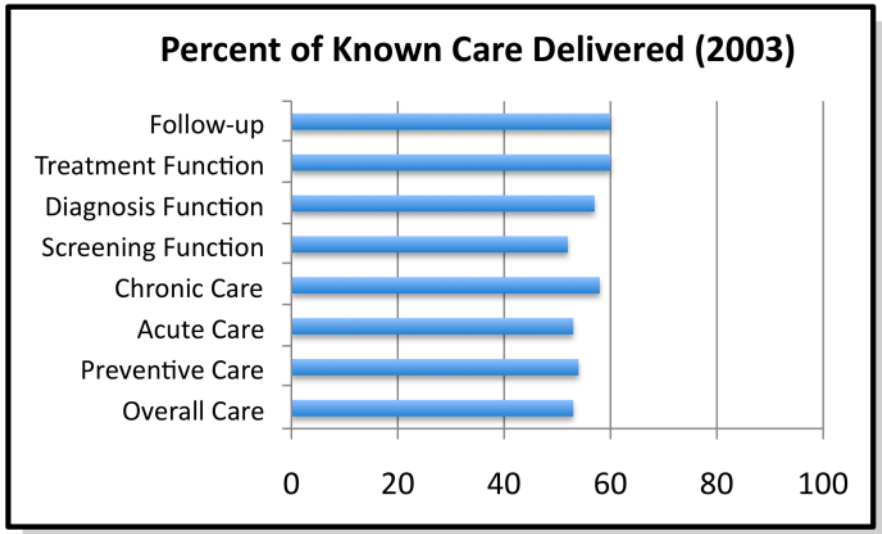
* Countries' age-standardized death rates before age 75; including ischemic heart disease, diabetes, stroke, and bacterial infections.

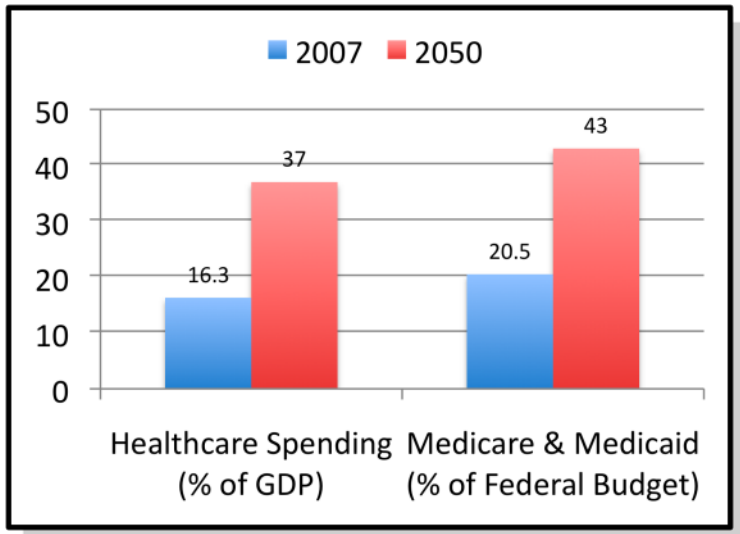
Data: E. Nolte and C. M. McKee, London School of Hygiene and Tropical Medicine analysis of World Health Organization mortality files (Nolte and McKee 2008).
Source: Commonwealth Fund National Scorecard on U.S. Health System Performance, 2008.

from Eric Dickson, MD
LAI Lean Academy Jan. 2011

US Healthcare - A Value Crisis

$$\text{Value} \approx \frac{\text{Delivered Care}}{\text{Cost}}$$

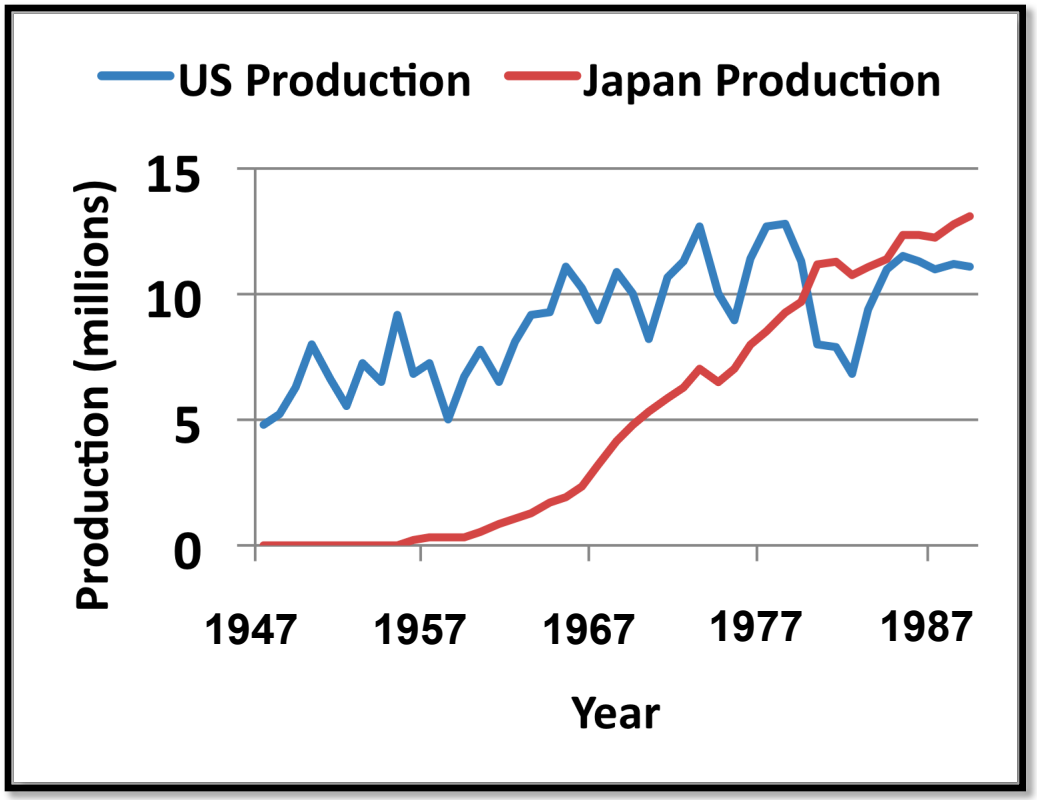




- Lean can increase healthcare value delivery by:
  - Improving healthcare quality
  - Decreasing healthcare costs
- It is one piece of a puzzle to solve the US healthcare crisis

Lean Arises From Japanese Auto Industry

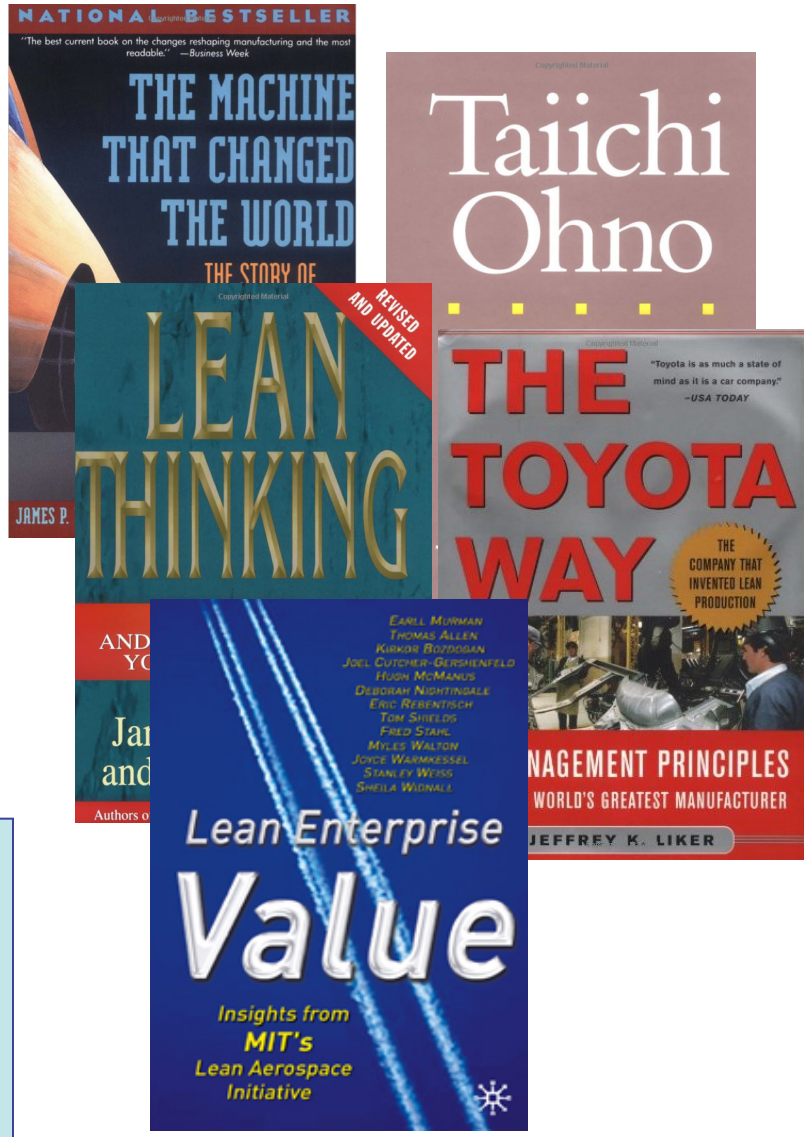
Selected Metrics for US & Japan Automobile Manufacturers		
Product Development (mid 1980s)		
	Japanese Producers	American Producers
Avg. Engineering Hrs per New Car (millions)	1.7	3.1
Avg. Development Time per New Car (months)	46.2	60.4
Employees in Project Team	485	903
Supplier Share of Engineering	51%	14%
Ratio of Delayed Projects	1 in 6	1 in 2
Summary of Assembly Plant Characteristics for Volume Producers, 1989		
	Japanese in Japan	American in N Am
Productivity (hrs/veh)	16.8	25.1
Quality (defects/100 veh)	60	82.3
Inventory (days for 8 sample parts)	0.2	2.9
Work Force on Teams	69.3%	17.3%
Suggestions per employee	61.6	0.4
Number of Job Classifications	11.9	67.1
Training Hrs of New Production Workers	380.3	46.4



Trends have continued since this 1989 data reported in *The Machine That Changed The World*

Lean as a discipline

- North American (mostly) research captured and codified Toyota practices
- Emphasis on transforming legacy organizations
- Initially focused on manufacturing, but always intended to apply to entire value stream



Lean is a method for process improvement – *It can be applied to any process, including those of Healthcare*

Lean Improves Processes by Eliminating Waste

- Wastes require excess work, excess capacity, excess time (and excess costs) to deliver product
- Standardize, stabilize, smooth workflow to make poorly-performing processes apparent
  - Only make what is needed—buffers hide problems
  - Just in time requests/deliveries/production, linked by a visual process, reveal weak links
- Never deliver or accept a defective product
- Don't overburden people/processes or otherwise threaten their performance reliability

Principles are generic—they apply to any process

Lean Concepts, Terms and Tools You Will Learn

- 5 Whys
- 6S
- 8 wastes
- A3 thinking and tool
- Andon
- Balanced work
- C_p, C_{pk}
- Capacity, throughput,
- Cycle time
- DMAIC
- Enterprise stakeholders
- Enterprises
- Flow
- Future state
- Gemba (Genba)
- Genchi Genbutsu
- Histograms
- Integrated teams
- Kanban
- Kitting
- Plan-do-study-act (PDSA)
- Process maps
- Processing time
- Pull
- Relational coordination
- RPIW
- Single piece flow
- Spaghetti diagrams
- Stakeholder value
- Standard work
- Takt time
- and analysis (VSMA)
- Variation impact
- Visual control
- Wait time
- ….. and more

Actually, no.

We will talk about how lean has been and can be applied to knowledge and service work, including Health Care

Lean Thinking Fundamentals

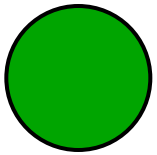
- Specify ***value*** – from the standpoint of the end customer (the patient)
- Identify the ***value stream*** – all value-added steps across departmental boundaries (the *value stream*), eliminating steps that do not create value
- Make value ***flow*** continuously – eliminate causes of delay, such as batches and quality problems
- Let customers ***pull*** value – avoid pushing work onto the next process or department; let work and supplies be pulled as needed
- Pursue ***perfection*** – through continuous process improvement

Ref: Mark Graban, *Lean Hospitals* (CRC Press, 2009).

Defining Value

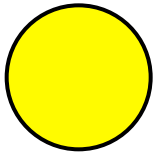
- Customer is willing to pay for activity
- Activity is transformative, moving the product closer to what the customer wants
  - *or* activity reduces risk and/or uncertainty in the product or process
- Activity is done right the first time
  - *or* iterations or experiments are planned and controlled

Value-Added vs. Non-Value Added Activities



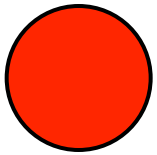
Value-Added Activity

- Transforms patient, material, information, decisions, or risks
- And the customer wants it (or would if they understood it…)
- And it's done right the first time (or as right as possible…)



"Needed" or "Enabling" Activity

- No value Is created, but cannot be eliminated based on current state of process, technology, policy or thinking
- Team coordination, corporate reporting, required record-keeping…



Non Value-Added Activity (WASTE)

- Consumes resources but creates no value to the customer
- Pure waste - if this activity is removed, can the process continue?
- Waiting, Inventory, Movement, Excessive/defective processing…

Eight ~~Seven~~ Wastes (muda)

1. Over-production	**Doing more than is needed by the customer or doing it before it is needed**
2. Inventory	**Excess inventory cost through financial costs, storage and movement costs, spoilage, wastage**
3. Transportation	**Unnecessary movement of the product in the system (patient, specimen, materials)**
4. Motion	**Unnecessary movement by employees**
5. Waiting	**Waiting for the next event to occur or the next work activity**
6. Defects	**Time spent doing something incorrectly, inspecting errors, or fixing errors**
7. Over-processing	**Doing work that is not valued by the customer, or caused by definitions of quality not aligned with patient needs**
8. Human Potential	**Waste and loss due to not engaging employees, listening to their needs, and supporting their careers**

Ref: Mark Graban, *Lean Hospitals* (CRC Press, 2009).

Waste in Healthcare

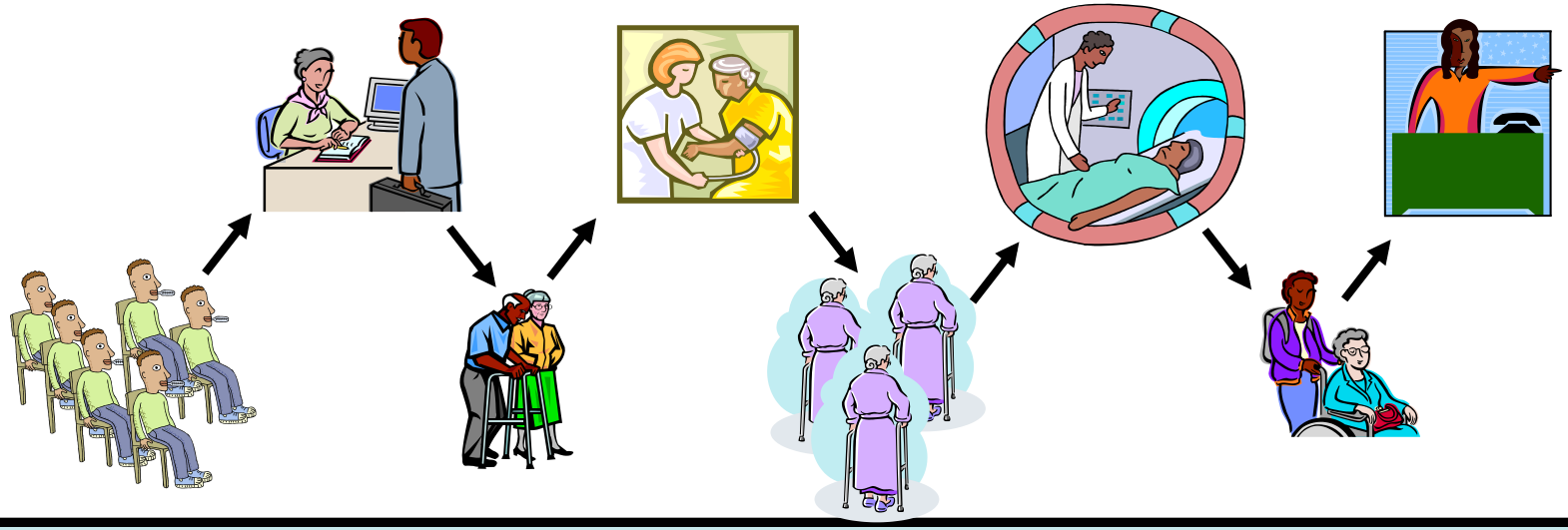
- "20-30% of Healthcare Spending is Waste"*
  - overtreatment of patients
  - failure to coordinate care
  - administrative complexity
  - burdensome rules
  - fraud
- Only 31-34% of nurse time spent with patients**

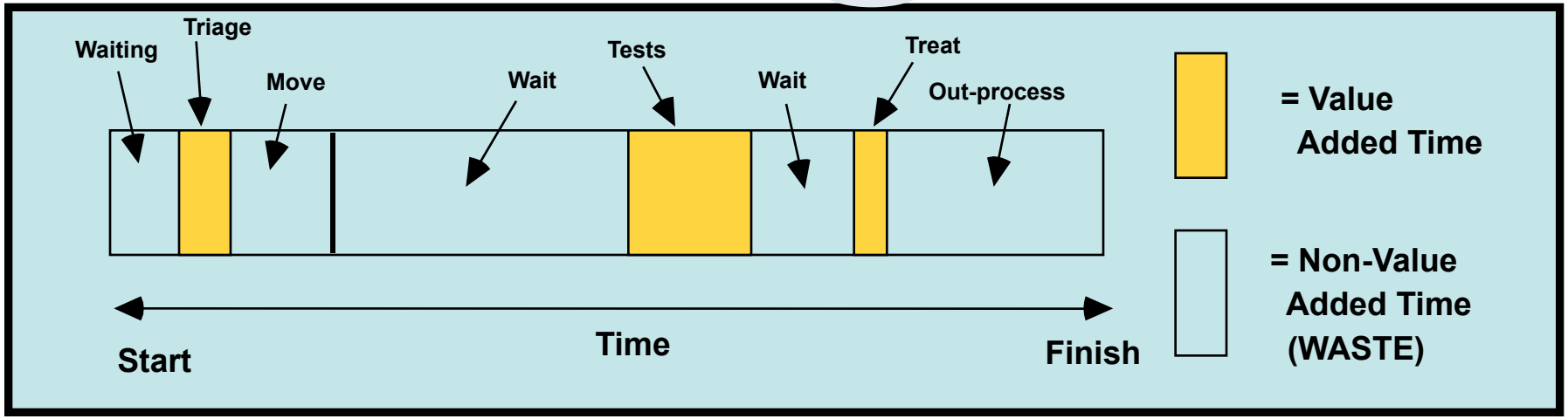
*Donald Berwick, former administrator of the Centers for Medicare and Medicaid Services, former President, Institute for Healthcare Improvement

**Data collected from multiple sources by Mark Graban

Much of the PATIENT'S time is spent WAITING

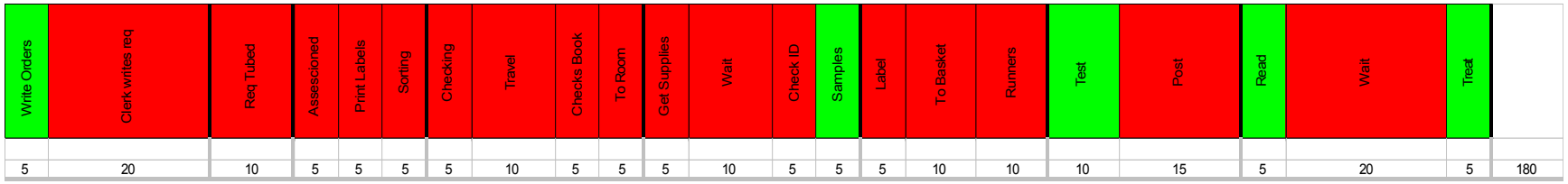
Notional example of Triage/test/Treat cycle



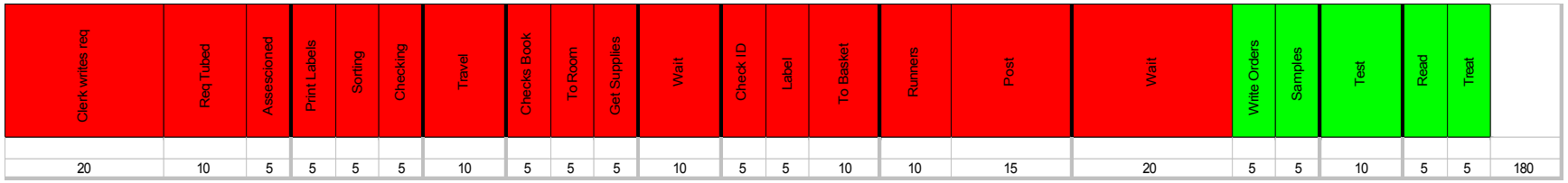


80% or more of the *time* spent in a healthcare processes is *waste*

Process



Sorted



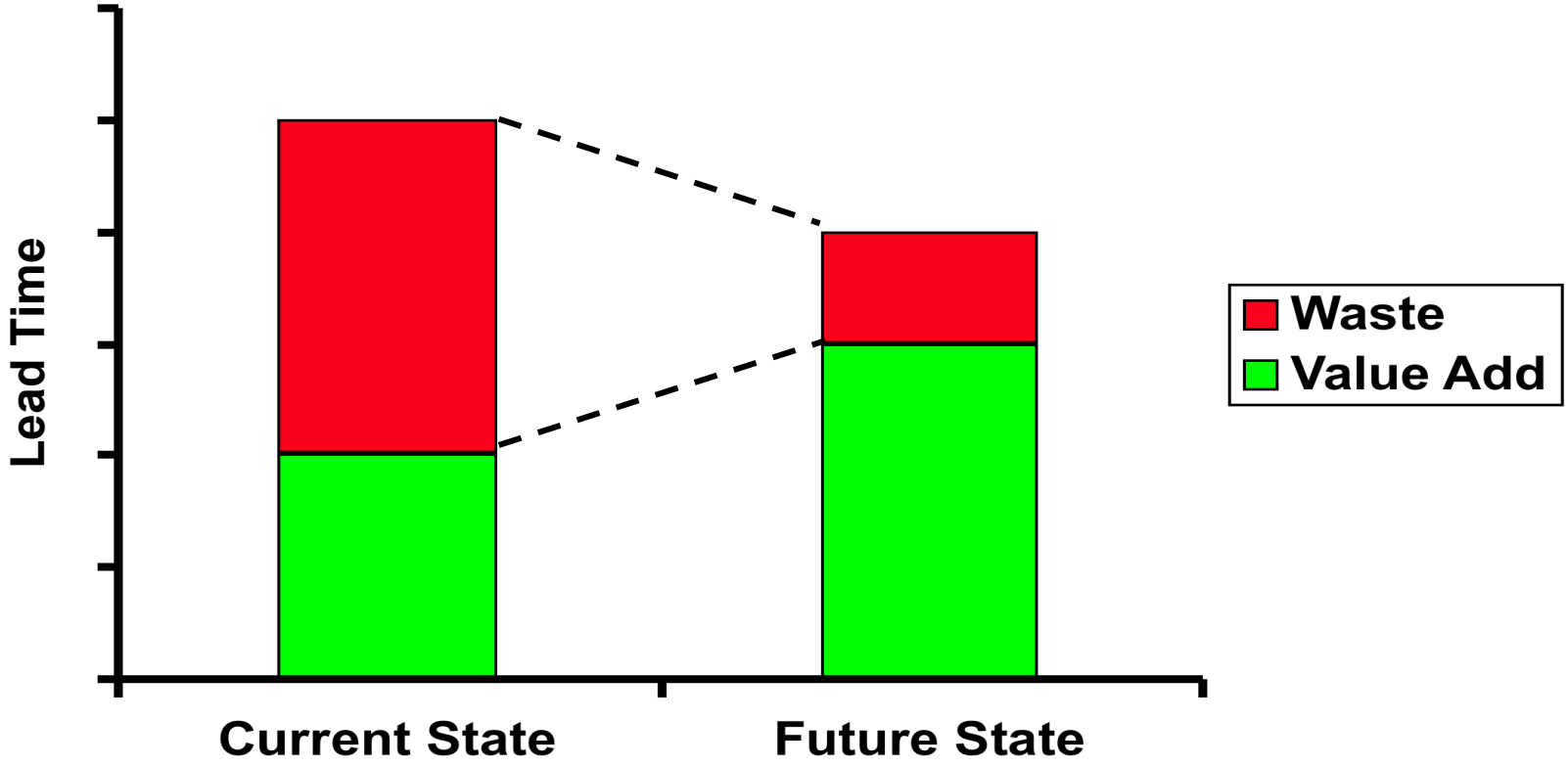
Source: University of Iowa Hospitals and Clinics

Less than 20% Value Added

A real medical example - a test-and-treat cycle
Most of the patient time is spent waiting, moving, etc.

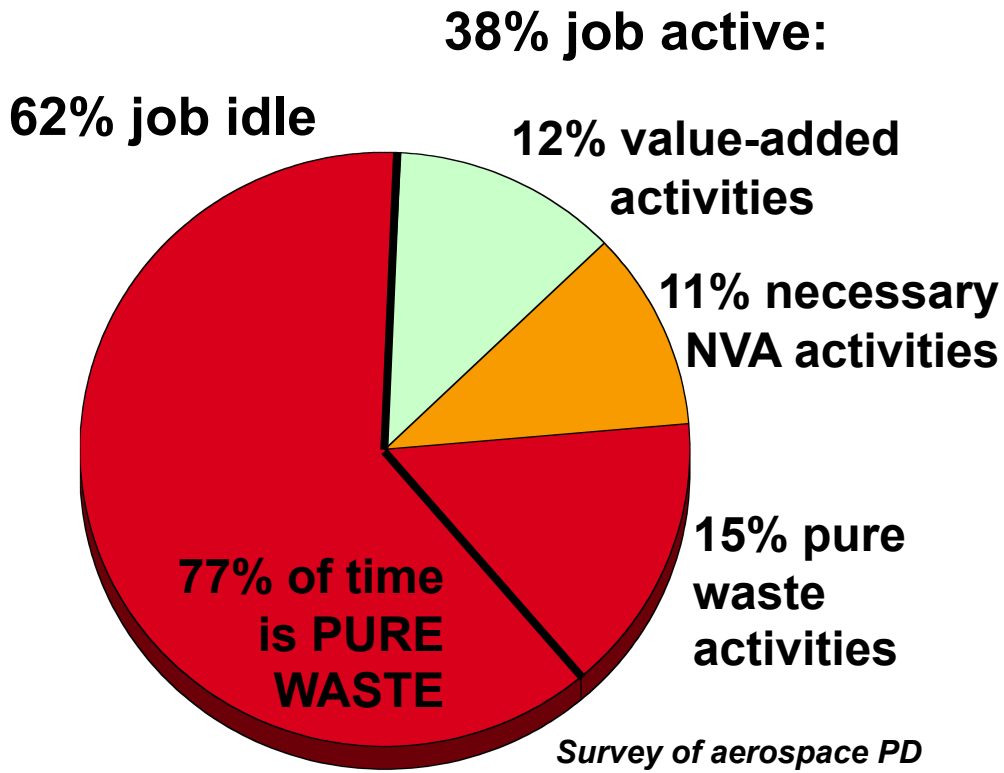
Lean Focuses on Reducing Waste

Increase % Value Added Work and reduce Waste to Increase Throughput, Lower Cost and Improve Quality



Interesting Analogy: Waste in Product Development

- Most aerospace engineering *tasks* are idle much of the time
- The actual work done by engineers is about 1/3 waste, 1/3 enabling, and 1/3 value added
- Work is varied and unpredictable
- *Tasks* are often similar, even repetitive



Survey of aerospace PD process time (2000)

10+ years of lean PD work can be leveraged

- **Healthcare has many processes and lots of waste**
- **Lean is an overall method (with many tools) for improving processes by removing waste**
- **There are many opportunities for lean application in Healthcare.**

Identify the *Value Stream*

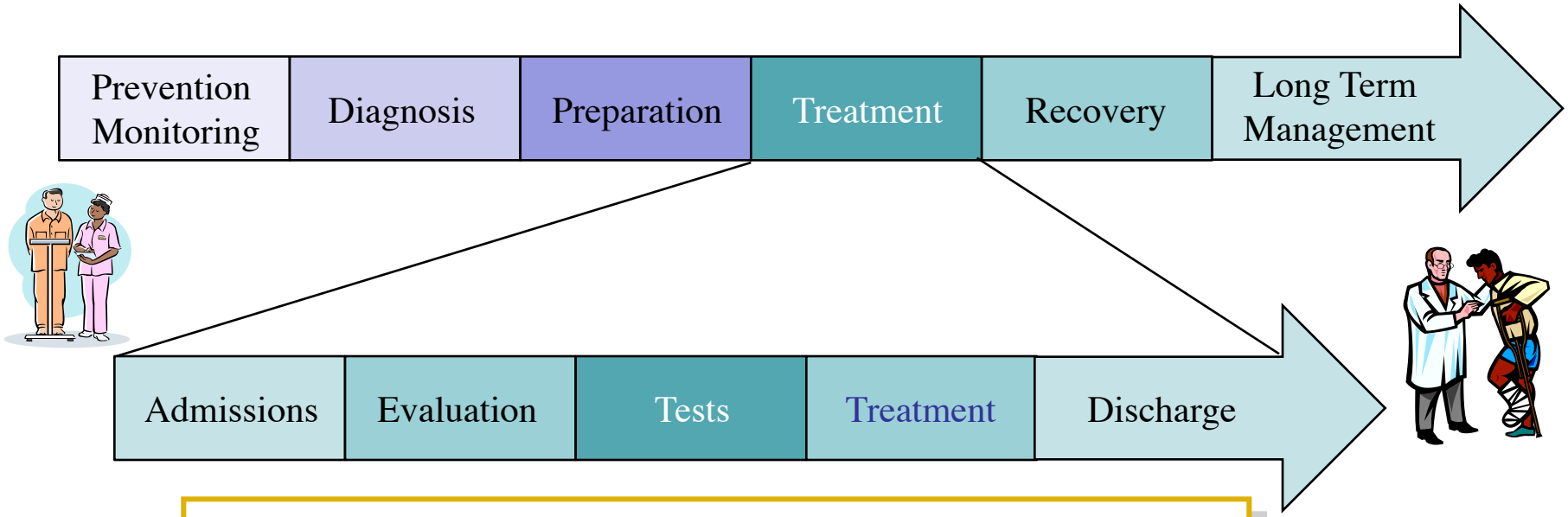
- All the actions required to transform a good or service from an initial state to a outcome desired by the customer
  - Actions include: problem solving, physical transformation, information management
- Something "flows" in a value stream. E.g. in healthcare:
  - Patient value streams

  - Meds and materials value streams

  - Information (records) value streams

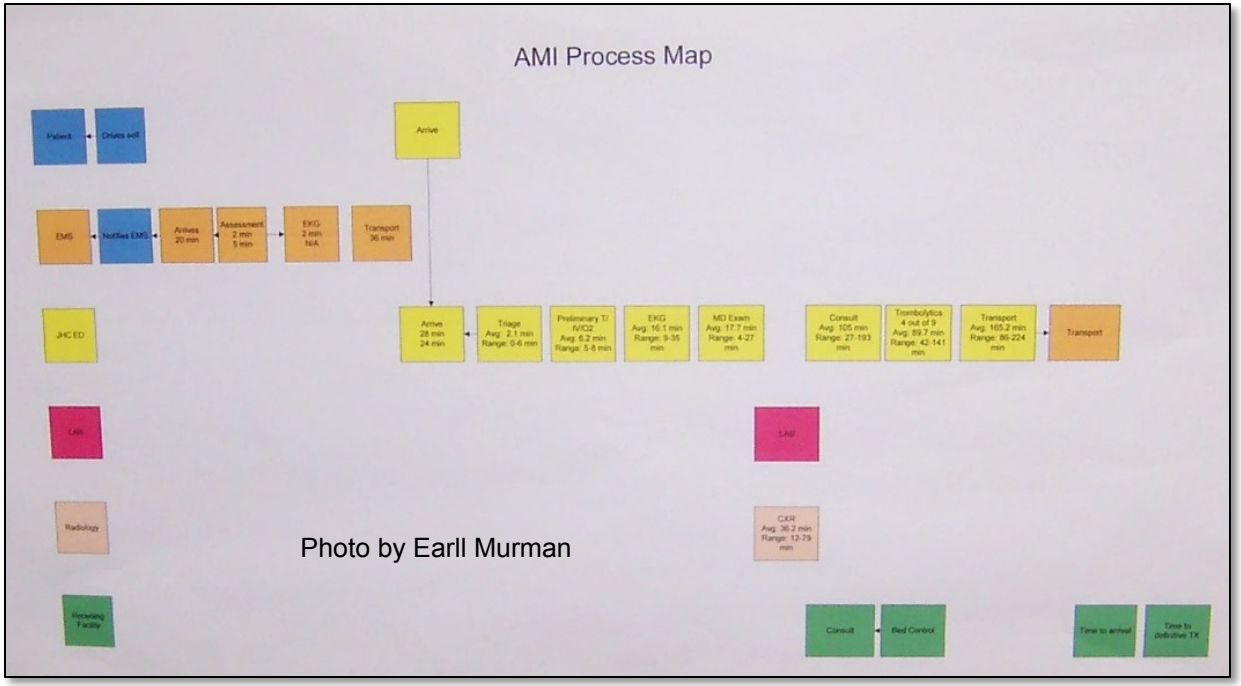
Patient Value Stream

For a given medical condition, the patient value stream has many actions and is fragmented among numerous care givers



Much lean to date focuses on this portion of the full patient value stream.

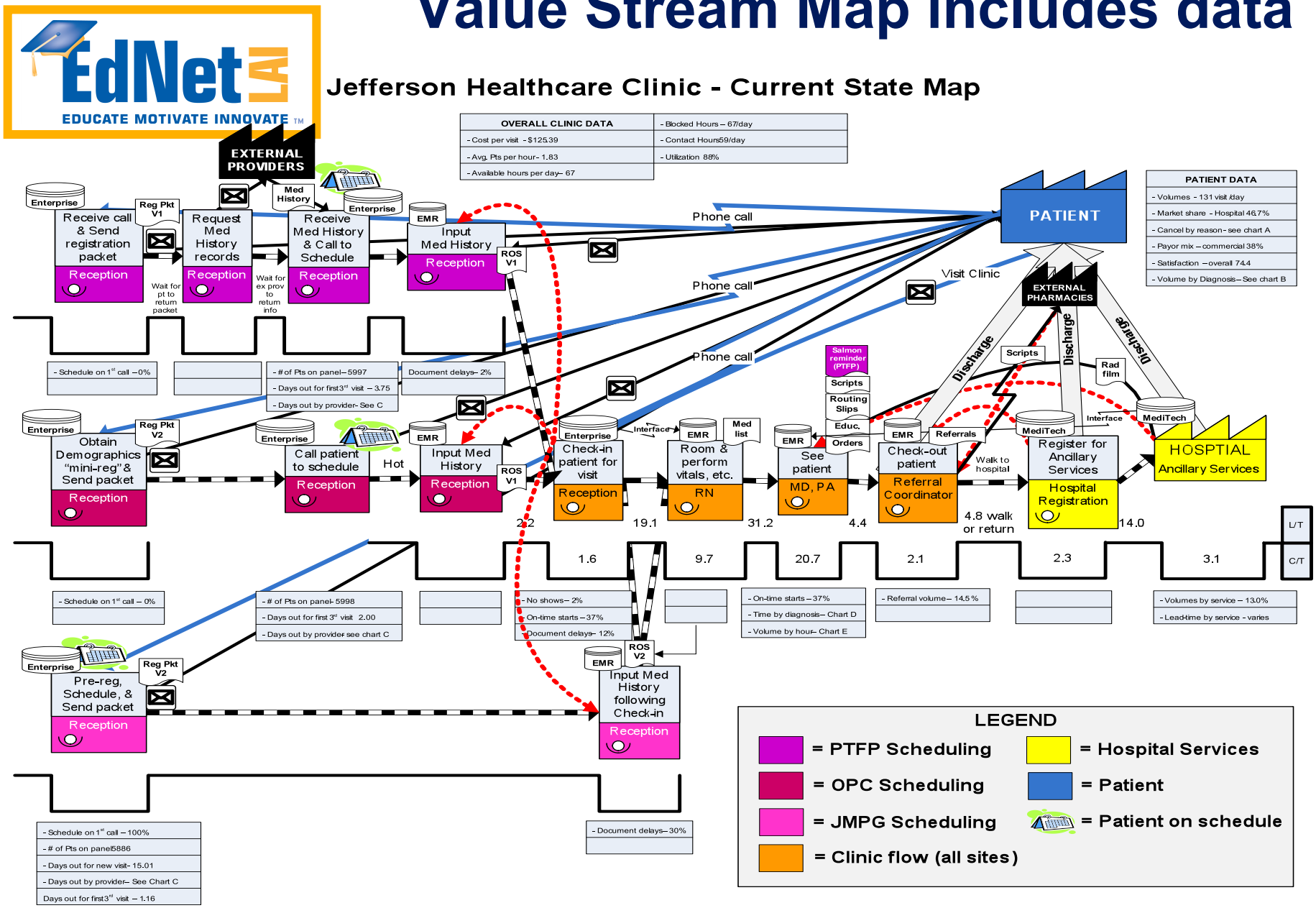
Process Maps



Process map for pre lean treatment of Acute Myocardial Infarction

- **Only understood processes can be improved**
- **Understanding a process is easier when it can be visualized**
- **A Process Map is an organized visualization of all the interrelated activities which combine to form a process**

Value Stream Map includes data

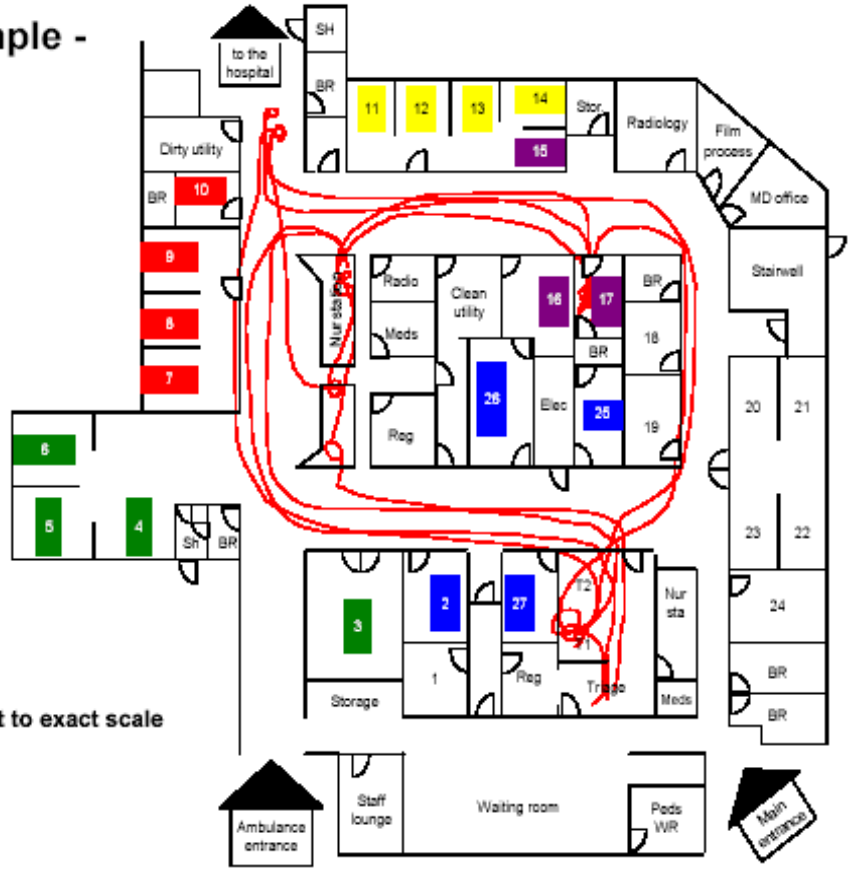


Source: Jefferson Healthcare, Port Townsend, WA

Other graphical representations useful for particular purposes

Spaghetti Chart example - BEFORE

Steps Triage Nurse takes to place patient in room



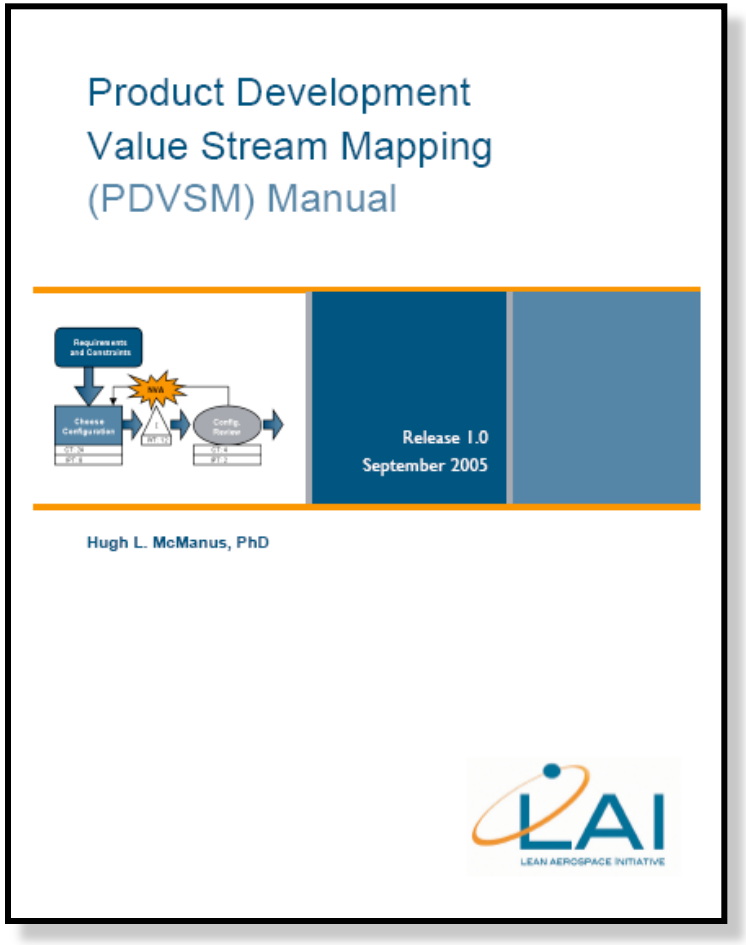
Not to exact scale

Total distance traveled = 1250 ft.

Spaghetti Charts are a powerful visual tool for seeing unnecessary movement

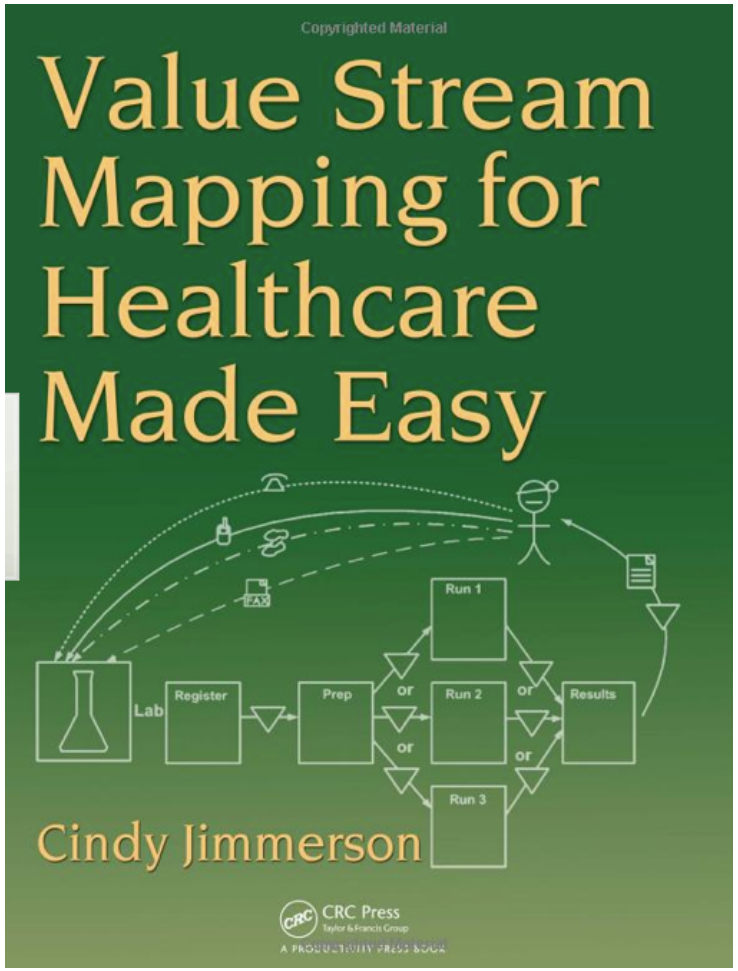
Source: University of Michigan Health System, Ann Arbor, MI

Value Stream Mapping Applied to Product Development



- Same basic techniques apply
- Flows are knowledge and information flows rather than physical products
- Process steps may overlap or involve planned iterations
- Value added steps add or transform knowledge, or reduce uncertainty (role of analysis steps)
- Quantifies key parameters for each activity (cycle time, cost, quality defects, inventory, etc.)
- 2005 document does NOT represent current knowledge; update in progress

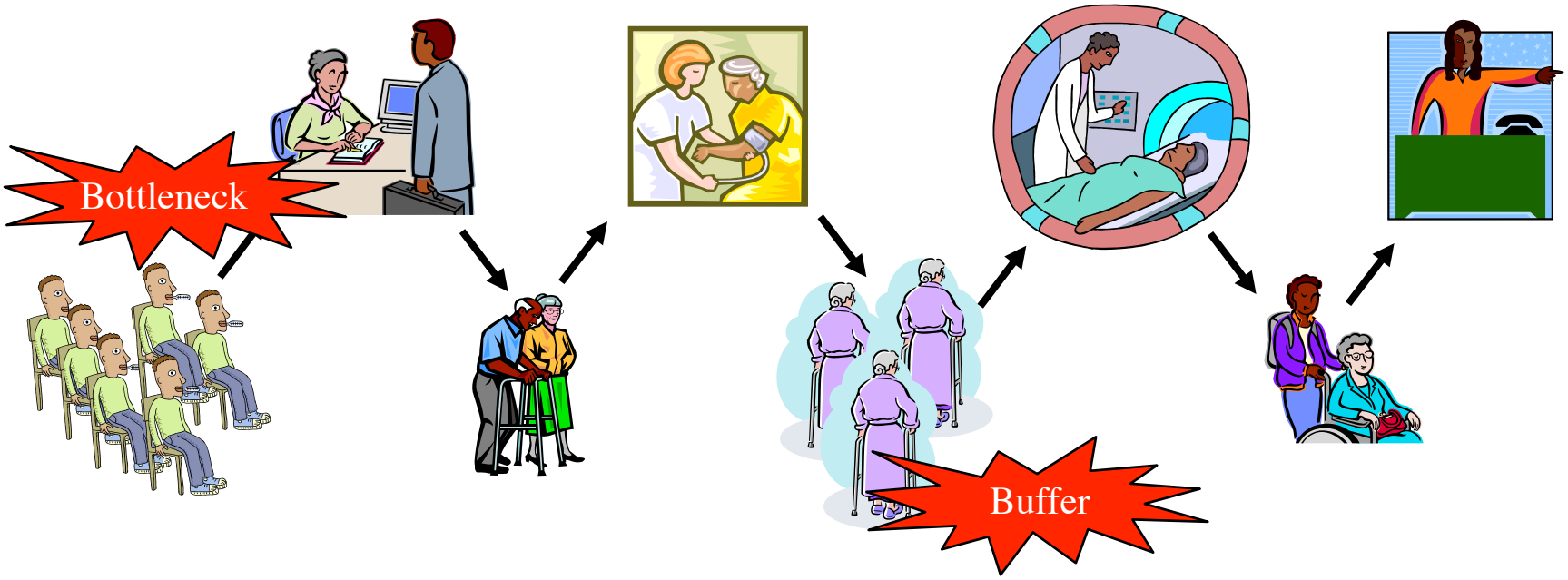
Value Stream Mapping Applied to Healthcare



- Same basic techniques apply
- Flows are varied and include the patient (customer!), products, and information
- Process steps may overlap or involve planned iterations
- Value added steps can add or transform knowledge, or reduce uncertainty (diagnosis and test)
- Quantifies key parameters for each activity (cycle time, cost, quality defects, inventory, etc.)

- There are many value streams in a Healthcare Enterprise
- There are lean tools for uncovering and visualizing them

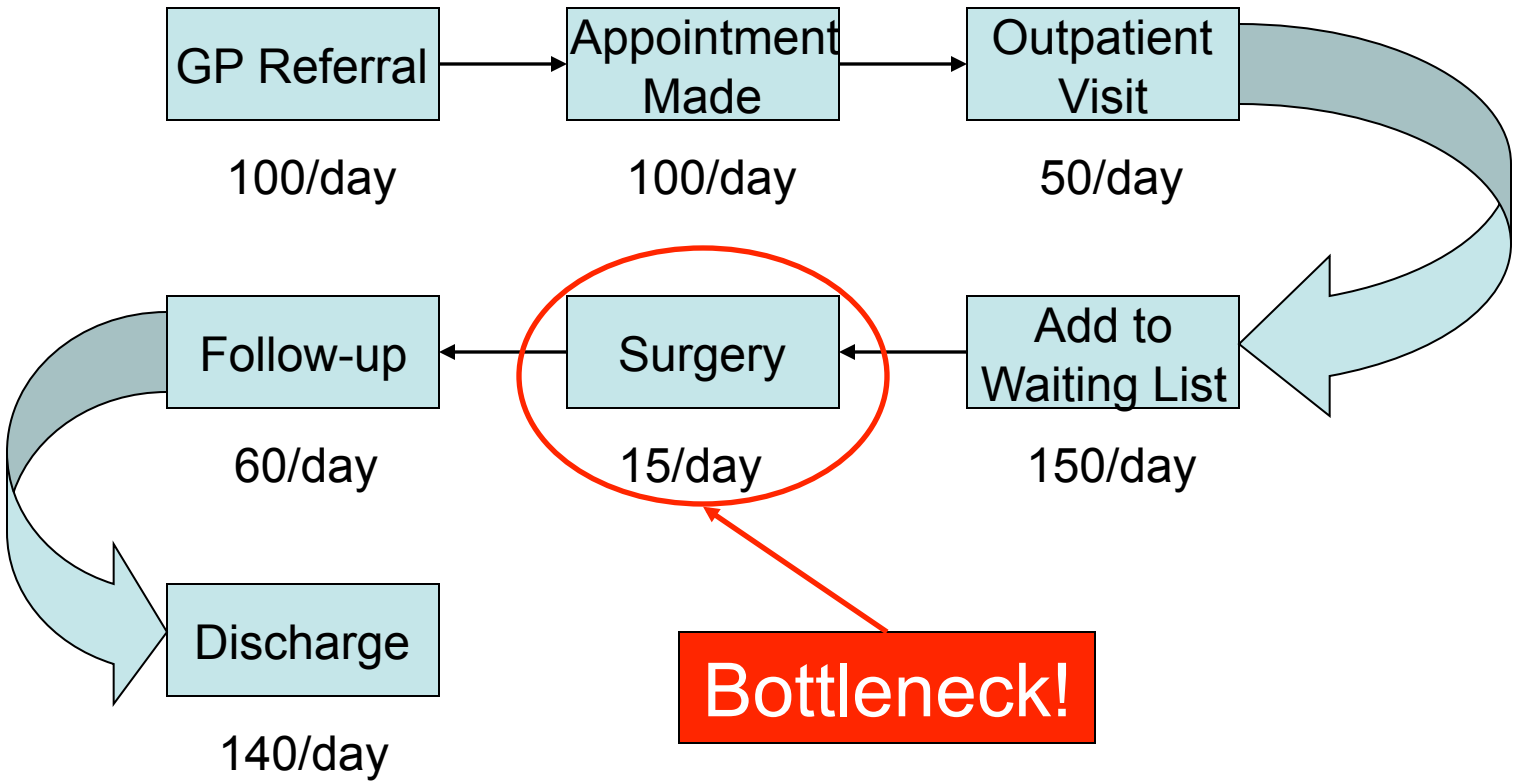
Make Value *Flow*



Creating flow:

- Focus on what is flowing through the process
- Eliminate bottlenecks, minimize buffers

First, avoid bottlenecks



All steps need *Capacity* to handle work

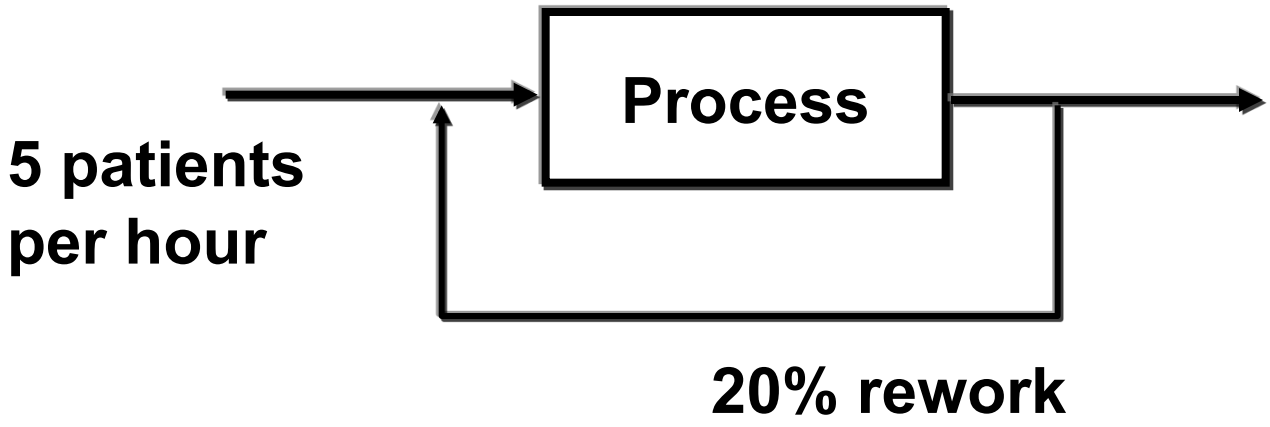
- **Theoretical Capacity:** Maximum sustainable flow rate at an activity

- **Effective Capacity:** Capacity of the activity accounting for detractors

Source:http://www.pbase.com/echolsteam/image/68404368

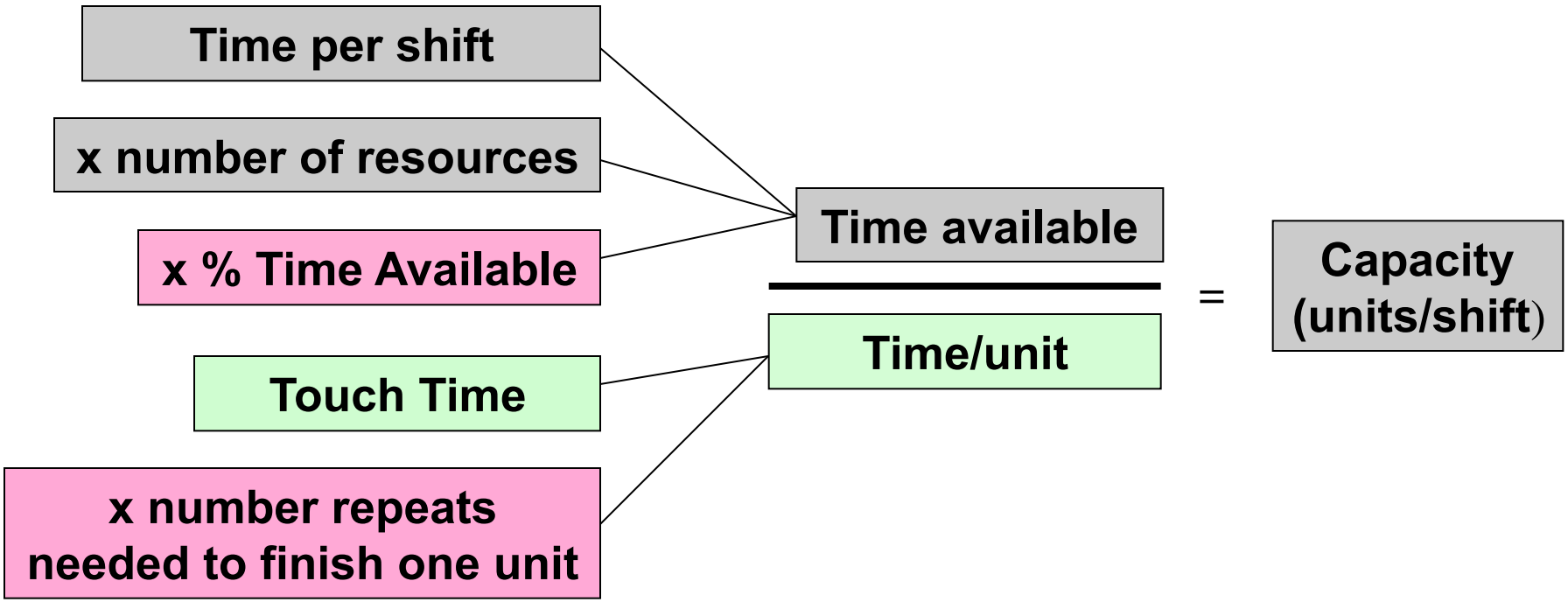
Capacity Detractors

- Example: Rework (defects) as a detractor



- Other detractors include unevenness and unreasonableness, multitasking, equipment downtime…
- The more complex the system, the greater the likelihood of detractors

Capacity Calculation

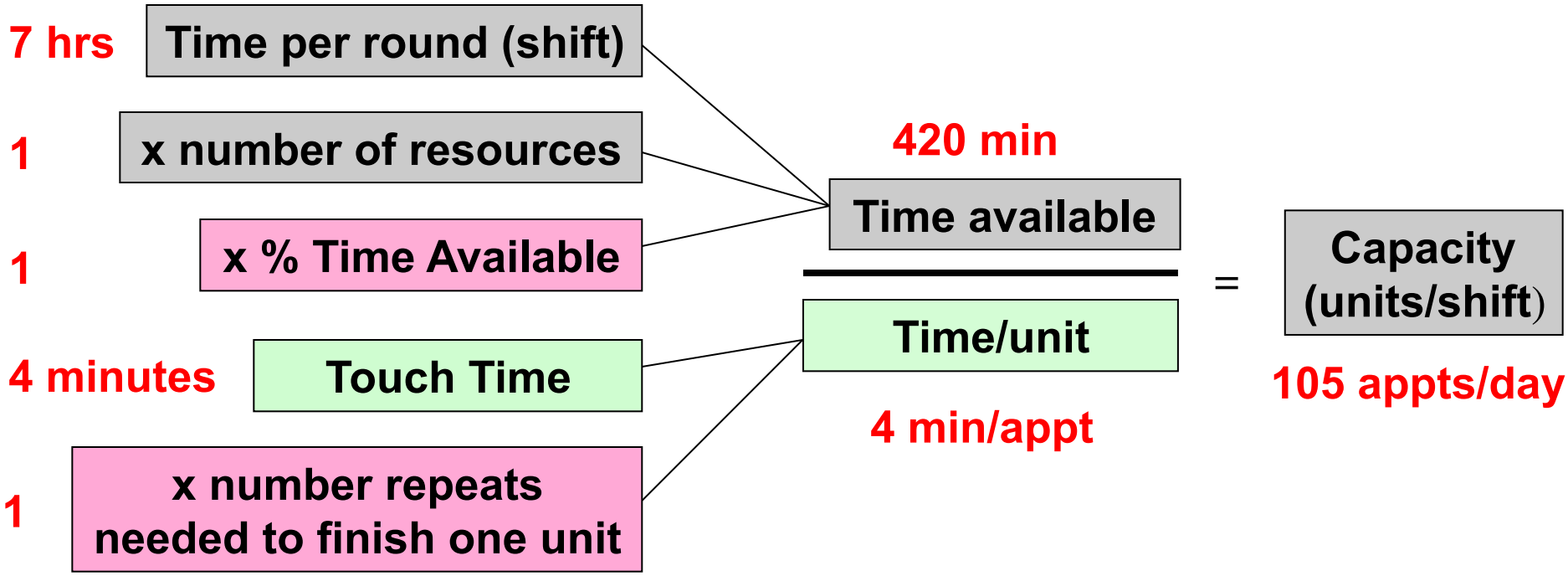


- Local terminology and practices will vary
- Basic concepts do not

Capacity Calculation – Typical Example

Assume "perfect" availability and no repeats

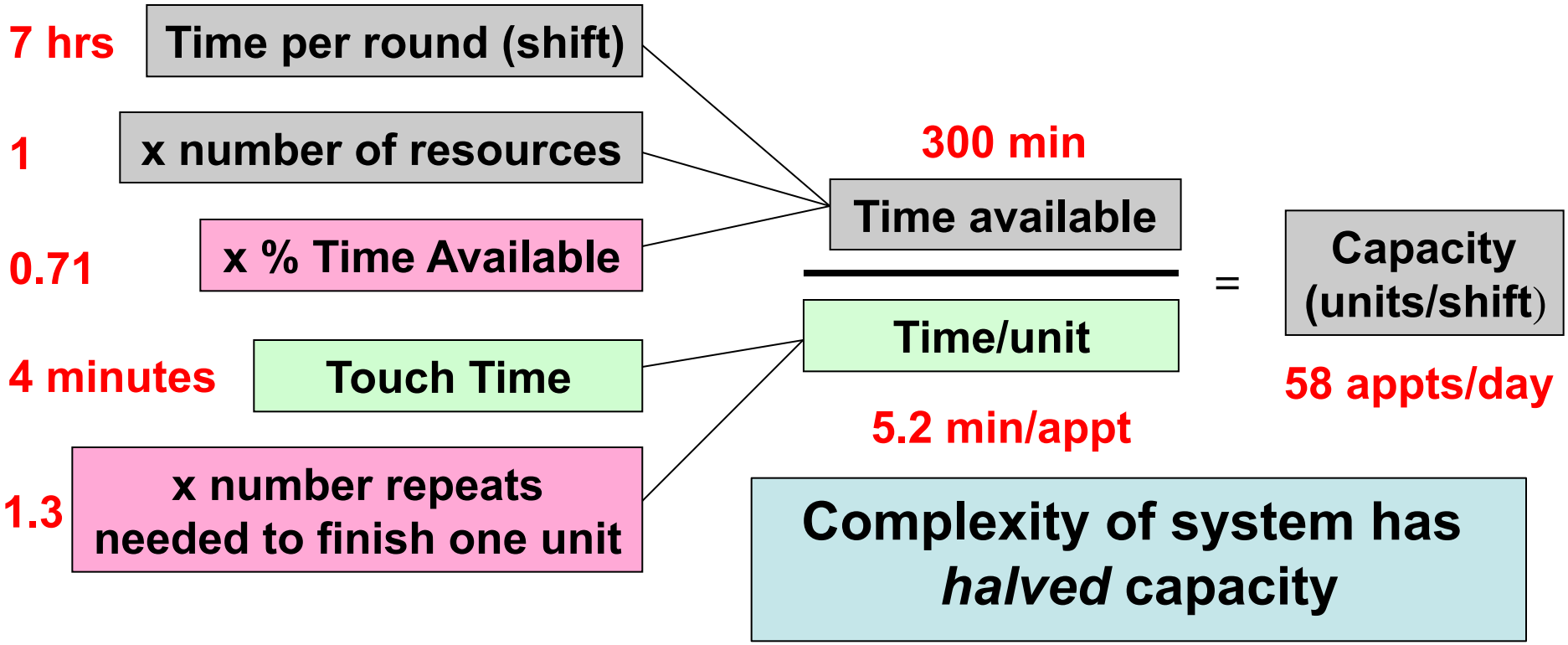
Appointment system:
- 7 hour shifts
- 4 minutes per call
- 1 operator



Capacity Calculation – Realistic Example

Assume 2 hours lost per day to meetings, coordination, slack time etc.

Assume 30% of the appointments need a second call to resolve conflicts and correct mistakes



Lean Interventions to achieve flow on the Value Stream

- **Eliminating waiting**
  - better synchronization of processes
  - making sure “bottleneck” processes have capacity
- **Smaller “batch sizes”**
  - Intermediate checks on customer satisfaction and technical performance to avoid long rework loops
- **Working to *Takt***
  - Do the work on a regular pace
- ***Lowering Complexity***
  - Simplify processes, limit multitasking and confusion
  - Tools include visual management, co-location, knowledge capture and sharing…

Use SIMPLE tools: Visual Control

Provider status chart in clinic waiting room

Source: Virginia Mason Medical Center

Resident status chart in long term care facility

Date	1	2	3	4	5	6	7	8	9	10	11	12	13
19-May-11	2200	1580	1795	1015	1785	1460	1935	1710	1735	1835	1835	1260	1675
20-May-11	2080	1490	1910	1260	1585	1385	1810	1710	1735	1835	1835	1260	1735
21-May-11	2180	1705	1960	1375	2010	1710	1935	1860	1735	1835	985	1260	1735
22-May-11	2055	1655	1960	840	1660	1800	1810	1740	1735	1835	1635	1360	1735
23-May-11	2220	1515	2120	1010	1735	1585	1935	1935	1735	1910	1635	1460	1350
24-May-11	1945	1345	2120	1240	1985	1710	1810	1960	1685	2060	1685	1580	2120
25-May-11	1660	1315	1835	670	1935	1535	1810	2395	1785	1860	1635		1400
26-May-11	2245		1935	560	1985	1535	1810	1735	1835	1935	1635	1360	1530
27-May-11	2045	1375	1935	1050	1760	1660	1685	1860	1835	1835	1710	1660	1810
28-May-11	1885		1935	1200	1760	1585	1810	1760	1835	1935	1710	1660	1810
29-May-11	1795		1935	685	1735	1535	1810	1735	1910	2080	1735	1560	2035
30-May-11	1985	1400	1970	650	1910	1725	1975	1675	1805	2055	1600	1135	1435
31-May-11	1995		2035	950	1835	1315	2035	1675	1805	2055	1600	1510	1520
1-Jun-11	1700		1990	1380	1610	1570	1810	1625	1850	1835	1610	1355	1625
2-Jun-11	1685		1835	1130	1635	1385	1810	1635	1935	1835	1635	1445	1570
3-Jun-11	1810		1835	1580	1710	1535	1810	1635	1935	1835	1635	1540	1635
4-Jun-11	1810		1835	1480	1685	1580	1810	1585	1935	1835	1685	1330	1580
5-Jun-11	1810		1835	1235	1885	1445	1810	1585	1935	1710	1635	1315	1570
6-Jun-11	2035		1835	1030	1625	1275	1935	1735	2060	1625	1510	1270	1570

Source: Faten Mitchell, Quality Improvement Advisor, Health Quality Ontario

Hydration Chart for residents

- Each column represents a resident
- Each row represents a day
- Each cell is daily fluid intake in ml
- Colors show fluid intakes levels relative to desired amounts

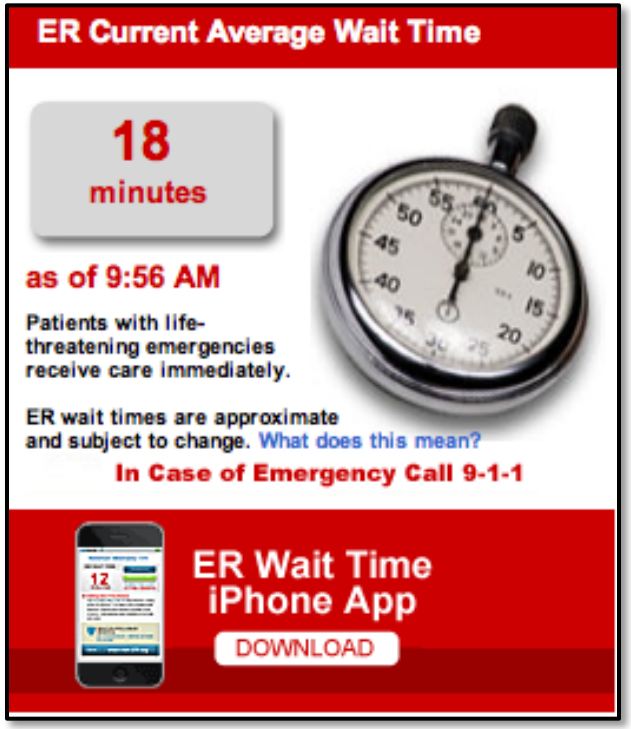
- **Flow can be created by removing bottlenecks from the value stream**
- **However, complexity of healthcare environment, and associated detractors, make this difficult**

Let Customers *Pull* Value

- In a **Push** system, each activity delivers its output when it is done.
  - Results in build up of batches with lots of inventory. Defective goods pile up
- In a **Pull** system every activity delivers its output just as the next activity needs its input.
  - Triggered by the end customer
  - Results in smooth flow with no batches or voids
  - Minimizes inventory and rework due to defects.
- **Pull** systems can be implemented in material flow using a *Kanban* approach.
- Implementation for people flow is more challenging

Various meanings of *Pull*

- Pull also means the organization responds, as a whole, to the needs of the stakeholders
- Customers perceive pull if you have:
  - Rapid response, inside the customers expectations
  - Rapid development, inside the customer's decision cycle
- Healthcare examples:
  - Walk-in clinics (if you can walk out quickly…)
  - On-line pharmacy



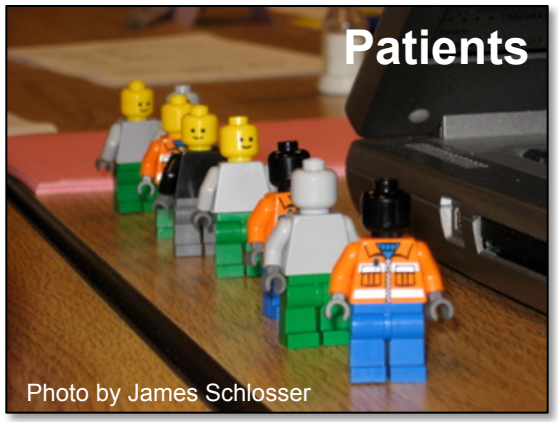
from Newton-Wellesley Hospital website nwh.org 3/27/12

Perfection: Building a Continuous Improvement Culture

- Much of this is learning by doing
- Training and participation plays a role
- Best practices: *All* employees have familiarization training, participate in event(s) with JIT tool training
- Training should be adapted to local environment/culture

LAI Lean Academy one-day Lean Healthcare course

Lego® Clinic Sim



- Realistic and fun
- Lego people move through 5 initially separate clinics
- Objective: Apply lean concepts to increase throughput, reduce Pt stay, reduce chaos

Case Study

- Jefferson Healthcare, WA
- Same lean fundamentals applied to improvement of 5 legacy clinics
- Objective: Increase throughput and revenue, improve patient satisfaction

Simulation Elements

- Clinics of 6 participants
- Participants are process owners
  - Scheduling, registration, triage, examination, diagnostic testing, discharge or hospital admission
  - Initial process rules specified
  - Processes may be improved
- Process variation
  - Patient arrival
  - Patient symptoms and pathways based on head, torso, leg colors
  - Dice roll for process variation & rework
- Budget based improvement choices

Simulation Scenes

- **Pull in the eyes of the customer can be achieved in healthcare processes**
- **The drive for perfection requires strong leadership, pervasive training, and persistence over time**

- **Next: The biggest barrier to classic lean in Healthcare**

Application of Lean to Healthcare Processes:

A Complex System Perspective

Part II – Variability and Complexity

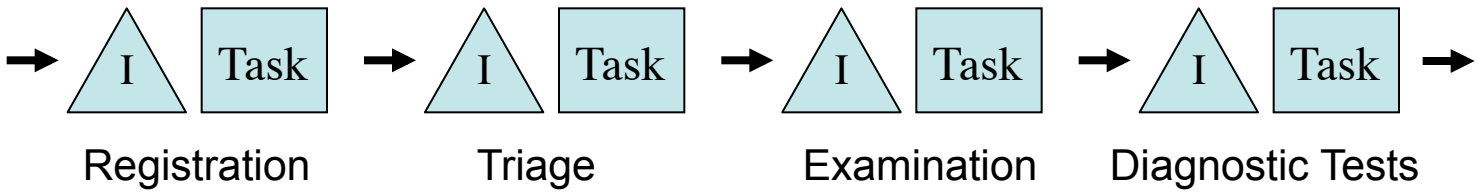
Wasteful Processes = Targets for Lean

- Static *Muda* wastes
  - the 7 (or 8 or 10 or 30) wastes applied to both the material and the *information* value streams
  - Note from PD research: Information "rots" at around 6% per month (!)
- Even more important to complex processes:
  - *Muri* – Overburden of people or equipment
  - *Mura* – Unevenness or instability in operations or outputs

Complex and variable nature of healthcare processes indicates focus on Muri and Mura (not typical of current lean implementations)

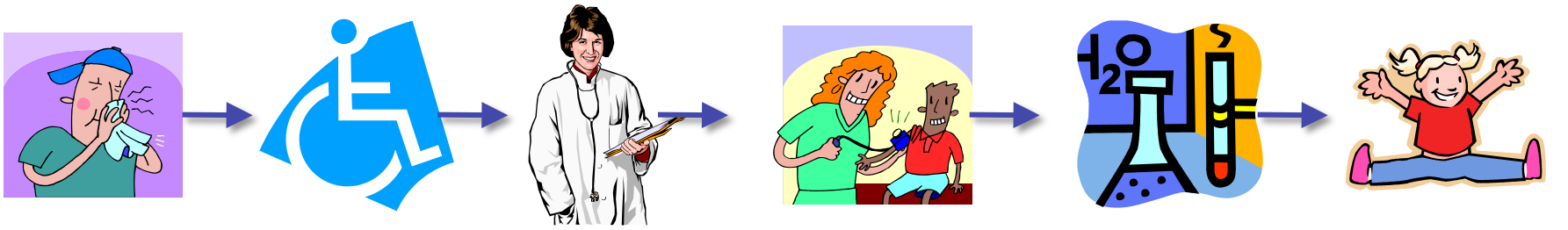
Intuitive and non-intuitive cases

- "Simple" overburden
  - Find actual capacity accounting for iteration and rework
  - Obtain resources (which may take a while)
  - Adjust workload and/or control "batch sizes" to synchronize
- Variability/instability the harder problem
  - A perfectly balanced, "flow" system will behave very badly if there in instability in either input or process!



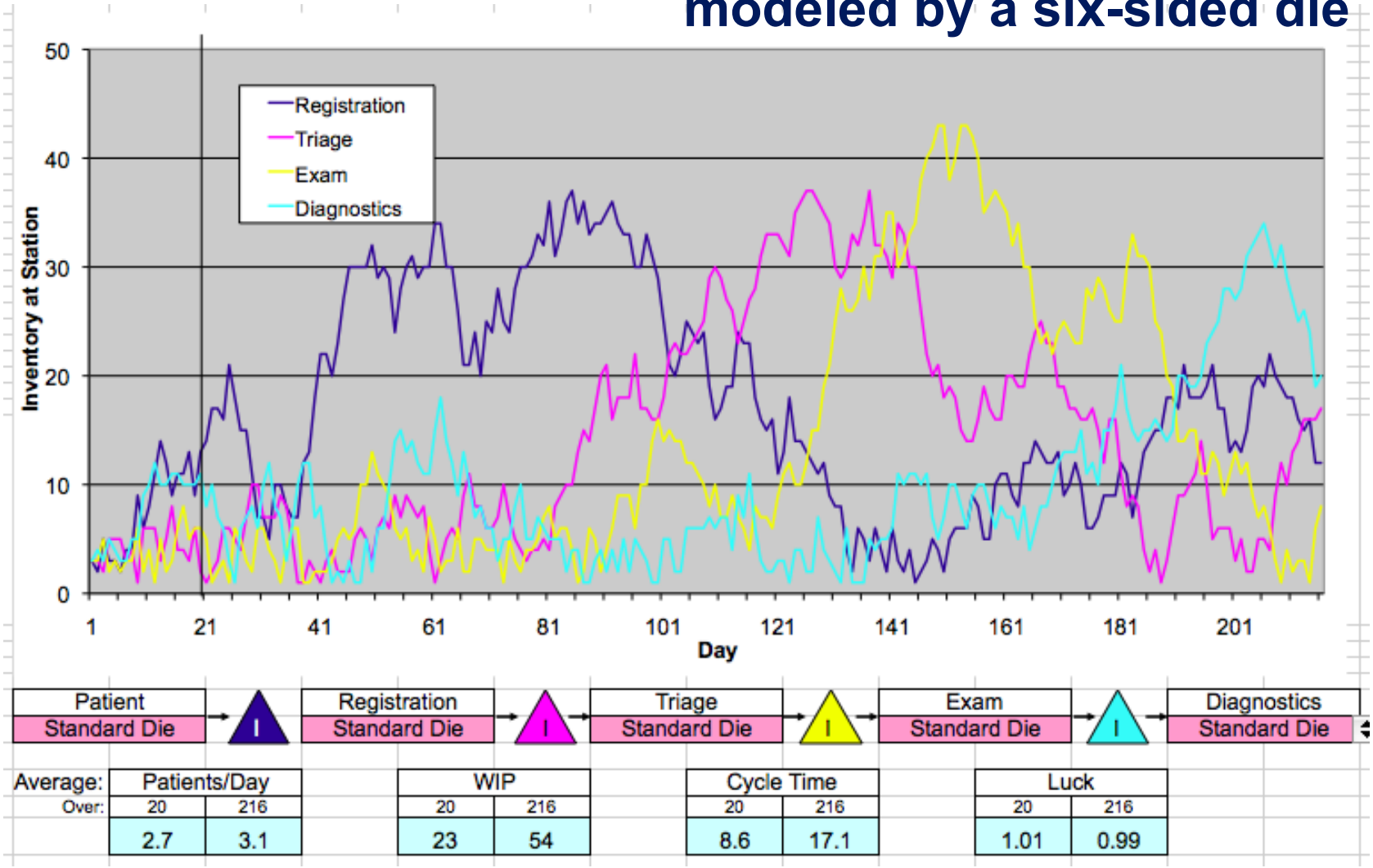
Direct Participatory Simulation

- 5-step clinic value stream
- Dice (provides variation) and a poker-chip "patients" (flowing value)
- Everyone, simultaneously,
  - Rolls die
  - Passes that many patients (or all in the waiting room, whichever is smaller) to the next step
  - Record number of patients in the waiting room
- Repeat for 20 "shifts"



Spreadsheet Simulation

Balanced flow system *but* performance modeled by a six-sided die



Average:	Patients/Day		WIP		Cycle Time		Luck	
Over:	20	216	20	216	20	216	20	216
	2.7	3.1	23	54	8.6	17.1	1.01	0.99

Queue Time

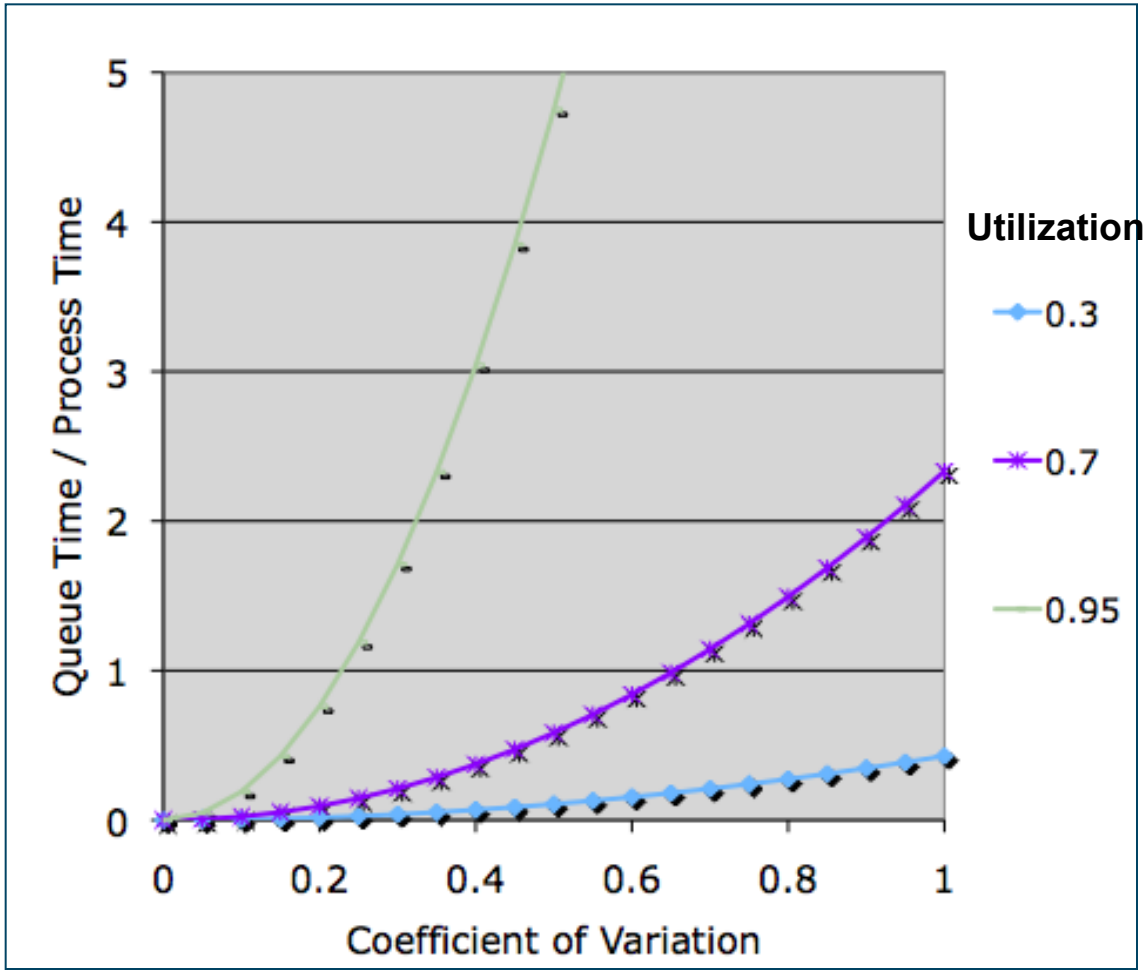
- **Based on the equation for queue cycle time,**

$$\text{Time\_in\_Queue} = \text{Activity\_Time} * \left(\frac{\text{Utilization}}{1 - \text{Utilization}} \right) * \left(\frac{CV_a^2 + CV_p^2}{2} \right)$$

- **CV_a is input variation**
  - **which we may not control**
- **CV_p is process variation**
  - **which we want to minimize**
- **Utilization rate is Demand/Capacity**
  - **Note to be "efficient" this should be 1…**

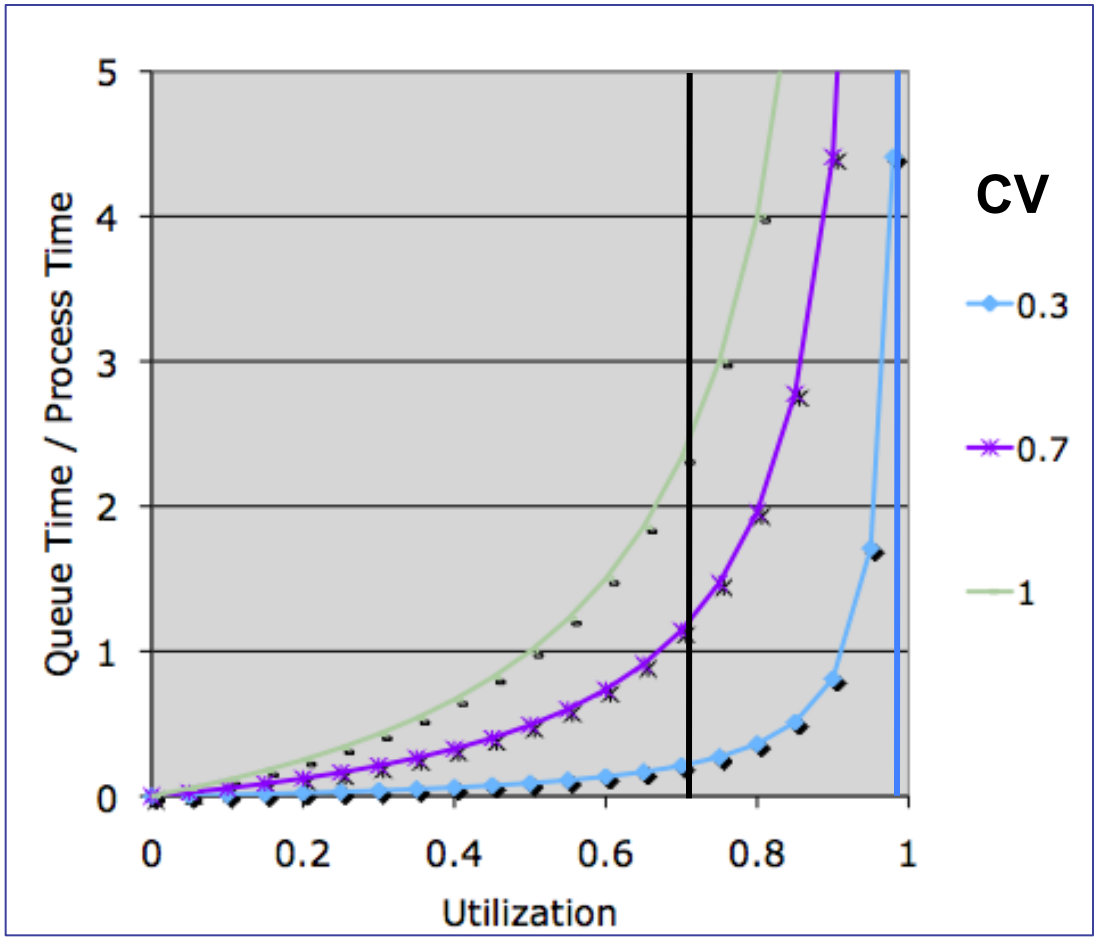
Controlling Variability

- Heroic reductions in variability required if utilization is high
- This is the motivation behind the 6-Sigma approach



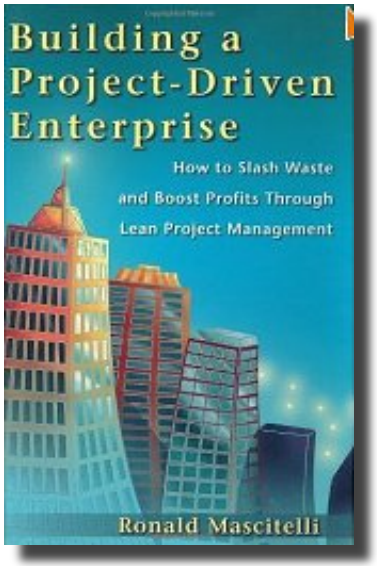
Controlling Utilization (overburden)

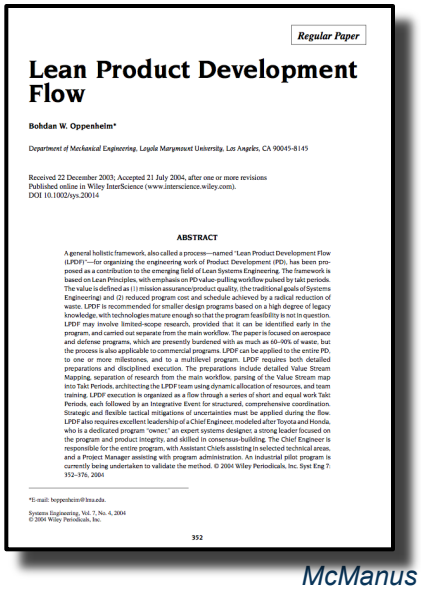
- For any variation level, some level of utilization makes queue time explode
- This is *muri* and *mura* in action
- Often, slight easing makes a dramatic difference



Adapting to Variation

- **Standardized system for adjusting staffing, resources, or schedule to absorb variation**
  - **Reserve capacity: for critical situations**
  - **Flexible staffing: "2-1/2 jobs"**
  - **Working to a pace: "pseudo-*Takt*"**
- **Not a solved problem, but plenty of ideas…**




Regular Paper

Lean Product Development Flow

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Received 22 December 2003; Accepted 21 July 2004, after one or more revisions
Published online in Wiley InterScience (www.interscience.wiley.com).
DOI 10.1002/sys.20014

ABSTRACT

A general holistic framework, also called a process—named 'Lean Product Development Flow (LPDF)'—for organizing the engineering work of Product Development (PD), has been proposed as a contribution to the emerging field of Lean Systems Engineering. The framework is based on Lean Principles, with emphasis on PD value-pulling workflow pulsed by takt periods. The value is defined as (1) mission assurance/product quality, (the traditional goals of Systems Engineering) and (2) reduced program cost and schedule achieved by a radical reduction of waste. LPDF is recommended for smaller design programs based on a high degree of legacy knowledge, with technologies mature enough so that the program feasibility is not in question. LPDF may involve limited-scope research, provided that it can be identified early in the program, and carried out separate from the main workflow. The paper is focused on aerospace and defense programs, which are presently burdened with as much as 60–90% of waste, but the process is also applicable to commercial programs. LPDF can be applied to the entire PD, to one or more milestones, and to a multilevel program. LPDF requires both detailed preparations and disciplined execution. The preparations include detailed Value Stream Mapping, separation of research from the main workflow, parsing of the Value Stream map into Takt Periods, architecting the LPDF team using dynamic allocation of resources, and team training. LPDF execution is organized as a flow through a series of short and equal work Takt Periods, each followed by an Integrative Event for structured, comprehensive coordination. Strategic and flexible tactical mitigations of uncertainties must be applied during the flow. LPDF also requires excellent leadership of a Chief Engineer, modeled after Toyota and Honda, who is a dedicated program "owner," an expert systems designer, a strong leader focused on the program and product integrity, and skilled in consensus-building. The Chief Engineer is responsible for the entire program, with Assistant Chiefs assisting in selected technical areas, and a Project Manager assisting with program administration. An industrial pilot program is currently being undertaken to validate the method. © 2004 Wiley Periodicals, Inc. Syst Eng 7: 352–376, 2004

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Systems Engineering, Vol. 7, No. 4, 2004
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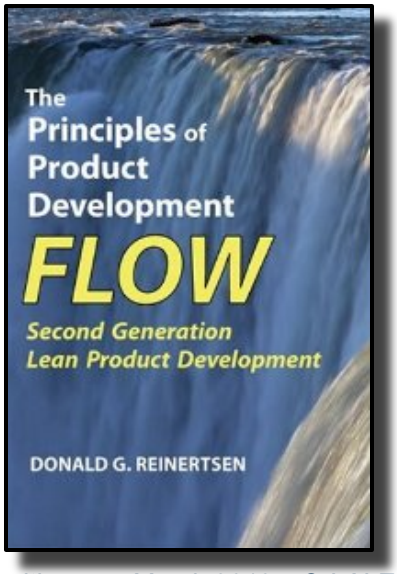
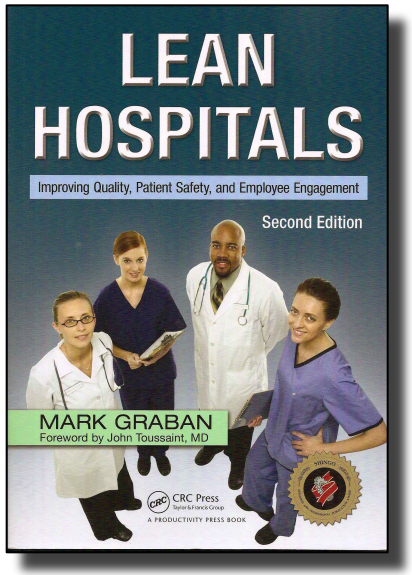
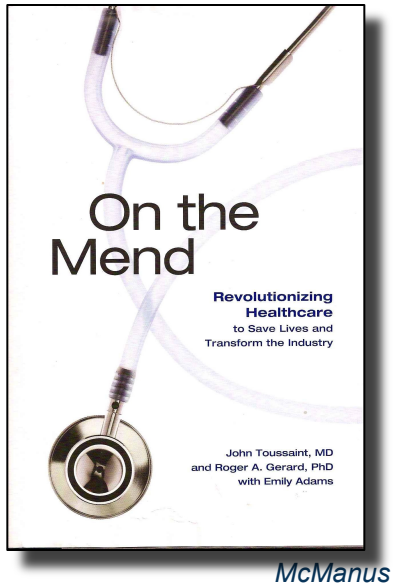
352

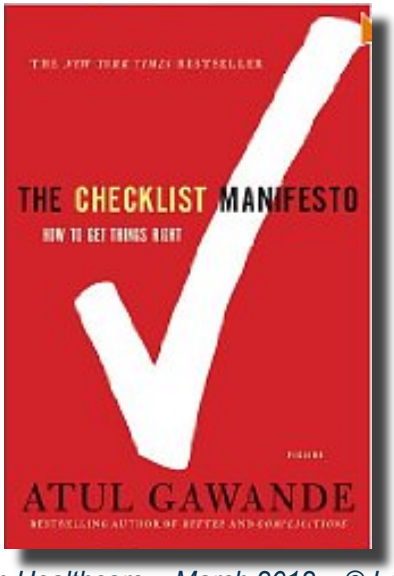


Adapting to Variation: Healthcare

- **Standardized system for adjusting staffing, resources, or schedule to absorb variation**
  - **Reserve capacity: for critical situations**
  - **Flexible staffing: "2-1/2 jobs"**
  - **Working to a pace: "pseudo-*Takt*"**
- **Not a solved problem, but plenty of ideas…**







Reducing Complexity

- Standardizing and simplifying systems to self-regulate without additional management
  - Daily management systems (self-organizing teams)
  - Organizing, Kitting and *Kanban* of supplies
  - Standardizing of common procedures (checklists)
- Moderate *local* payoff (less work)
- Potentially huge *systems* payoff through reduced variation and overburden
  - Do not "monetize" local savings – use them to make the system perform better

- Variation will disrupt even a “perfect” system
- Badly
- Variation (Mura) and Overburden (Muri) are linked in a nasty way
- Both must be reduced, if anything *more* aggressively than static wastes
- Input variations (patients) may not be controllable; internal variations and complexity *are*

Lean Produces Results in Healthcare

A few of many examples:

- Waiting time for orthopedic surgery reduced from 14 weeks to 31 hours (from first call to surgery) – *ThedaCare, WI*
- 48% readmission rate reduction for COPD patients - *UPMC St. Margaret Hospital, PA*
- $180M capital spending cost avoidance from lean improvements – *Children's Hospital, WA*
- 72% reduction in lab results turnaround time from 2004-2010 without addition of head count or instrumentation – *Alegent Health, NE*

Case Study

Jefferson Healthcare

Jefferson County, WA – Population 29,542 (2008 est.)

Photo by Earll Murman

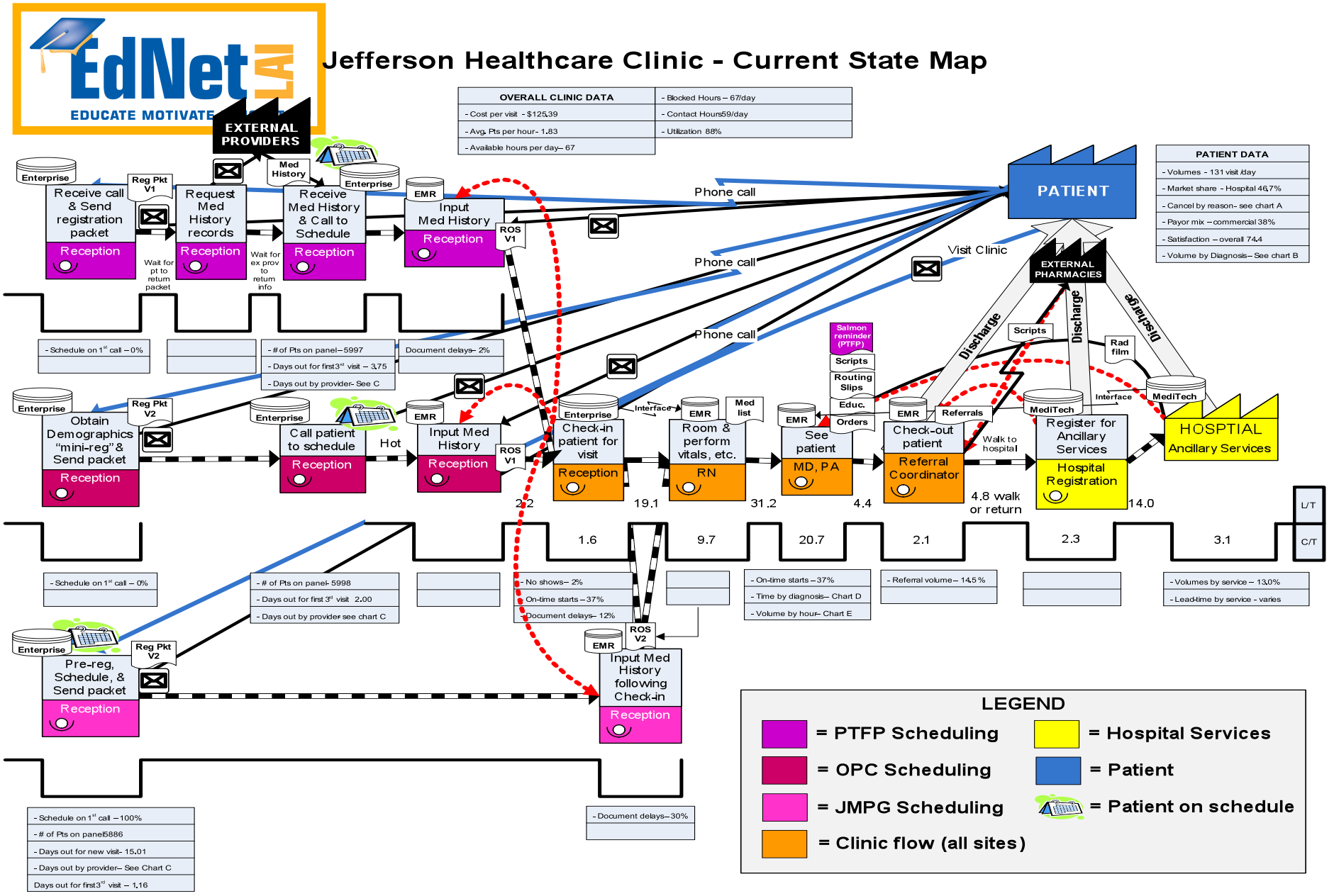
Source: Google

Improving JHC Outpatient Clinics Through VSMA & Lean Thinking

- **Situation**
  - Five legacy outpatient clinics
  - Few standard processes
  - Little coordination between clinics and with other parts of JHC
  - Patients per day per doctor under national norms
  - Poor flow and facility layout
- **Primary Event Focus:**
  - Identify standard patient flow for clinic encounters; improve patient access and provider productivity

Photos by Earll Murman

Jefferson Healthcare Clinic - Current State Map



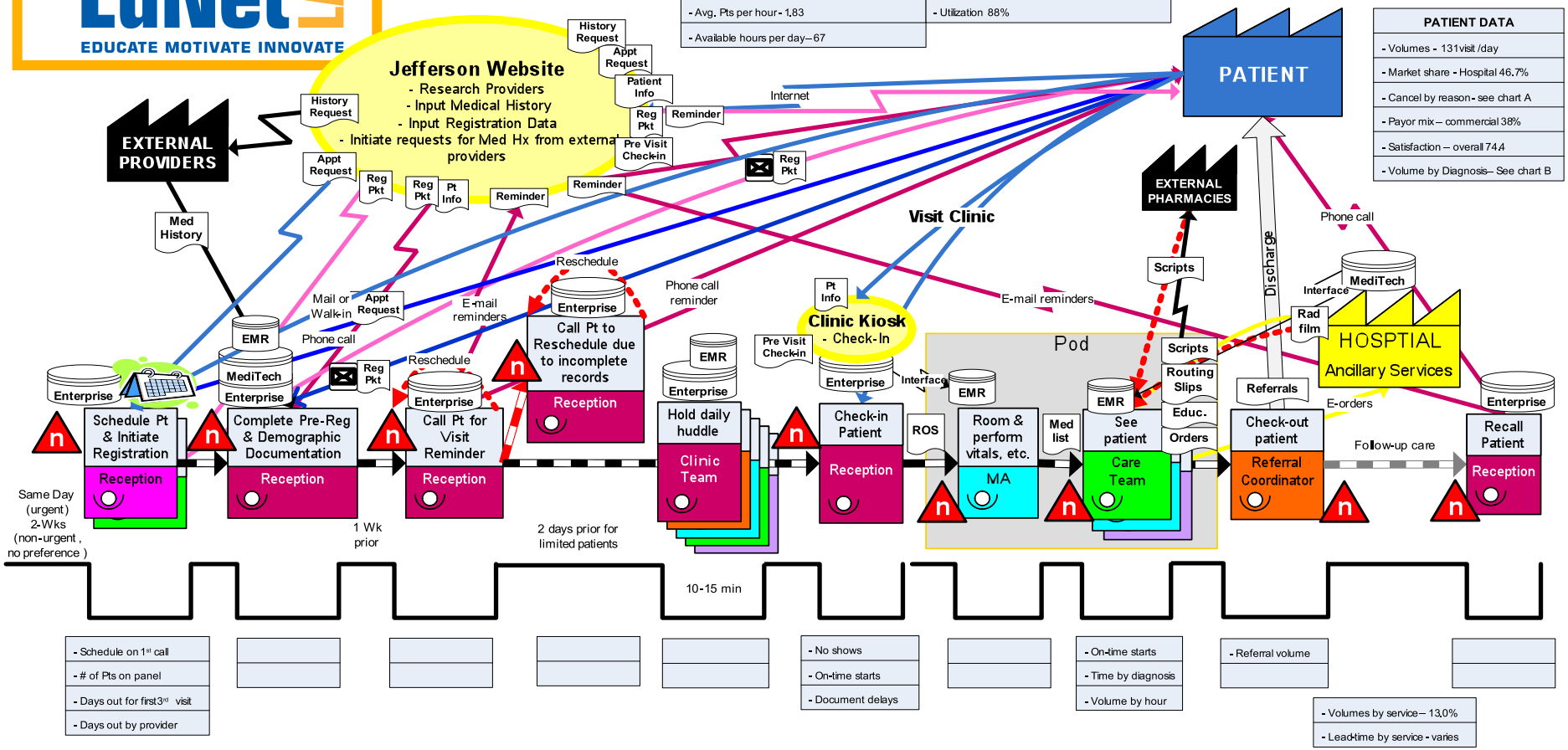
Source: Jefferson Healthcare, Port Townsend, WA

Jefferson Healthcare Clinic - Ideal State Map

EdNet LAI
EDUCATE MOTIVATE INNOVATE

OVERALL CLINIC DATA	- Blocked Hours – 67/day
- Cost per visit - $125.39	- Contact Hours 59/day
- Avg. Pts per hour - 1.83	- Utilization 88%
- Available hours per day – 67	

PATIENT DATA
- Volumes - 131 visit /day
- Market share - Hospital 46.7%
- Cancel by reason - see chart A
- Payor mix – commercial 38%
- Satisfaction – overall 7.4.4
- Volume by Diagnosis – See chart B



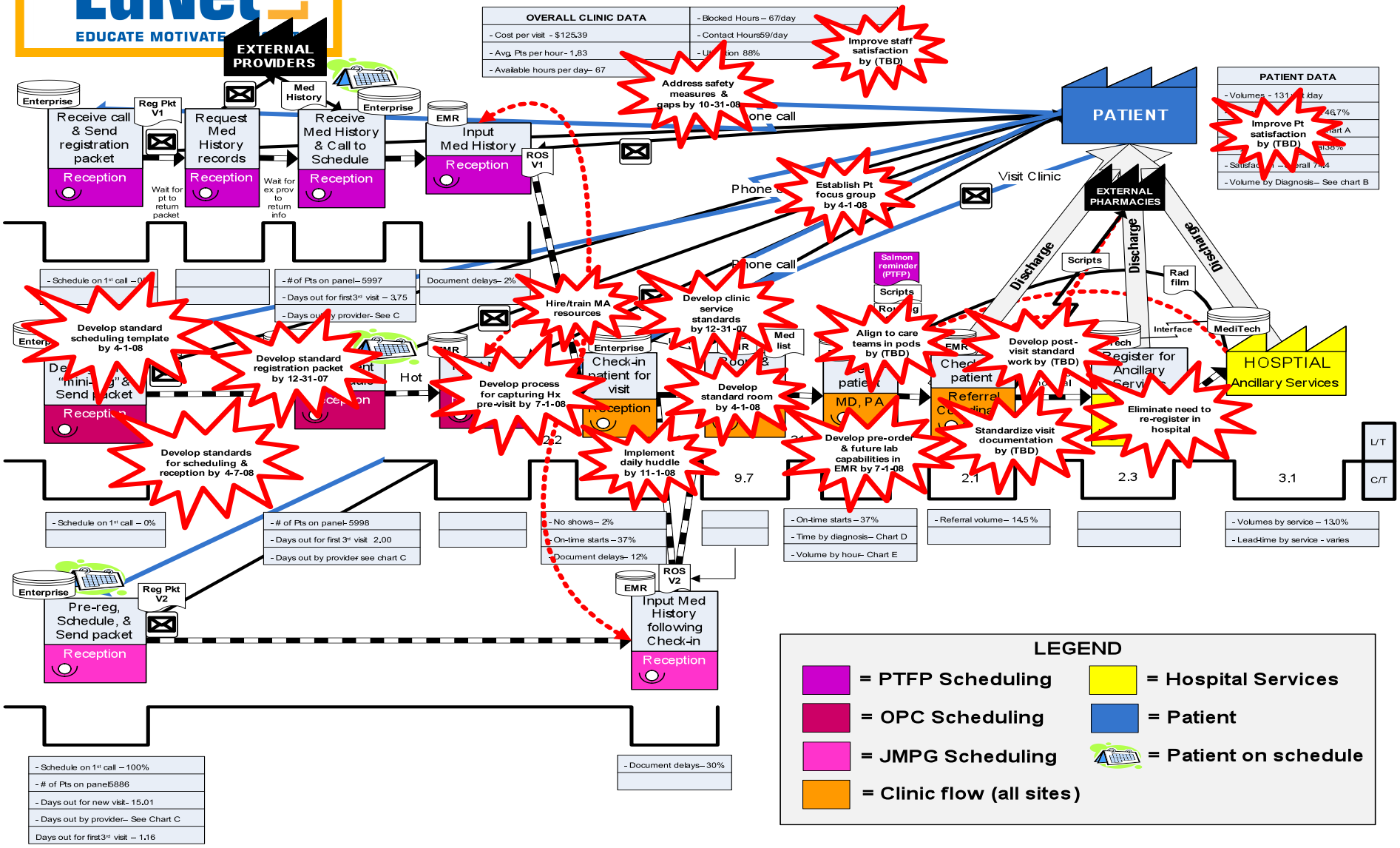
- Schedule on 1st call					- No shows		- On-time starts	- Referral volume	
- # of Pts on panel					- On-time starts		- Time by diagnosis		
- Days out for first 3rd visit					- Document delays		- Volume by hour		- Volumes by service – 13,0%
- Days out by provider									- Lead-time by service - varies

LEGEND

- = Scheduling Receptionist
- = Clinic Receptionist
- = Referral Coordinator
- = MA
- = MD/PA
- = RN
- = Hospital Services
- = Patient
- = Patient on schedule
- = Queues (Inventory)

Source: Jefferson Healthcare, Port Townsend, WA

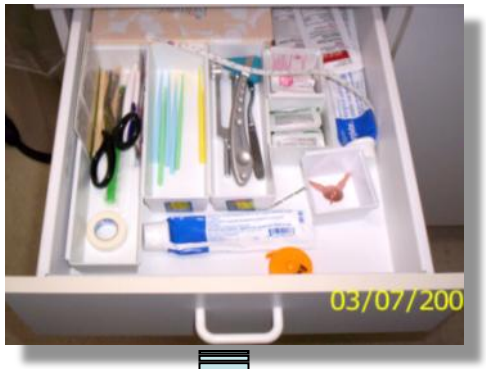
Jefferson Healthcare Clinic – Future State Focus (2008)



Source: Jefferson Healthcare, Port Townsend, WA

Standard Rooms and Central Supplies

5S Events in each Clinic



Source: Jefferson Healthcare

Daily Management System

Implement daily huddle

Photos by Earll Murman

Lean Events Targeting Each Step in the Clinic Value Stream

Standard Work creates a foundation to build on

FIW Dec 2007
FIW Mar 2008
FIW Mar 2009

RPI Jun 2008
RPI Mar 2009

RPI Sep 2008

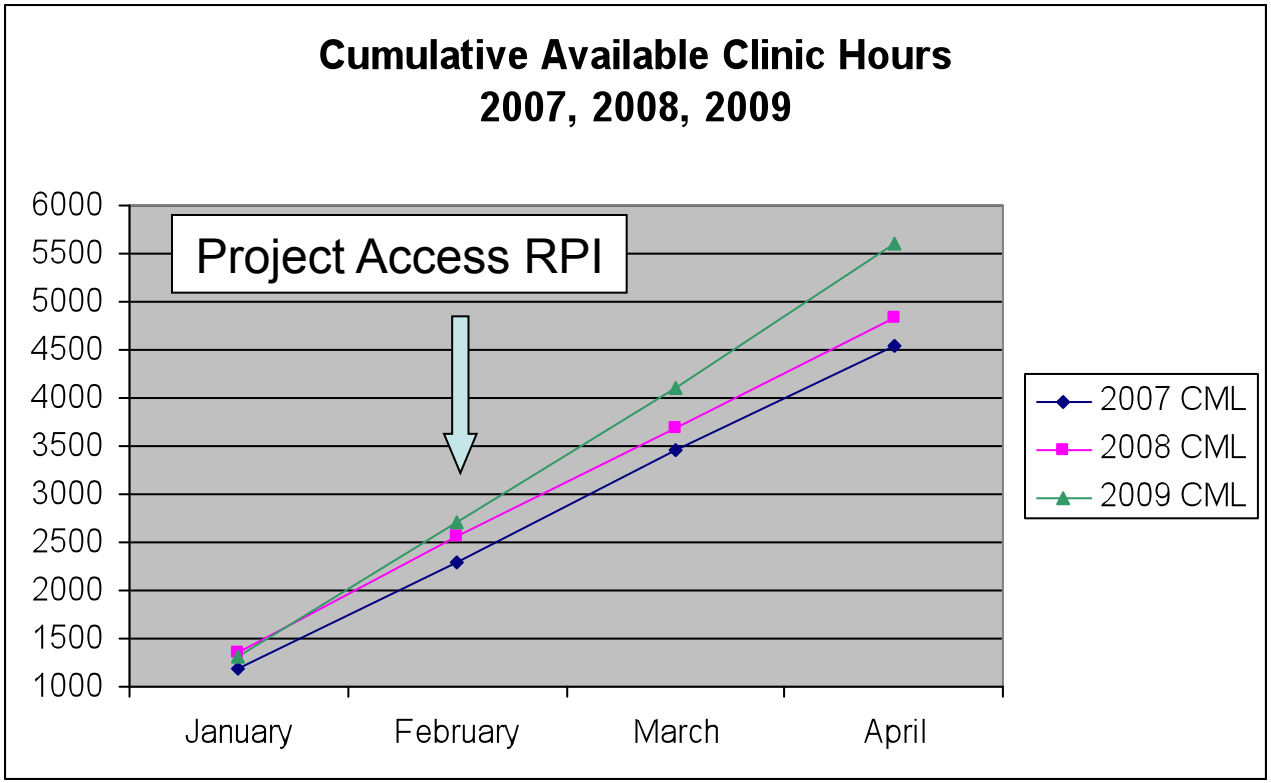
FIW = Focused Improvement Workshop

Source: Jefferson Healthcare

Results

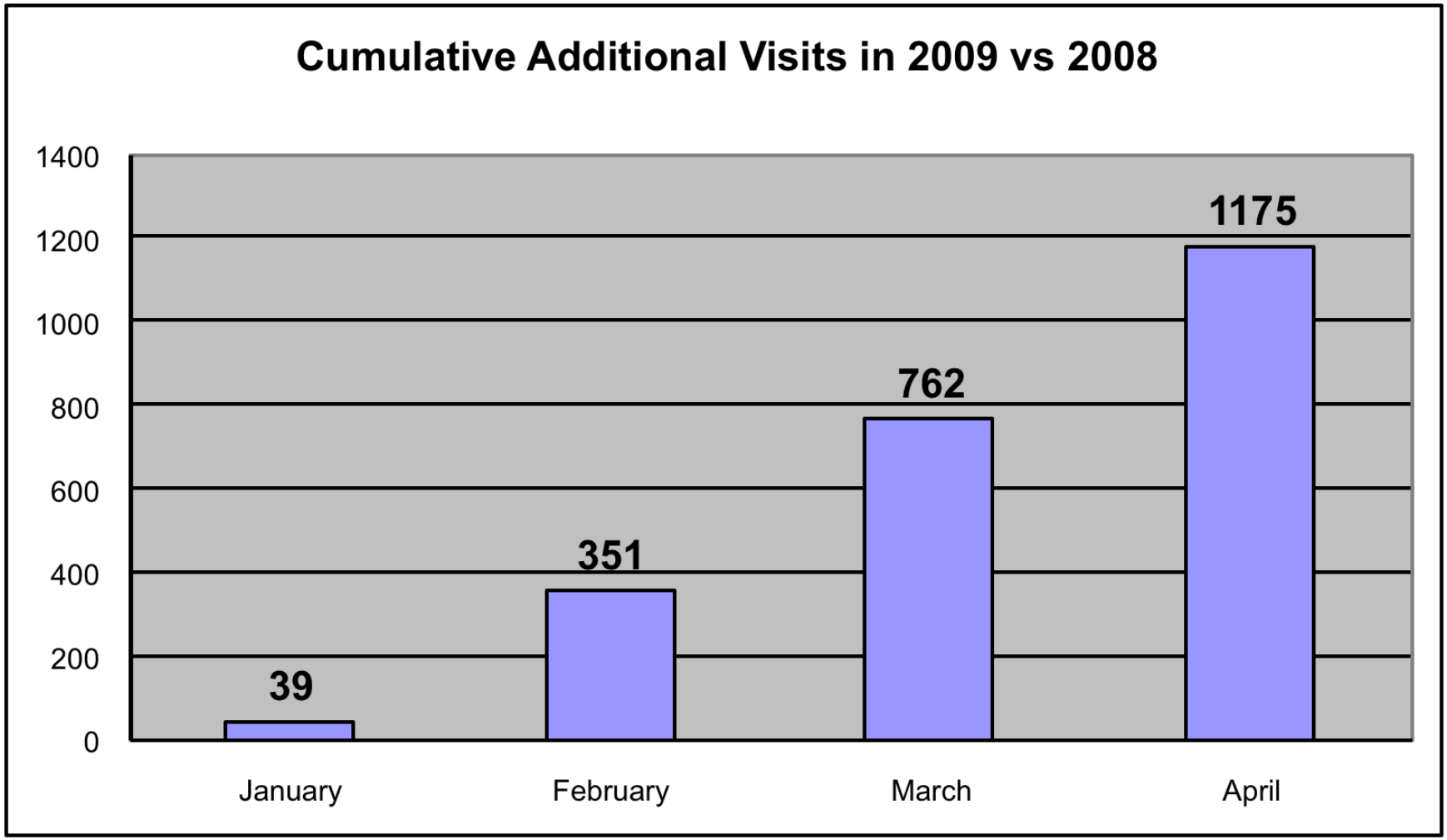
Project Access RPI
(Feb 2009):

- Reorganized Medical Staff Structure
- Consolidate Provider meetings reducing meeting hours.
- Revise scheduling guidelines (20 min vs. 40 min vs. 60 min)
- Create schedule management strategies using daily huddle



Source: Jefferson Healthcare

Results



Source: Jefferson Healthcare

- **Lean has been successfully applied to Healthcare processes**
- **Little projects can provide dramatic (local) improvements**
- **Consistent reduction of complexity and variation *across the value stream* provides significant overall performance gains**

What affects the bottom line?
Jury is out, but a PD analog exists…

- LAI / McKinsey study*
  - 300 subjects, 28 companies
  - what PD practices correlated with project success?
- High performing companies consistently did better on a variety of metrics
- High performing companies tended to employ *a lot* of advanced PD practices
- No "silver bullet" practice, but a few correlated particularly strongly with success

*Mike Gordon, Chris Musso, Eric Rebentisch, and Nisheeth Gupta, The Path to Developing Successful New Products, WSJ, November 30, 2009

The Main Differentiators between Top and Bottom Performers

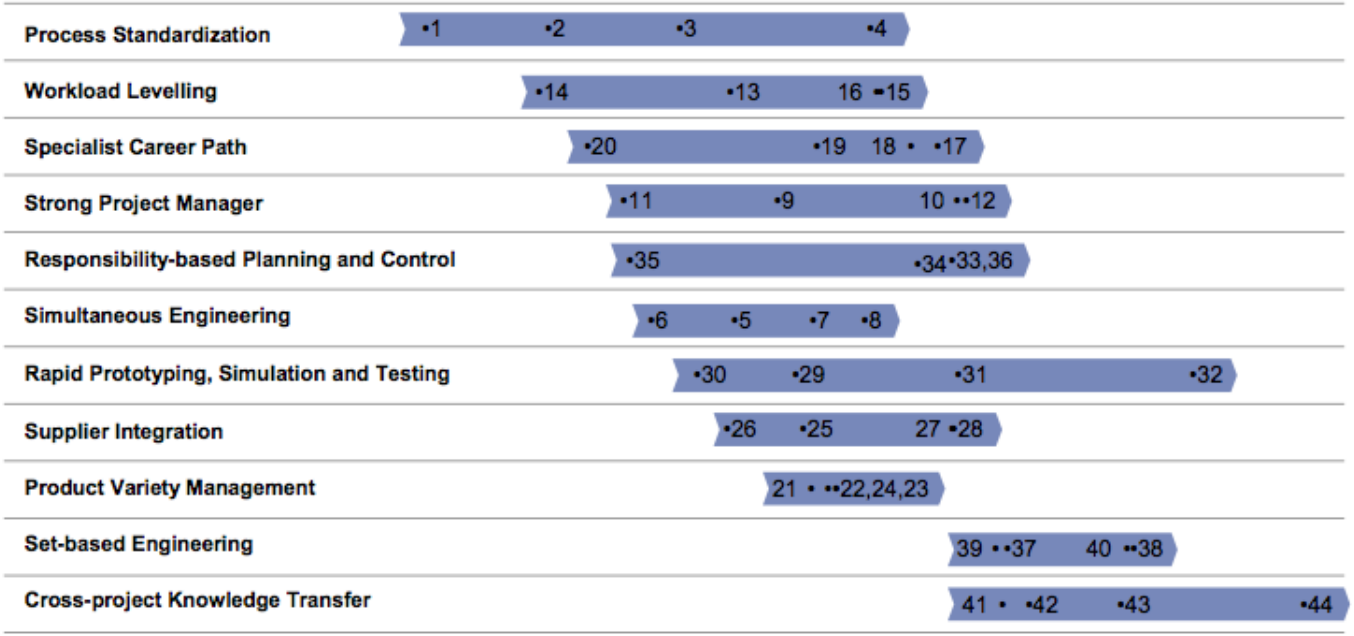
1. **High level of upfront project preparation**
   - Scoping of project
   - Staffing of project
   - Handling of "Fuzzy Front End"
2. **Focus on project team**
   - Emphasize on Project Organization over Line Organization
   - Strong project leadership
3. **Keep eyes on the ball**
   - Exploration of customer needs at each step of the project
   - Close customer integration, constant feedback loops

These LEAN characteristics correlate with business success

List from Dr. Josef Oehmen

Where to start?

- **LAI study of lean practices. Difficulty, impact, interdependencies considered.**



- **Process Standardization, Workload leveling suggested as first steps.**

Rebentisch, Eric, and Hoppmann, Joern, "New Insights on Implementing Lean in Product Development Systems," LAI, 2009

Wrapup

- **Lean does apply to Healthcare**
  - There is plenty of waste to be found
  - The *Value, Value Stream, Flow, Pull, Perfection* model works (roughly in order)
  - Tools must be selected and customized base on your needs
- **Variation and Complexity challenge traditional application of lean (but not the concepts)**
  - Reduce *Muri* (overburden) and *Mura* (variation) as well as static wastes
  - Don't monetize modest savings – apply them across the value stream to improve *system* performance

Lean does not tell you how to treat patients – it frees you to do it more and better

Acknowledgements

- The LAI EdNet Lean Healthcare Team:
  - Prof. Earll Murman, Prof. Annalisa Weigel, and Jackie Candido
  - Prof. Sharon Johnson (WPI)
  - Prof. Deanna Willis, MD (U Indiana),
  - Whitney Walters (UM Health System)
  - Prof. Barrett Thomson (U Iowa)
  - Prof. Steve Shade (Perdue)
- Mark Graban, MD (author, *Lean Hospitals*)
- Eric Dickson, MD (President, UMass Memorial Medical)
- The MIT Lean Advancement Initiative and its Educational Network, partial sponsors of this work

QUESTIONS?

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