

# Human Factors and Behavioral Economics to Design High Value Healthcare

**Jonathan Gleason, MD**

**Vice President,**

**Clinical Advancement and Patient  
Safety**

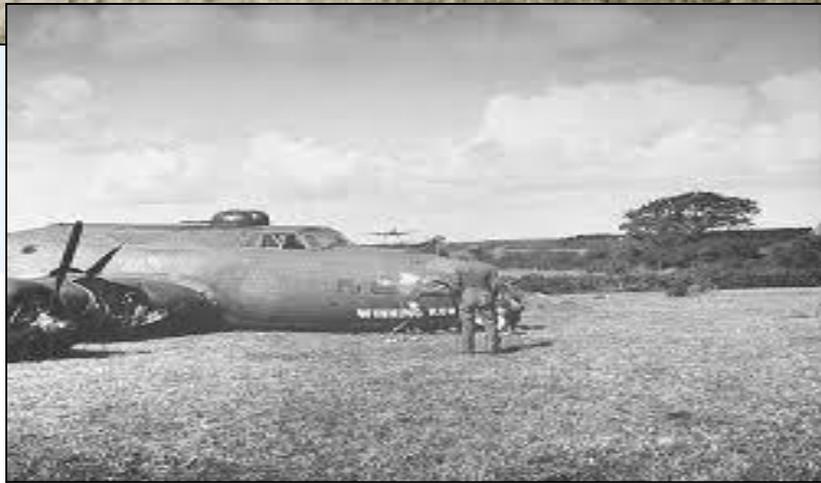
# DISCLOSURES

**No Financial Disclosures.**

# Objectives

- **Describe the use of Behavioral Economics to design better healthcare.**
- **Describe the role of Human Factors in the continual redesign of healthcare.**
- **Describe the role of Human Factors related to:**
  - Proactive identification of risk
  - Mitigation of unavoidable risk
  - Reactive response to errors

# Human Factors



# Human Factors



# Human Factors



1. Change the Human
2. Change the System



# Build STRONGER Interventions...

**Awareness  
(mitigate)**

**Prevention  
(eliminate)**

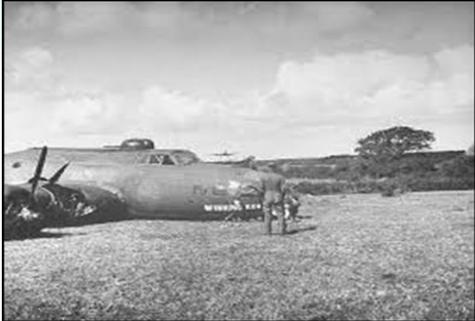
**WEAK**

**STRONG**



**High Failure Rate**

**Low Failure Rate**



<b>Fiction/Myth</b>	<b>Fact</b>
<b>Eliminate human error</b>	<b>Design resilient systems for unanticipated events</b>
<b>Use education to modify behavior</b>	<b>Modify Design to fit people</b>
<b>Focus on individuals</b>	<b>System approach (individual, environ, task, organization, team)</b>
<b>Limited set of principles that can be learned in a brief session</b>	<b>Scientific discipline</b>
<b>All Human Factors professionals have the same expertise</b>	<b>Common Goal - different specialties</b>

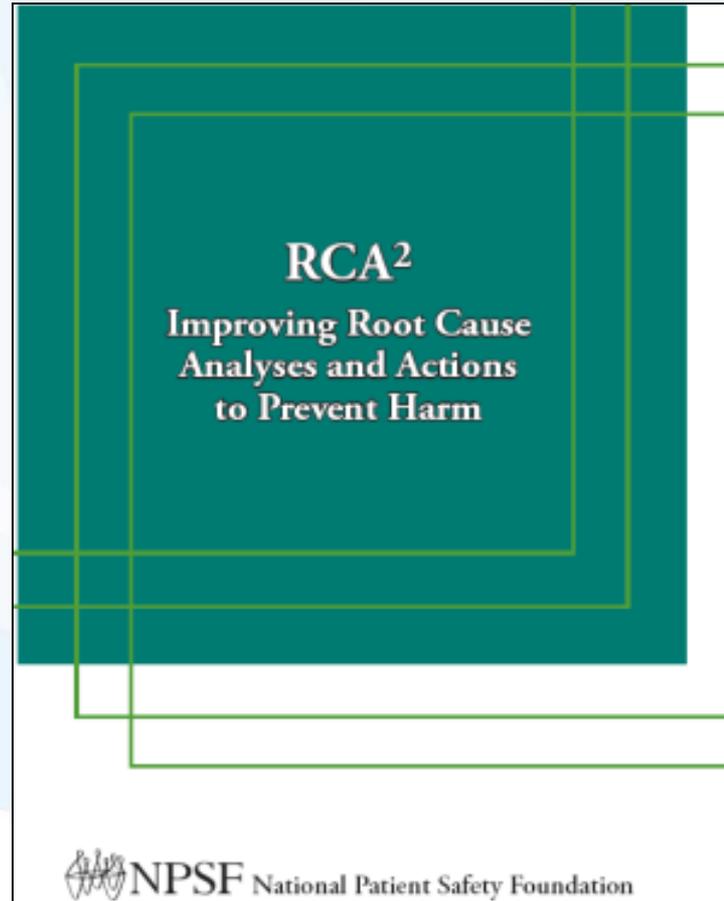
Russ, A. L., Fairbanks, R. J., Karsh, B. T., Militello, L. G., Saleem, J. J. & Wears, R. L. 2013. The science of human factors: separating fact from fiction. *BMJ Qual Saf*, 22, 802-8.

# Translational Human Factors

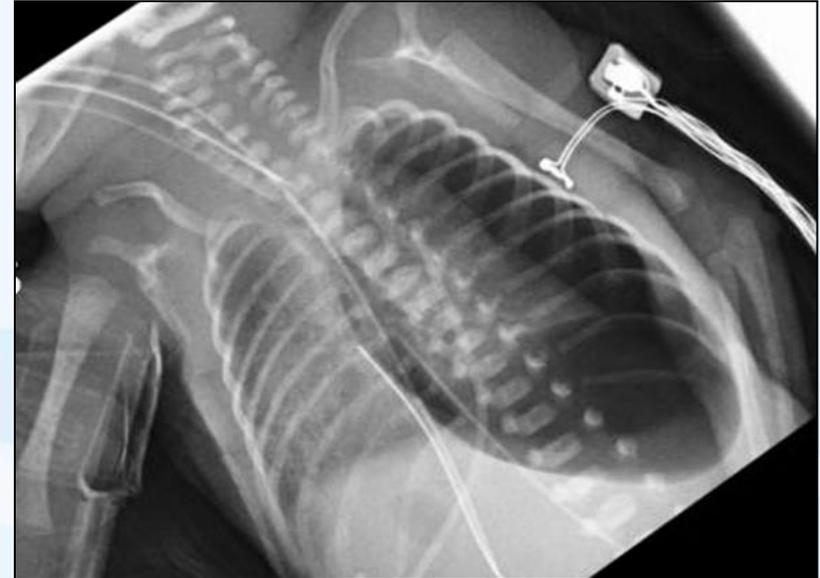


**Continual Redesign...  
...Design Moment**

# #1 - Response to Errors



# RCA<sup>2</sup> – Simulated Re-Enactment



# Name, Name M.

Study List

Exam.Tag

Study

Queue Cont.

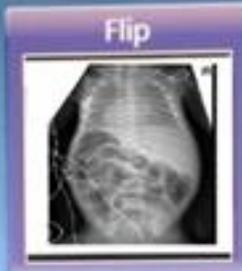


QUICK

Acquisition

Image Proc

Rotate&Flip



Value

Value

ROI Adjustment

FIT Detail

Rotate&Flip

Hybrid Tool

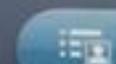
Text

Reset

Pod. Chest  
A AP

1 / 1

90°



PORTABLE AP ERECT



Image Display Too...

89.2  
[Slider bar]

73.6  
[Slider bar]

Normal  
[Dropdown menu]

0.0°  
[Slider bar]

-5.0 -3.0 2.0 4.0

Dt: 0.8

Optimal Range

Close



[Navigation icons: Home, Left, Right, Rotate, Refresh]



kVp: 60  
mAs: 10.0

3

System is not configured. Select protocol to continue.



GE OLC

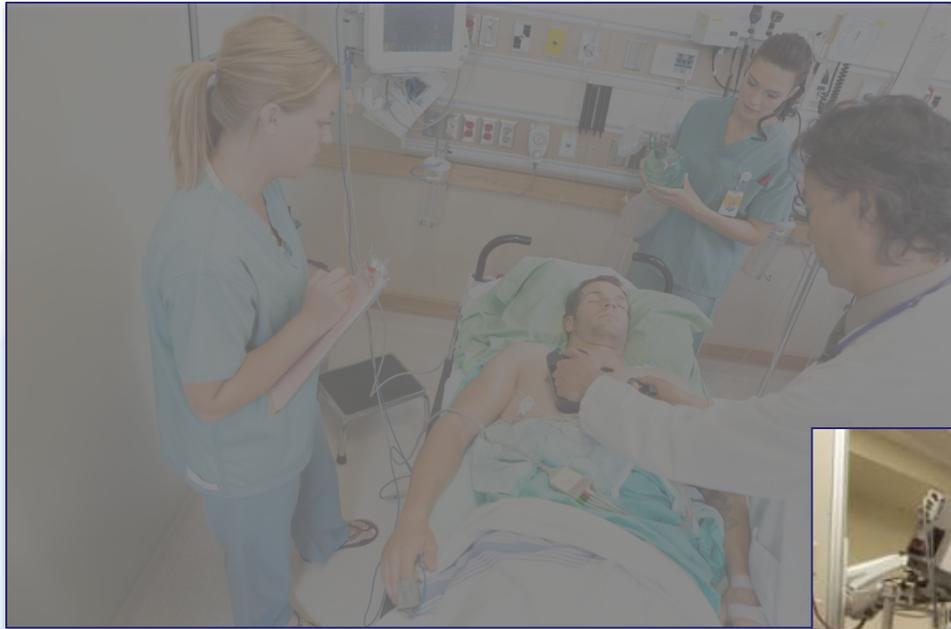


1:58

HU:100%

1707/3793

# Work as imagined



# Work as performed



# MRI Safety and SIMULATION



# RCA<sup>2</sup> – Simulated Re-Enactment

Patient Confirmation ? X

**PATIENT SAFETY**

Name: Matck, Bridget T  
Position: Head First-Supine  
Height: 5'10"  
Weight: 185

**FIRST LEVEL MODE**

SAR   
Gradient

**MEDICAL INFORMATION**

Contrast Allergies  
Pregnancy Status  
Medical Alerts  
Special Needs

**STUDY**

All Programs | Frequent

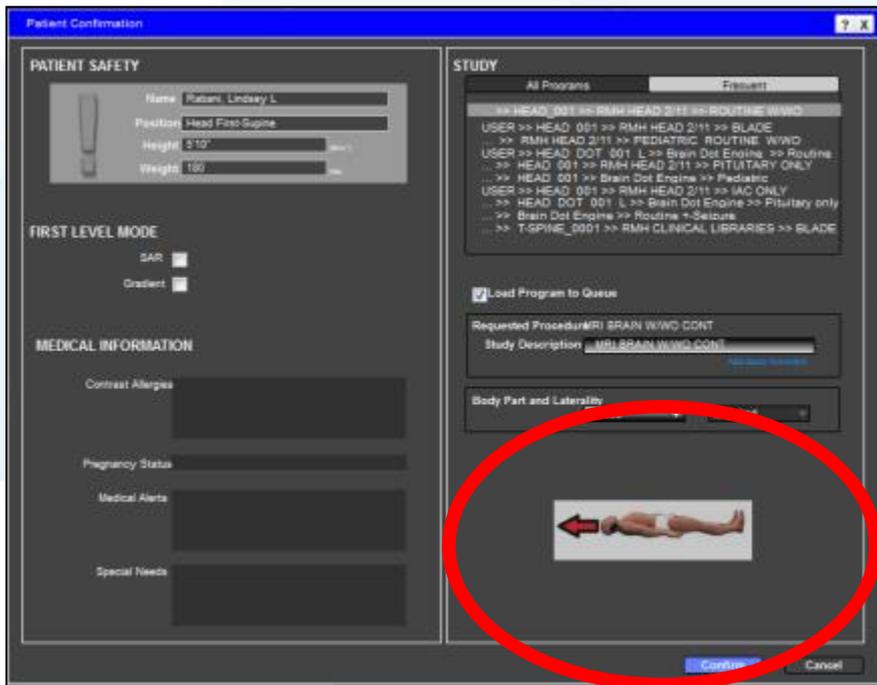
```
>>> HEAD_001 >>> RMH HEAD 2/11 >>> ROUTINE W/WO  
USER >>> HEAD_001 >>> RMH HEAD 2/11 >>> BLADE  
... >>> RMH HEAD 2/11 >>> PEDIATRIC ROUTINE W/WO  
USER >>> HEAD_DOT_001 L >>> Brain Dot Engine >>> Routine  
... >>> HEAD_001 >>> RMH HEAD 2/11 >>> PITUITARY ONLY  
... >>> HEAD_001 >>> Brain Dot Engine >>> Pediatric  
USER >>> HEAD_001 >>> RMH HEAD 2/11 >>> IAC ONLY  
... >>> HEAD_DOT_001 L >>> Brain Dot Engine >>> Pituitary only  
... >>> Brain Dot Engine >>> Routine + Seizure  
... >>> T-SPINE_0001 >>> RMH CLINICAL LIBRARIES >>> BLADE
```

Load Program to Queue

Requested Procedure: MRI BRAN W/WO CONT  
Study Description: MRI BRAN W/WO CONT [Add Study Comment](#)

Body Part and Laterality: Head Unpaired

# RCA<sup>2</sup> – Simulated Re-Enactment



# Triple Lumen Catheter Clamp

**OLD CLAMP:** Breaks at hinge



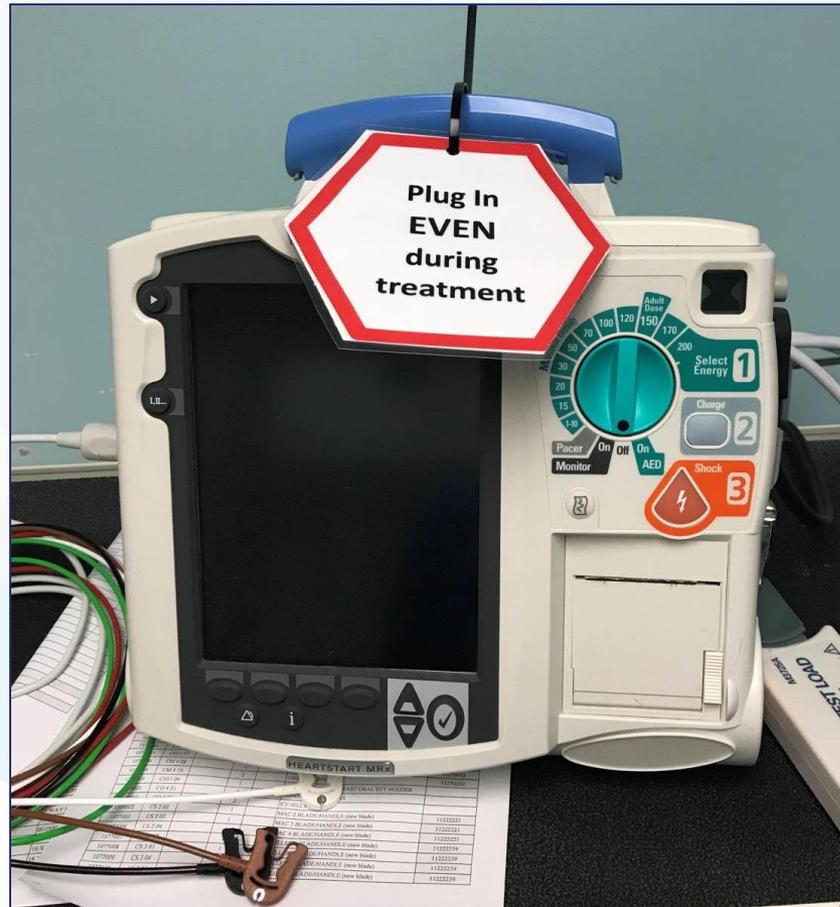
**Weakens/breaks  
when opened**

**NEW CLAMP:** Hinge design

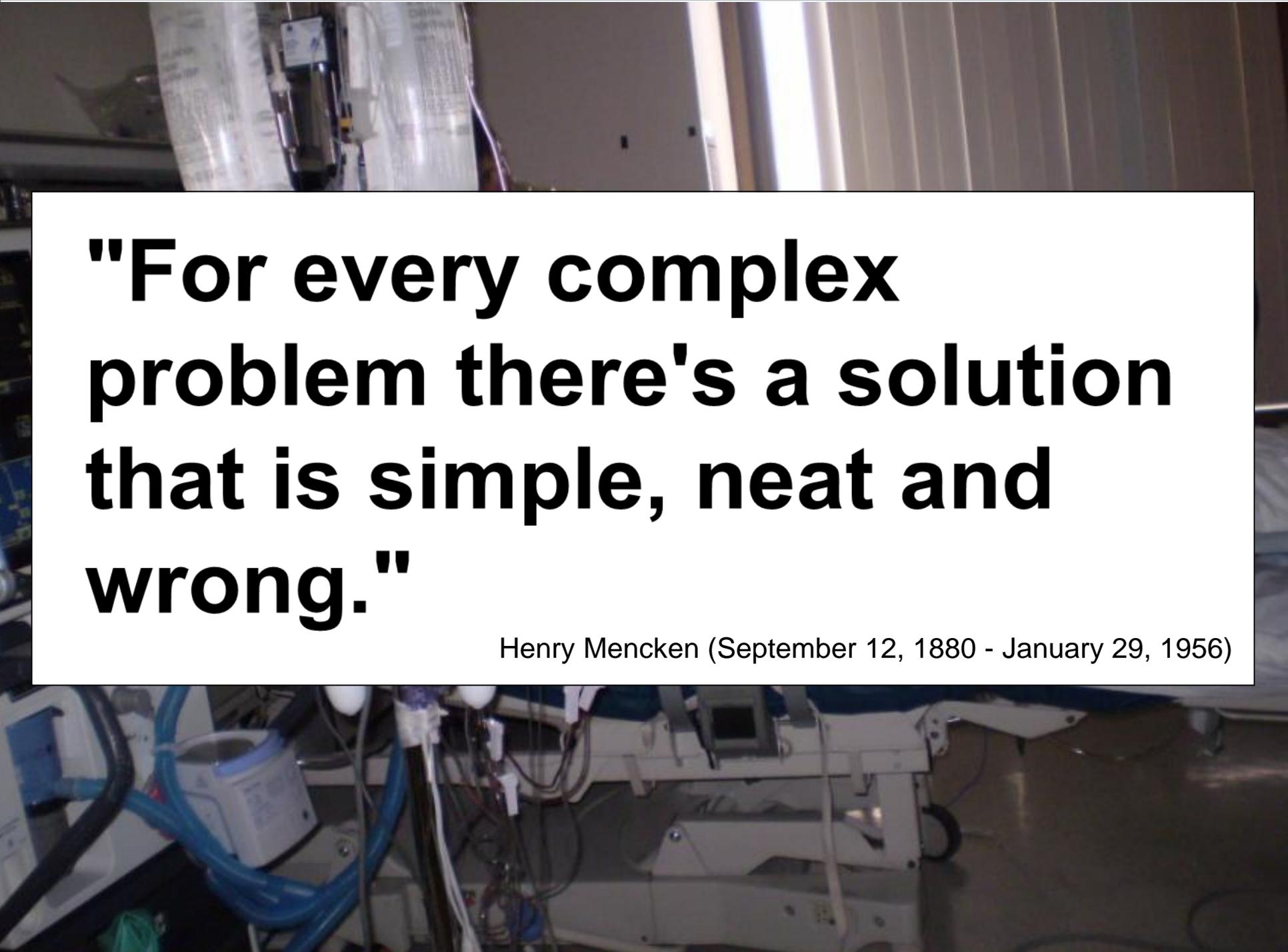


**Pivot hinge,  
bigger clamp,  
thicker plastic**

# # 2 - Mitigation of Unavoidable Risk





A photograph of a hospital room. In the foreground, there is a patient bed with various medical equipment attached, including blue tubing and a white container. The background shows a white wall with a window and some medical equipment. The lighting is somewhat dim, typical of a hospital room.

**"For every complex  
problem there's a solution  
that is simple, neat and  
wrong."**

Henry Mencken (September 12, 1880 - January 29, 1956)

# #3 - Proactive Identification of Risk



**Procurement  
Opportunity**

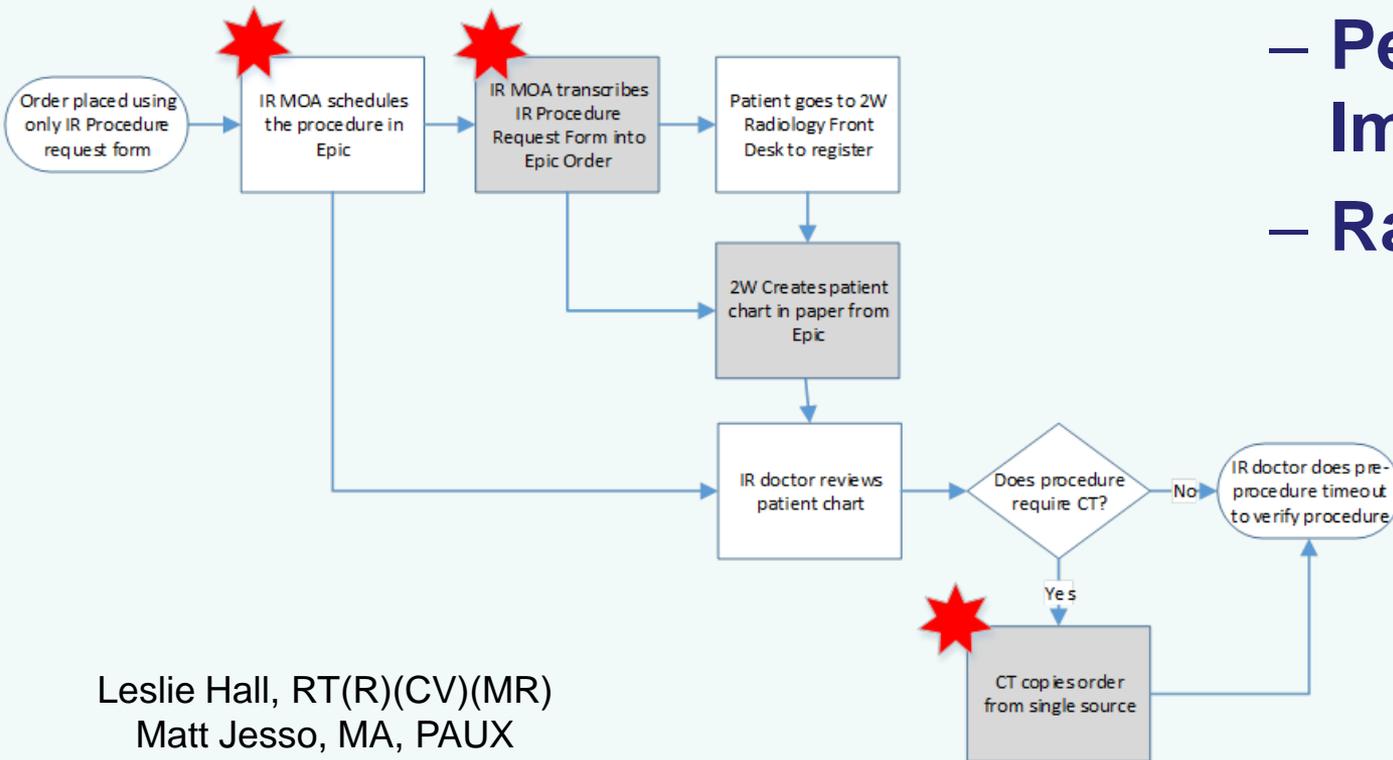
# Predict where errors will occur



# Near Miss → Redesign

- 5 Near Miss Events  
– Jul-Oct 2017

- Interdisciplinary
  - Human Factors
  - Performance Improvement
  - Radiology

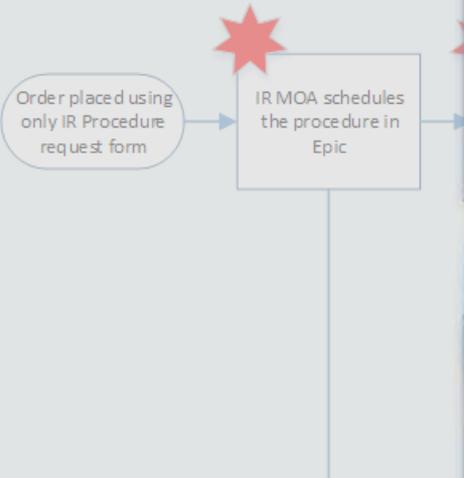


Leslie Hall, RT(R)(CV)(MR)  
Matt Jesso, MA, PAUX  
John Schumacher, BSE

The form is titled "Interventional Radiology" and is from Carilion Clinic. It includes fields for Patient Name, DOB, and MRN. The "Ordering Physician" section includes fields for Clinical Indication (LIP), Procedure Requested, and Special Pathology Request. The "Current Imaging" section includes fields for Contrast Allergy, Blood Thinners/Anticoagulants, and Requesting Physician. The "IR Physician Approval" section includes fields for Date Reviewed, Reviewed By, Modality CT, and Additional Notes. The "Patient Appointment Information" section includes fields for Scheduled Date/Time of Biopsy, Patient Arrival Date/Time, and Care Appr. Date/Time.

# Interventional Radiology: Biopsy Procedure Process

- 5 Near M
- Jul-Oct



Disciplinary  
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ology

Leslie Hall, RT(R)(CV)  
Matt Jesso, MA, PA  
John Schumacher, B

<b>IR</b> Interventional Radiology		
<small>Carilion Roanoke Memorial Hospital, Interventional Radiology, 1500 Bellvue Ave., Roanoke, VA 24012, 800-993-7000</small>		
Patient Name: _____	DOB: _____	MRN: _____
<b>Ordering Physician</b>		
*Clinical Indication (IPI):	Left or Right	_____
Procedure Requested:	Left or Right	_____
Special Pathology Request:	_____	
Current Imaging:	_____	
Consent Allergic: Yes No	PI Weight: _____	
Blood Thinners/Anticoagulants: Yes No	_____	
Requesting Physician: _____	Point of Contact Person: _____	
<b>IR Physician Approval</b>		
Date Reviewed: _____	Reviewed By: _____	
Modality: CT _____ US _____ Fluoro _____	(Angio Room 1 2 3 4)	
Additional Notes: _____	_____	
Allergies: Yes No	Lab Needed: CBC EBP CMP PT/INR Other: _____	
<b>Patient Appointment Information</b>		
Schedule Date/Time of Biopsy: _____	Patient Arrival Date/Time: _____	
Queue Appt. Date/Time: _____	Lab Name: _____	Lab Phone: _____

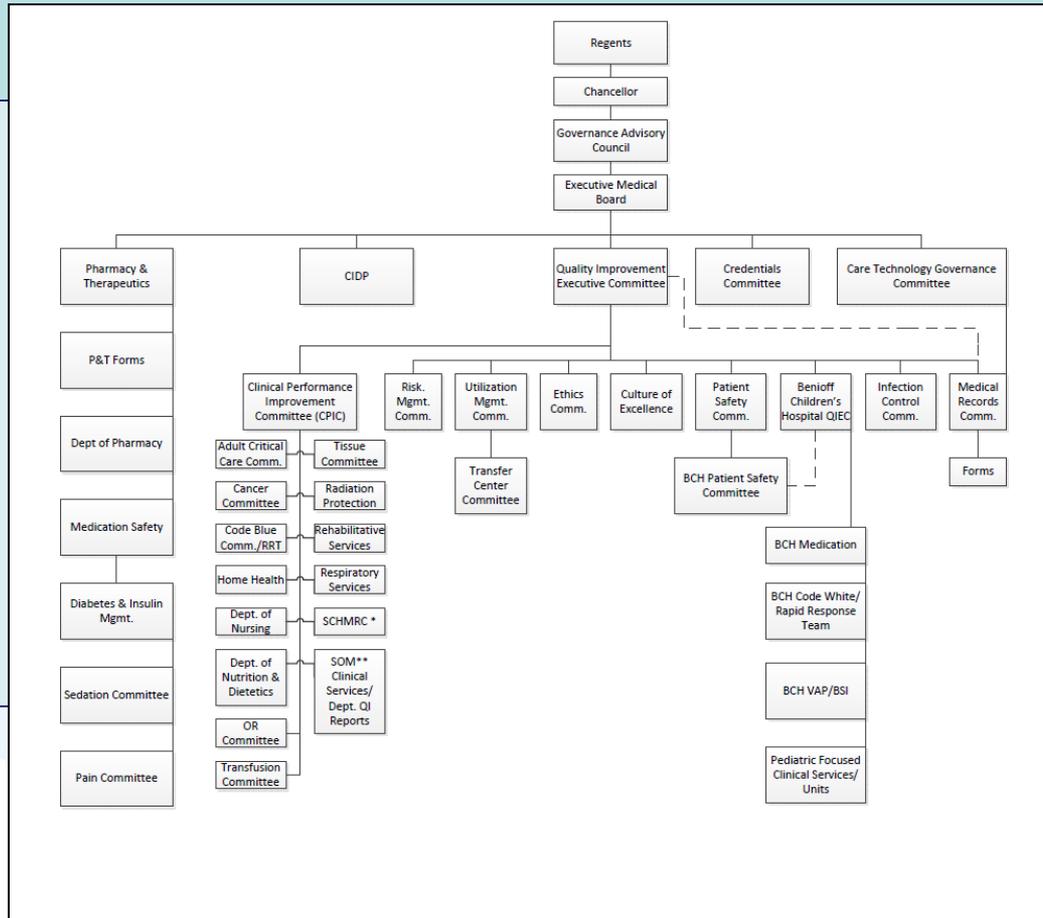


# Human Behavior: The Final Frontier

# Application to VALUE...

***HOW*** are we going to effect  
change?

# What *is* the PLAN?



# What *is* the PLAN?



Systematic Reviews

ajog.org

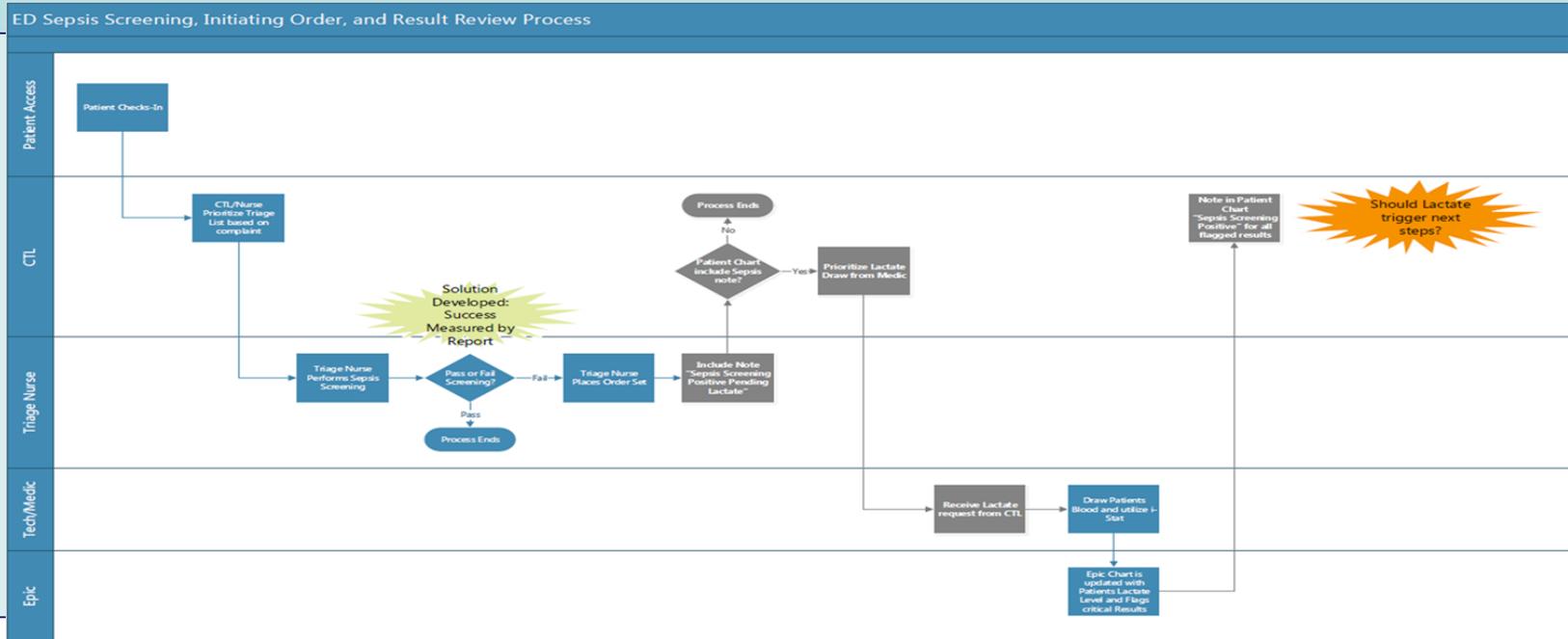
## Nonantimuscarinic treatment for overactive bladder: a systematic review



Cedric K. Olivera, MD, MS; Kate Meriwether, MD; Sherif El-Nashar, MD, PhD; Cara L. Grimes, MD; Chi Chung Grace Chen, MD; Francisco Orejuela, MD; Danielle Antosh, MD; Jon Gleason, MD; Shunaha Kim-Fine, MD; Thomas Wheeler, MD, MSPH; Brook McFadden, MD; Ethan M. Balk, MD, MPH; Miles Murphy, MD, MSPH; Systematic Review Group for the Society of Gynecological Surgeons

The purpose of the study was to determine the efficacy and safety of nonantimuscarinic treatments for overactive bladder. Medline, Cochrane, and other databases (inception to April 2, 2014) were used. We included any study design in which there were 2 arms and an  $n > 100$ , if at least 1 of the arms was a nonantimuscarinic therapy or any comparative trial, regardless of number, if at least 2 arms were nonantimuscarinic therapies for overactive bladder. Eleven reviewers double-screened citations and extracted eligible studies for study: population, intervention, outcome, effects on outcome categories, and quality. The body of evidence for categories of interventions were summarized and assessed for strength. Ninety-nine comparative studies met inclusion criteria. Interventions effective to improve sub-

# What *is* the PLAN?



# What *is* the PLAN?

ORIGINAL ARTICLE **CLINICAL PRACTICE MANAGEMENT**



## Systematic Review of the Application of Lean and Six Sigma Quality Improvement Methodologies in Radiology

*Thelina Amaratunga, MD, MSc<sup>a,b</sup>, Julian Dobranowski, MD<sup>a</sup>*

### Abstract

**Purpose:** Preventable yet clinically significant rates of medical error remain systemic, while health care spending is at a historic high. Industry-based quality improvement (QI) methodologies show potential for utility in health care and radiology because they use an empirical approach to reduce variability and improve workflow. The aim of this review was to systematically assess the literature with regard to the use and efficacy of Lean and Six Sigma (the most popular of the industrial QI methodologies) within radiology.

**Methods:** MEDLINE, the Allied & Complementary Medicine Database, Embase Classic + Embase, Health and Psychosocial Instruments, and the Ovid HealthStar database, alongside the Cochrane Library databases, were searched on June 2015. Empirical studies in peer-reviewed journals were included if they assessed the use of Lean, Six Sigma, or Lean Six Sigma with regard to their ability to improve a variety of quality metrics in a radiology-centered clinical setting.

**Results:** Of the 278 articles returned, 23 studies were suitable for inclusion. Of these, 10 assessed Six Sigma, 7 assessed Lean, and 6 assessed Lean Six Sigma. The diverse range of measured outcomes can be organized into 7 common aims: cost savings, reducing appointment wait time, reducing in-department wait time, increasing patient volume, reducing cycle time, reducing defects, and increasing staff and patient safety and satisfaction. All of the included studies demonstrated improvements across a variety of outcomes. However, there were high rates of systematic bias and imprecision as per the Grading of Recommendations Assessment, Development and Evaluation guidelines.

**Conclusions:** Lean and Six Sigma QI methodologies have the potential to reduce error and costs and improve quality within radiology. However, there is a pressing need to conduct high-quality studies in order to realize the true potential of these QI methodologies in health care and radiology. Recommendations on how to improve the quality of the literature are proposed.

**Key Words:** Quality improvement, Lean, Six Sigma, radiology, diagnostic imaging

*J Am Coll Radiol 2016;13:1088-1095. Copyright © 2016 American College of Radiology*

# What *is* the PLAN?

**BestPractice Advisory**

**PROBLEM**  
This patient's CYP2C19 genotype is associated with very impaired metabolic activation of the prodrug clopidogrel (Plavix) and elevated risk for stent thrombosis or other cardiovascular events following PCL.

**REASONS**  
Reduced clopidogrel activation in this genotype results in significantly reduced platelet inhibition, increased residual platelet aggregation, and decreased clopidogrel efficacy.

**RECOMMENDATIONS - MODIFY TREATMENT BY CHOOSING ONE OF THE FOLLOWING:**

(A) Prescribe prasugrel (EFFIENT) 10 mg daily  
\*Contraindications: History of stroke or transient ischemic attack, active bleeding  
\*Caution: Increased bleeding risk: Age > 75 years, Body weight < 60 kg

OR

(B) Prescribe ticagrelor (BRILINTA) 90mg twice daily  
\*Contraindications: History of intracranial hemorrhage, active bleeding, severe hepatic impairment  
\*Caution: Aspirin doses >100 mg/day reduce ticagrelor effectiveness and should be avoided.

[More information on clopidogrel and CYP2C19](#)

For questions about this alert or the personalized medicine program, please contact : PMP-HELP@cts.luff.edu 1441.

Last CYP2C19=\*2/\*2 on 6/1/2013

- Open order: Place order for prasugrel (EFFIENT) tablet and remove order for clopidogrel
- Open order: Place order for ticagrelor (BRILINTA) tablet and remove the clopidogrel order
- Open order: Continue to order clopidogrel (PLAVIX) tablet - 75 mg daily please remove the first order as it w

Accept



# What *is* the PLAN?

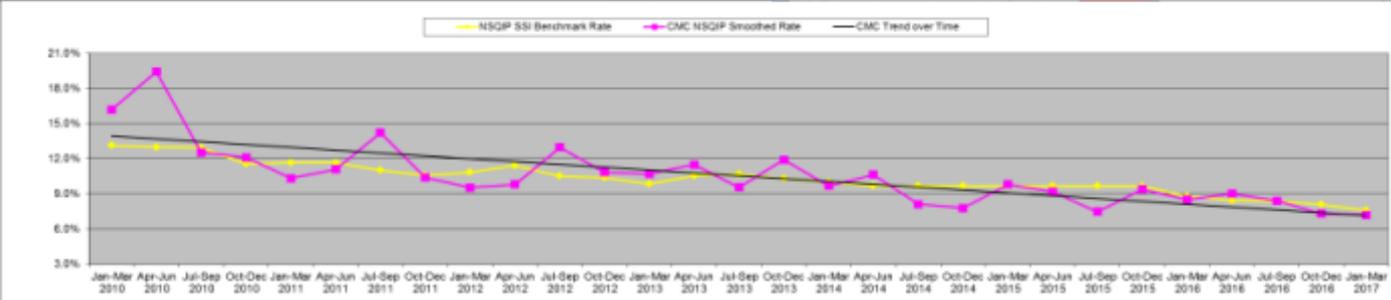
2016	18	Down	9.48	August 15 - July 16	7.3
		Down	1.04	July 15 - June 16	0.9
2017	14	Up	73.79%	FY16 (Oct. - Sept.)	72.3
		Down	11.56	FY16 (Oct. - Sept.)	4.4



Year	No. of Infections	Predicted: 2008 Risk Model	SIR: 2008 Risk Model	Predicted: 2017 Risk Model	SIR: 2017 Risk Model
2015	33	92.4	✓ 0.4	51.4	✓ 0.6
2016	27	87.5	✓ 0.3	48.7	✓ 0.6
2017	13			36.9	✓ 0.4

Measure Name	PTD Performance	"Estimate" Penalty	Measure
<b>Hospital-Acquired Condition (HAC) Reduction Program</b>			
AHRQ Modified PSI 95 Composite	0.78		Communication with
CLABSIRate	0.71		Communication with
CAUTI SRrate	1.62		Responsiveness of H
SSI Colon	1.13	Unable to Calculate National Avg	Communications abo
SSI Hysterectomy	1.63		Cleanliness and Qua
HFSA	0.69		Discharge Informa
C. Diffile	1.18		Care Transitions
<b>Hospital Readmission Reduction Program</b>			
Overall Rating of Hospital			
30-Day Mortality, AM "Survival Rate" OE			

Facility:	Carilion Medical Center		
Patient Safety Grade	2017	AHRQ Average (BM)	Gap - BM
A = Excellent	35%	34%	1%
B = Very Good	41%	42%	-1%
C = Acceptable	19%	19%	0%
D = Poor	4%	4%	0%
E = Failing	1%	1%	0%



49.54%	Unable to calculate at this time
73.22%	
1.00	
1.00	
0.99	
0.59%	
0.60	
0.00	
0.67	

Reference points for each program:

- HAC Reduction: We cannot be certain of program performance because we do not know how others are performing in this competitive program.
- Readmission Reduction Program: The performance period ended in June, 2017. We cannot minimize the CMS algorithm so we monitor our observed to expected ratio compared to the Premier 50th percentile.
- Value-Based Purchasing Program: We cannot accurately reproduce CMC's 30 day mortality measures, thus inpatient mortality Q/E is utilized to trend performance. In addition, there is no reliable method to replicate the Hip/knee complications and Medicare Spend Per Beneficiary measures.

# What *is* the PLAN?

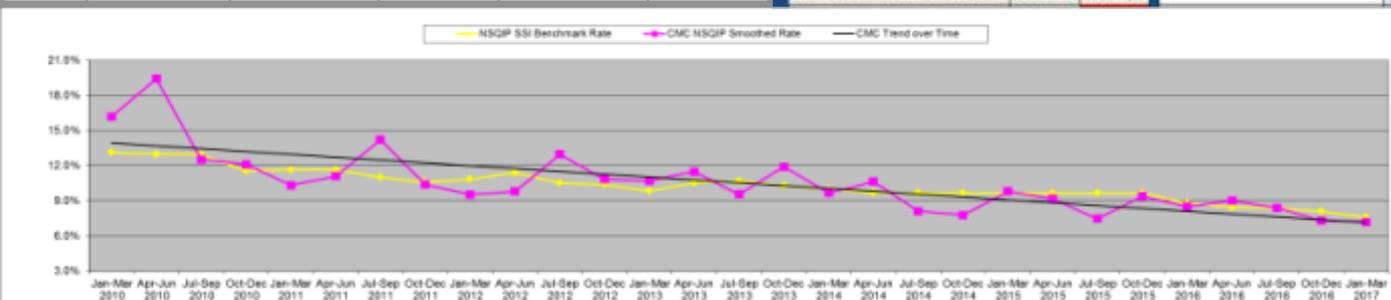
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D = Poor	4%	4%	0%
E = Failing	1%	1%	0%



Measure Name	30-Day Mortality: AM "Survival Rate" O/E	Performance	Critical Penalty
30-Day Mortality: AM "Survival Rate" O/E	49.54%	73.22%	1.00
	1.00		
	1.00		
	0.99		
	0.59%		
	0.60		
	0.00		
	0.67		

Reference points for each program:

1. HAC Reduction: We cannot be certain of program performance because we do not know how others are performing in this competitive program.
2. Readmission Reduction Program: The performance period ended in June, 2017. We cannot minimize the CMS algorithm so we monitor our observed to expected ratio compared to the Premier 50th percentile.
3. Value-Based Purchasing Program: We cannot accurately reproduce CMS's 30 day mortality measures, thus inpatient mortality O/E is utilized to trend performance. In addition, there is no reliable method to replicate the Hip/knee complications and Medicare Spend Per Beneficiary measures.

# Consider This...

**VALUE** is **BUILT** -

**YOU CANNOT TEACH YOUR WAY TO VALUE**



# Application to VALUE?

Research Letter | Less Is More

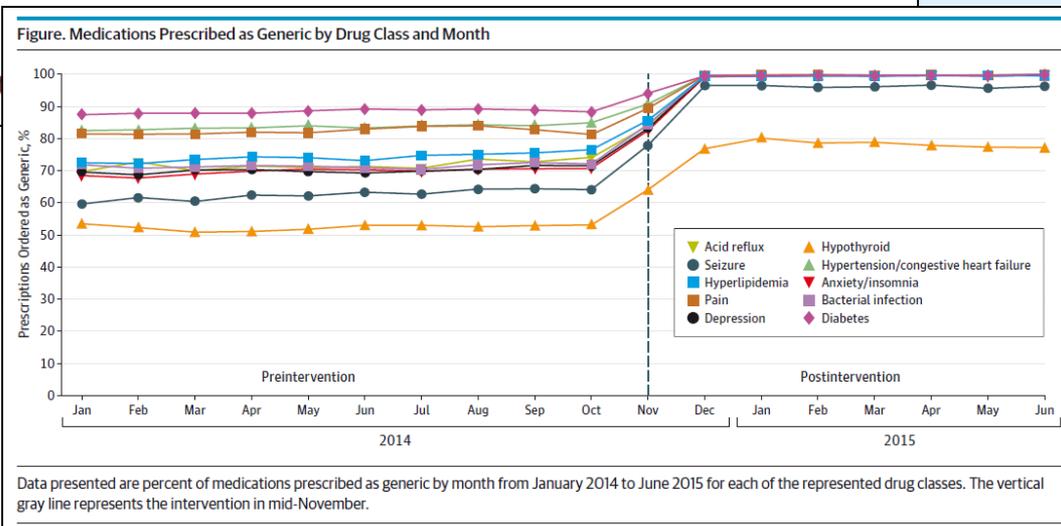
June 2016

## Generic Medication Prescription Rates After Health System-Wide Redesign of Default Options Within the Electronic Health Record

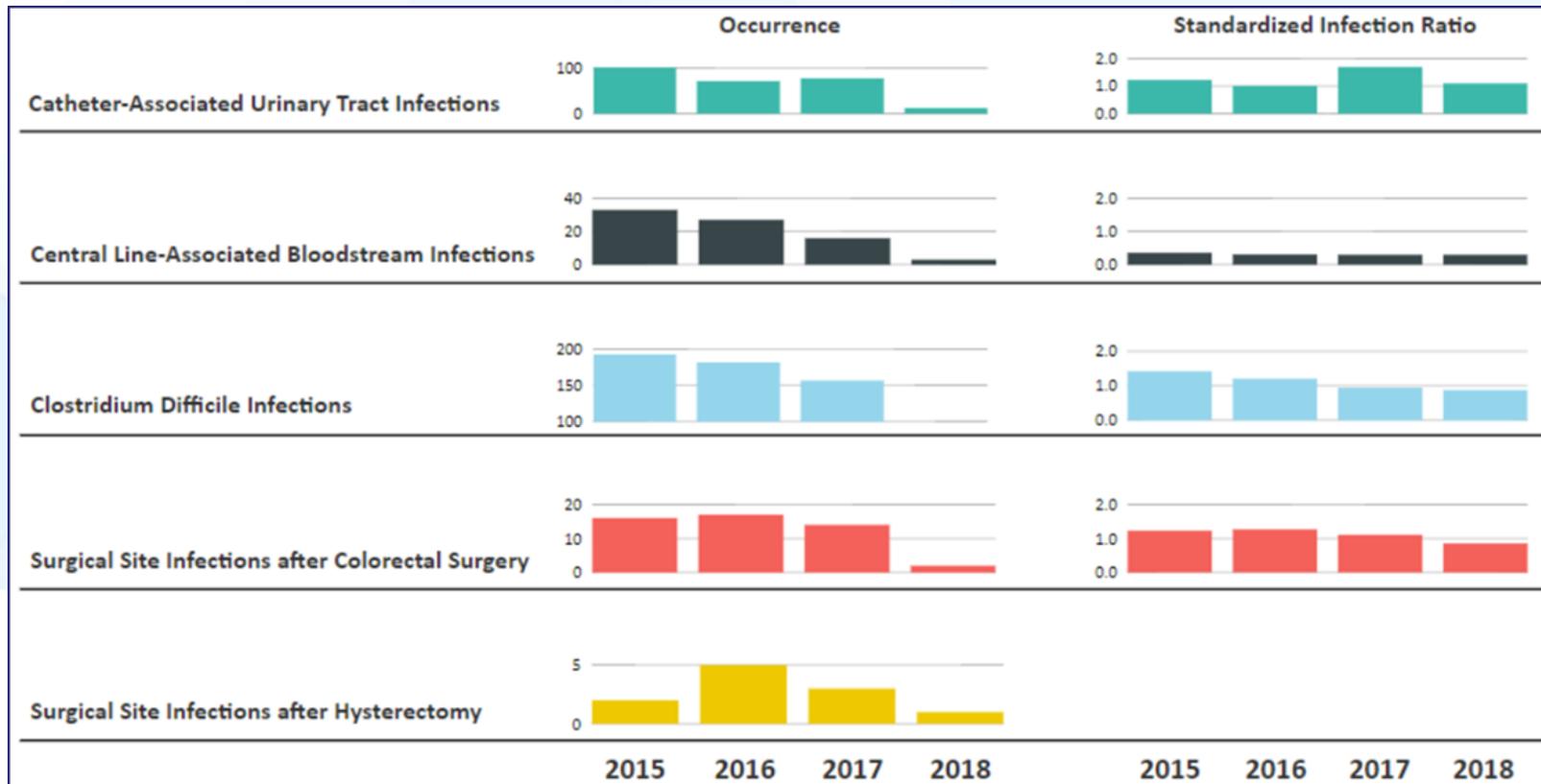
Mitesh S. Patel, MD, MBA, MS<sup>1,2</sup>; Susan C. Day, MD, MPH<sup>2</sup>; Scott D. Halpern, MD, PhD<sup>2</sup>; *et al*

» Author Affiliations | Article Information

*JAMA Intern Med.* 2016;176(6):847-848. doi:10.1001/jamain



# Behavioral Economics



**Consider this...**

**PRIORITIZE the Clinical  
Operating System**

# Clinical Advancement Program

**MEANINGFUL  
IMPROVEMENT**

**HUMAN  
FACTORS**



**PROCESS  
IMPROVEMENT**



**CLINICAL  
ADVANCEMENT  
PATIENT  
SAFETY**

**ANALYTICS**



**SAFETY  
CULTURE**



# BCPE

(Board of Certified Professional Ergonomists)

**Certified Professional Ergonomist (CPE)**

**Certified Human Factors Professional (CHFP)**

**Certified User Experience Professional (CUXP)**



# Learn MORE...



**HFES 2018**

International Annual Meeting

October 1-5  
Philadelphia Marriott  
Philadelphia, PA



Human Factors  
and Ergonomics  
in Health Care



Human Factors & Ergonomics Society  
(HFES)

International Ergonomics Association  
(IEA)



The Doctor, Sir Lu



A long-exposure photograph of a night sky showing star trails. The trails are concentric circles centered on a point in the sky, indicating the Earth's rotation. The foreground shows a green field, a wooden fence, and a town with lights in the distance under a twilight sky.

**QUESTIONS???**