Resiliency engineering and human factors as a path to high-reliability organizing

Oren Guttman, MD, MBA

Ed Asplundh Chief Quality and Patient Safety Officer | Jefferson Health Abington

Enterprise Vice President for High Reliability and Patient Safety | Jefferson Health

Oren.guttman@Jefferson.edu

310-595-642

EQIC

EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Disclosures

- None

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Objectives

At the end of session, participants will be able to:

- understand the role of human factors and resiliency engineering in high-reliability organizing;
- understand “system complexity” model as it relates to healthcare delivery and high-reliability organizing; and
- demonstrate the application of human factors and resiliency engineering principles in clinical operational practice.

Hello

- Two-state non-profit
- 18 hospitals; 3745 beds
- Complex ambulatory care integrated healthcare delivery network
- >50 outpatient and urgent care centers
- Leading rehabilitation and post-acute facilities
- $5.9 billion in revenue
- About 39,000 employees

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

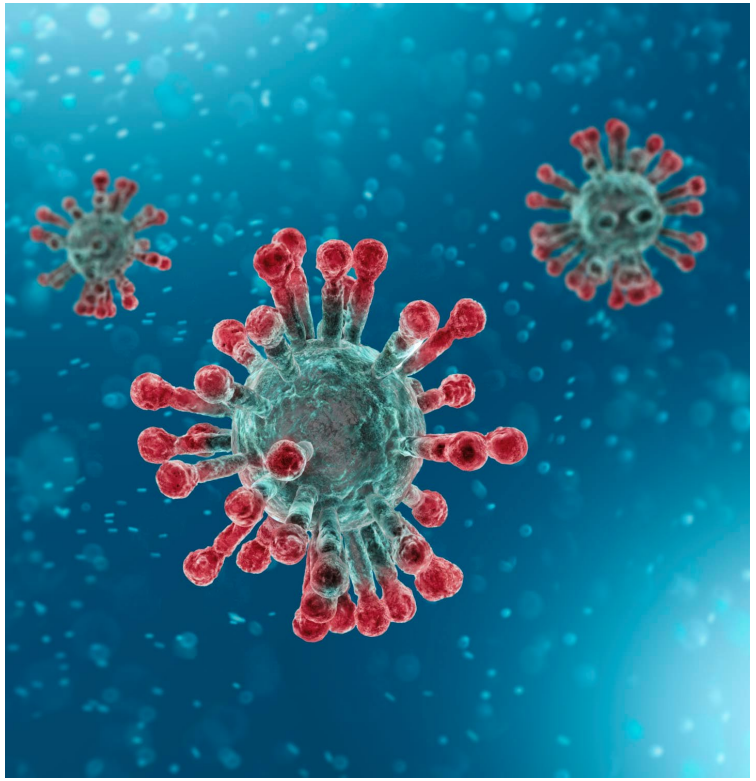
Key message #1

Healthcare is on fire and change is here to stay

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Healthcare delivery daily operations are exceedingly challenged

- Continuous supply chain disruptions
- Higher acuity patients and longer LOS
- Decreased levels of support from visitors and families at the bedside
- Turnover of staff never seen before
- Loss of experienced and expert clinicians impacting mentorship; “Great resignation”
- Higher staffing ratios
- Record levels of fatigue and burnout leading to less vigilance
- New-to-practice clinicians graduated early without adequate preparation
- Reduced capacity to absorb normal fluctuations in patient surges
- Increasing demands for efficient operations



EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Cybersecurity threats at all-time high

- The FBI's Internet Crime Complaint Center:
  - Pre-pandemic: 1000/day
  - Post-pandemic: 3-4000/day
- Patient records breached:
  - 41 million in 2019
  - 3x > than in 2018
- Data restore rate
  - Only 69% of actual data restored


HOSPITALS, MEDICAL DEVICES, LEGAL

How patient safety is being hampered by rampant ransomware attacks

There is a lot of discussion on how ransomware costs healthcare billions of dollars and not enough discussion on how it impacts the patient's safety.

By CHRIS BOWEN

Post a comment / Nov 11, 2021 at 2:00 PM


DISCOVER

THE SCIENCES | MIND | TECHNOLOGY | HEALTH | ENVIRONMENT | PLANET EARTH | LIFESTYLE

TECHNOLOGY

Cyberattacks on Health Care Are Rising — But Many Hospitals Aren't Prepared

Hackers are ramping up medical system breaches and demanding large ransoms, highlighting the dark side of increasingly digital-focused patient care.

By Molly Glick | Sep 13, 2021 7:00 PM

(Credit: hxdbzxy/Shutterstock)

Waiting for a breakthrough

Please don't wait to give

RELATED CONTENT

How Will the Infrastructure Bill Boost the Nation's Technology?

Latin Is Dead, but Not Extinct

The Metropolis With Highest Density of Surveillance Cameras in


NEWS RELEASE

ECRI Names Cybersecurity Attacks the Top Health Technology Hazard for 2022

This year's Top 10 report cautions healthcare leaders about safety concerns with IT-related security challenges, COVID-19 supply chain shortages, telehealth, medication safety, and other device risks

January 18, 2022

ECRI

https://www.himss.org/sites/hde/files/d7/u132196/2018_HIMSS_Cybersecurity_Survey_Final_Report.pdf

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Burnout is high and resiliency is at all-time low after the pandemic

- Healthcare workers are the #1 victims of workplace violence (OSHA)
- Sicker patients
- More production pressure
- Less support staff
- Challenged access
- More red tape

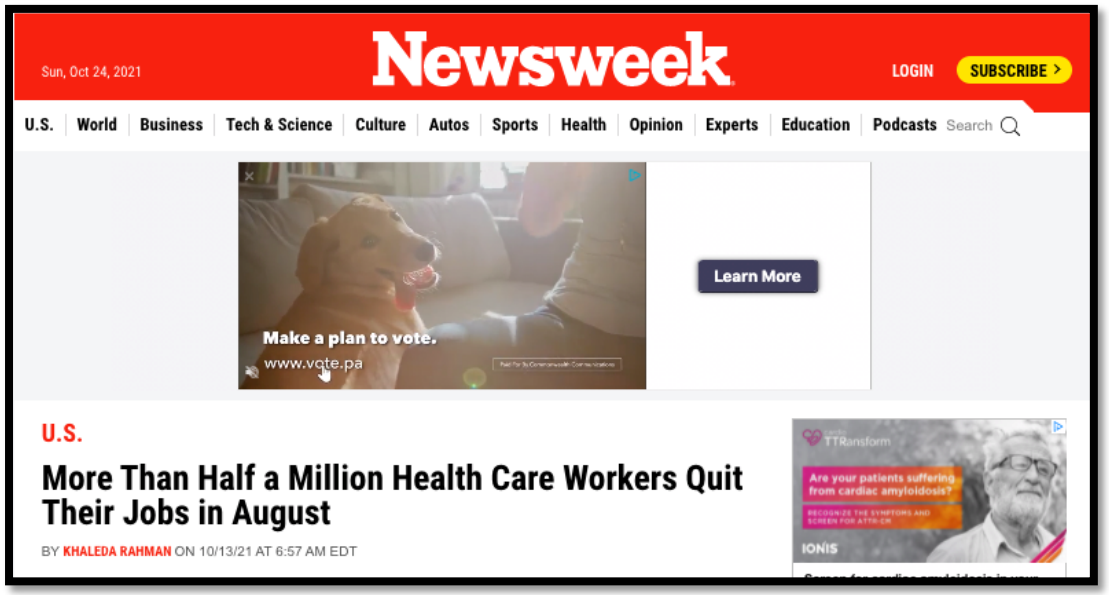
EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Staffing and human teams are unstable

Turnover tsunami

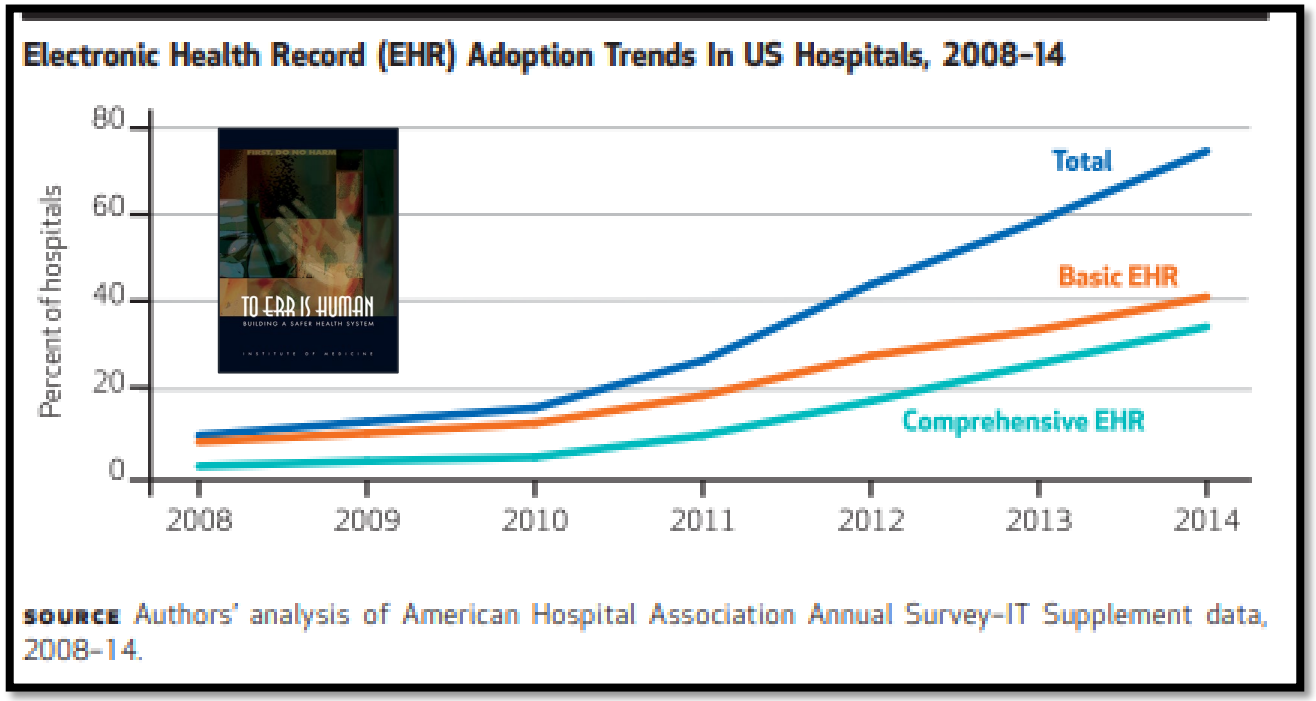
Nearly 1 in 5 Health Care Workers Have Quit Their Jobs During the Pandemic

Medical workers cited COVID-19, poor pay and burnout as reasons for layoffs, resignations

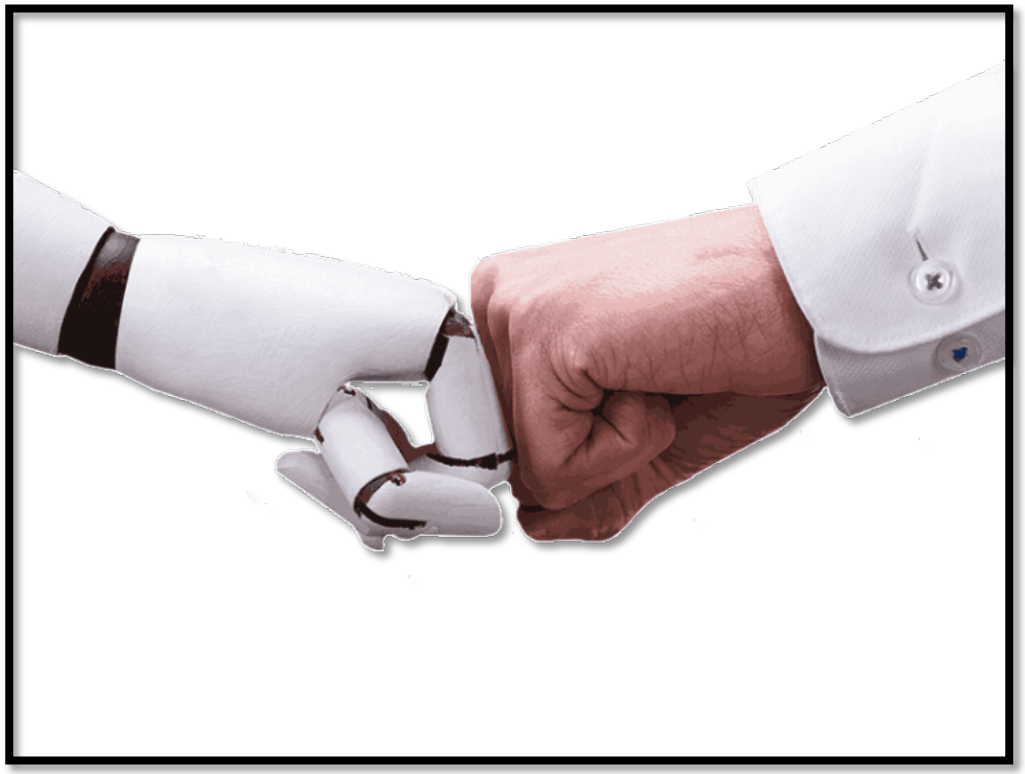


EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Human-machine teaming is our new reality



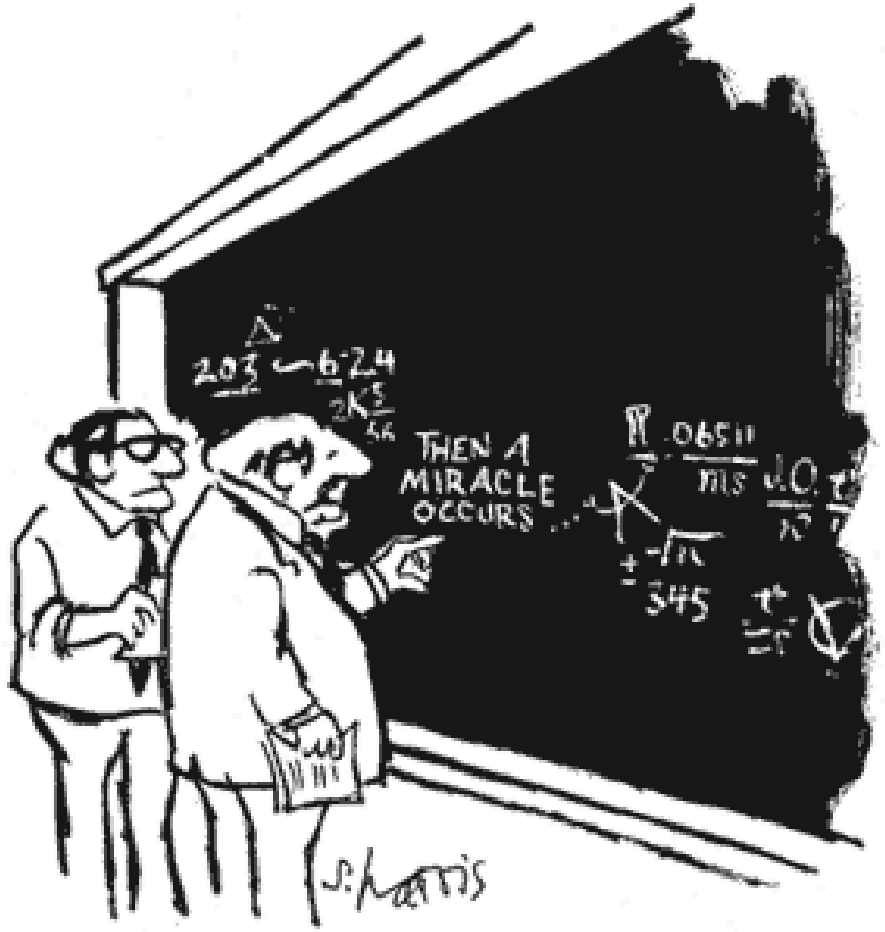
The machines are no longer our tools, they are our partners



EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Key message #2

What Got Us Here, Won't Get us There...

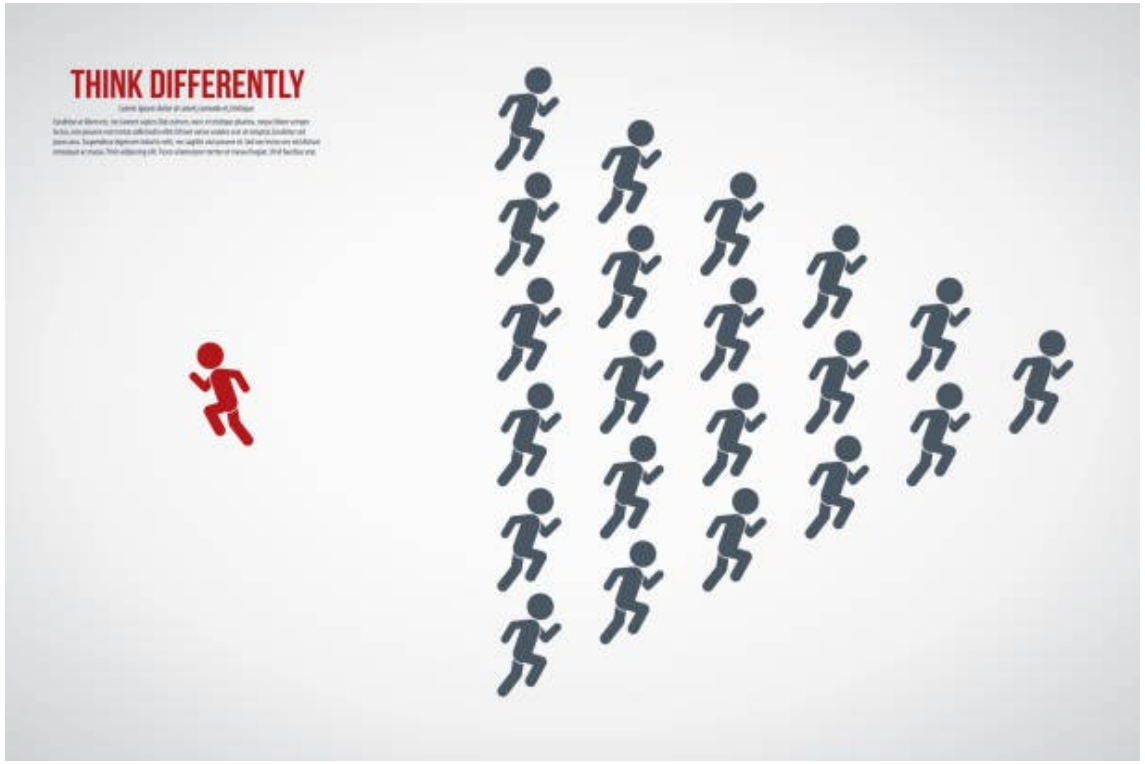


"I THINK YOU SHOULD BE MORE EXPLICIT HERE IN STEP TWO."

Quote by Marshal Goldsmith

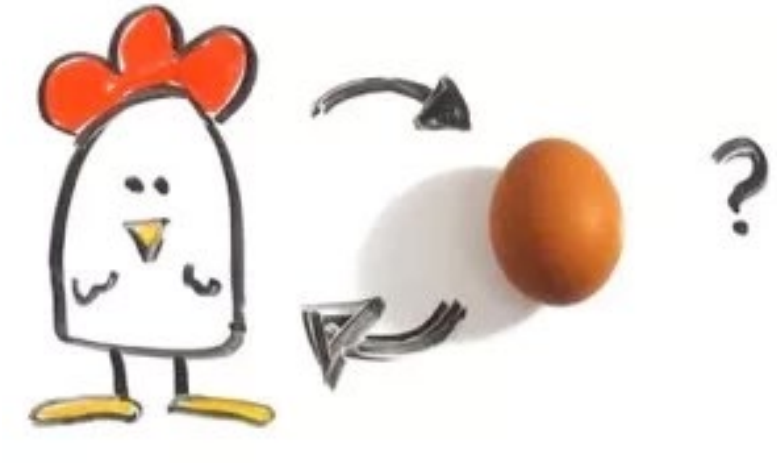
EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

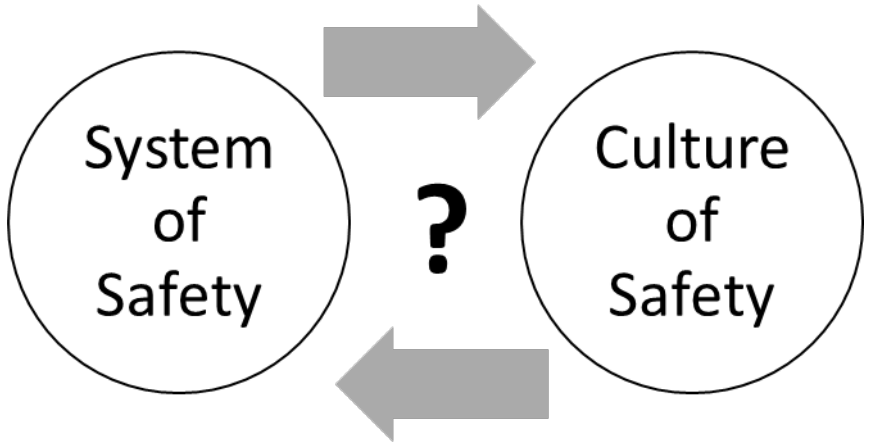
We need courage to challenge sacred assumptions about how to get to safe



Maybe THE question to move us along…

Chicken or the egg—where do you start?



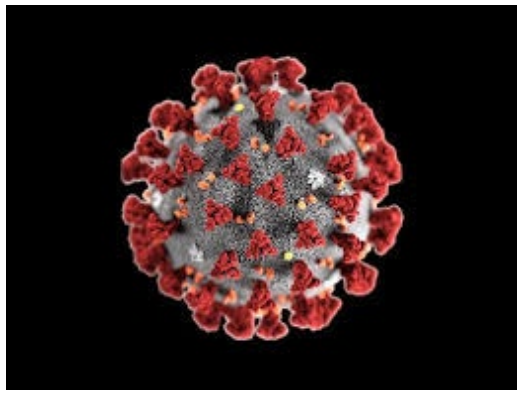


Does a Culture of Safety define the operating system or does a System of Safety define the culture?

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

We need BOTH!!!

Limitations of social systems approach to safety

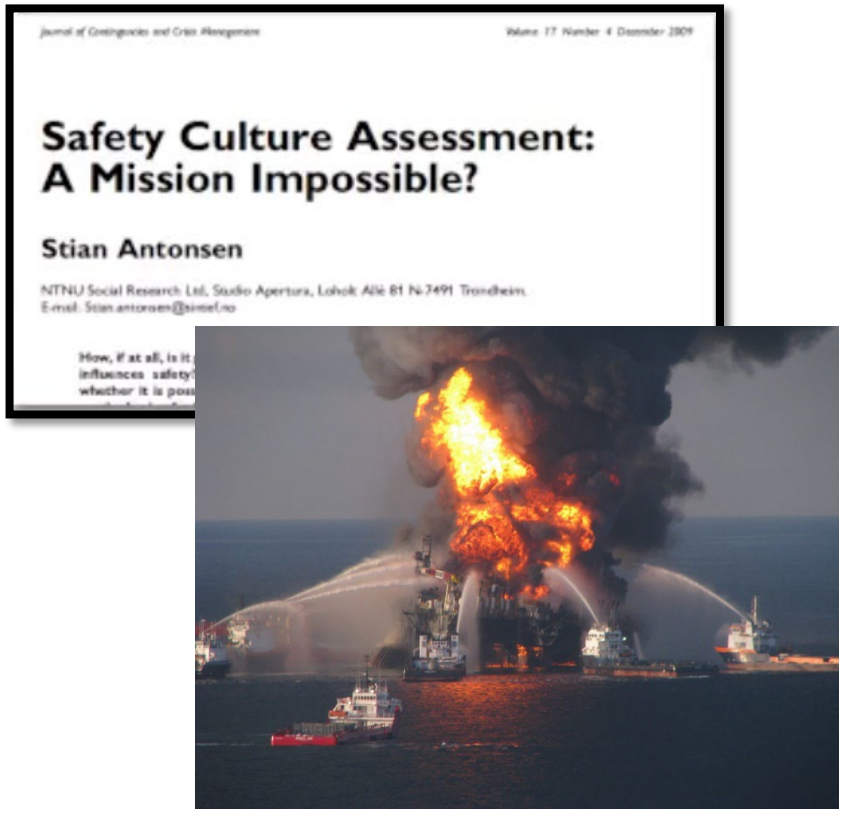


In a post-COVID, ever more digital world, what are the limitations of a Social Systems Approach, with a focus on people, teams, accountability, i.e. safety culture work as a means to improving patient safety?

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Social system work disconnect and predictive value

Disconnect with reality



- Snorre Alpha is a Norwegian offshore oil/gas platform operated in the North Sea.
- In 2004, it suffered a subsea blowout (a buildup of gas from the reservoir blew “out of control”), which, luckily, did not ignite.
- The two descriptions of the same culture are dramatically different.
  - In the Safety Culture Survey, employees reported a very positive perception of the safety culture on the platform.
  - In contrast, the accident investigation provided a radically different view of work-life on the platform, indicating that production pressure often outweighed safety considerations.
- The lack of concurrence between the two descriptions suggests that social systems have little predictive value in patient safety.

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Antonsen, S. Safety Culture Assessment: A Mission Impossible? November 2009 Journal of Contingencies and Crisis Management 17(4)

Limitations of a social system approach to safety

- Jan. 2020 to Oct. 2012
- Medline, Cochran
- 3679 abstracts
- 35 articles
- 29 showed some improvement or **< 1%**

Promoting a Culture of Safety as a Patient Safety Strategy

A Systematic Review

Sallie J. Weaver, PhD, Lisa H. Lubomksi, PhD, Renee F. Wilson, MS, Elizabeth R. Pfoh, MPH, Kathryn A. Martinez, PhD, MPH, and Sydney M. Dy, MD, MSc

Twenty-nine studies reported some improvement in safety culture or patient outcomes, but measured outcomes were highly heterogeneous. Strength of evidence was low, and most studies were pre–post evaluations of low to moderate quality. Within these limits, evidence suggests that interventions can improve perceptions of safety culture and potentially reduce patient harm.

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Focusing on culture before/without systems redesign burns out clinicians

A significant contributor to staff burnout is poor system design

- Clinicians hold themselves to high professional standards.
- We don't hold our tools and technology to those same standards.
- Then we ask staff to care for patients in environments with tools that are not designed well for the people that use them… and then expect them to be superhuman and not make operator errors.
- Focusing on behavioral change before system and process optimization leads to staff burnout and frustration.

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Focusing on safety culture without a focus on system redesign is distracting at best, ineffective at worst

Focus on safety culture can be distracting

"There is a risk that a focus on cultural dimensions of safety (which, in fact, are often interpreted by managers within industry as the behavioral dimensions of safety), less attention is paid to more effective levers for safety improvement, such as design work on inherent safety and the implementation of technological improvements."

ELSEVIER

Safety Science

Volume 48, Issue 2, February 2010, Pages 268-278

Can focus on safety culture become an excuse for not rethinking design of technology?

Carl Rollenhagen

Show more

+ Add to Mendeley Share Cite

https://doi.org/10.1016/j.ssci.2009.07.008 Get rights and content

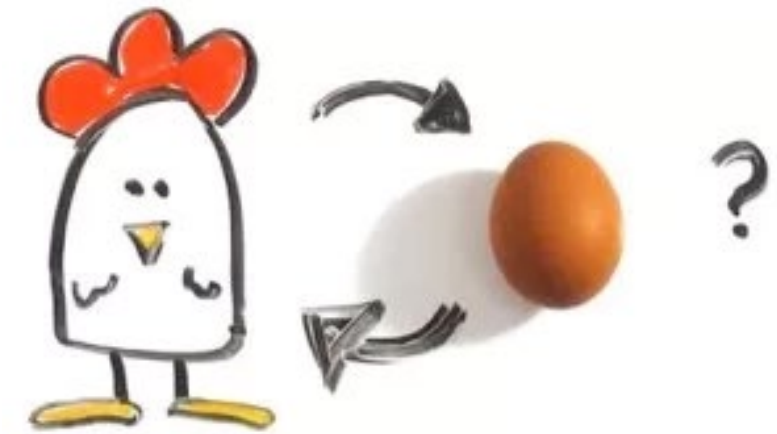
Abstract

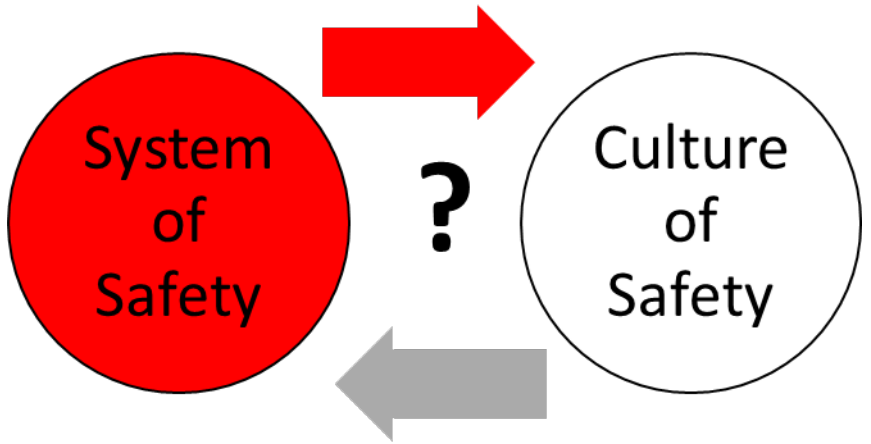
Two generic organisational contexts associated with technological designs in relation to safety culture are discussed: (1) operating organisations using existing technologies, and (2) design organisations as producers of technologies. It is argued that the concept of safety culture, if misused, may lead to the adoption of non-effective change strategies in the operational context. On the other hand, it is also argued that design organisations should invest more attention to issues commonly subsumed under the concept of safety culture. In this case, however, the concept of safety culture has to be adapted to fit the demands facing design organisations. Issues of morality and their association with the safety culture concept will be discussed. It is suggested that a stronger focus on understanding innovation and safety together should nourish future research about culture's influence on design and safety.

[Rollenhagen 2010]

A question of epistemology…

Chicken or the egg—where do you start?





A System of Safety defines the culture and not the other way around.

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

We Need BOTH!!!

Key message #3

Respond to system complexity with more resiliency, not just, and maybe even more, than reliability.

Make it easy to detect errors and rescue from error becoming failure.

Clinical operating system

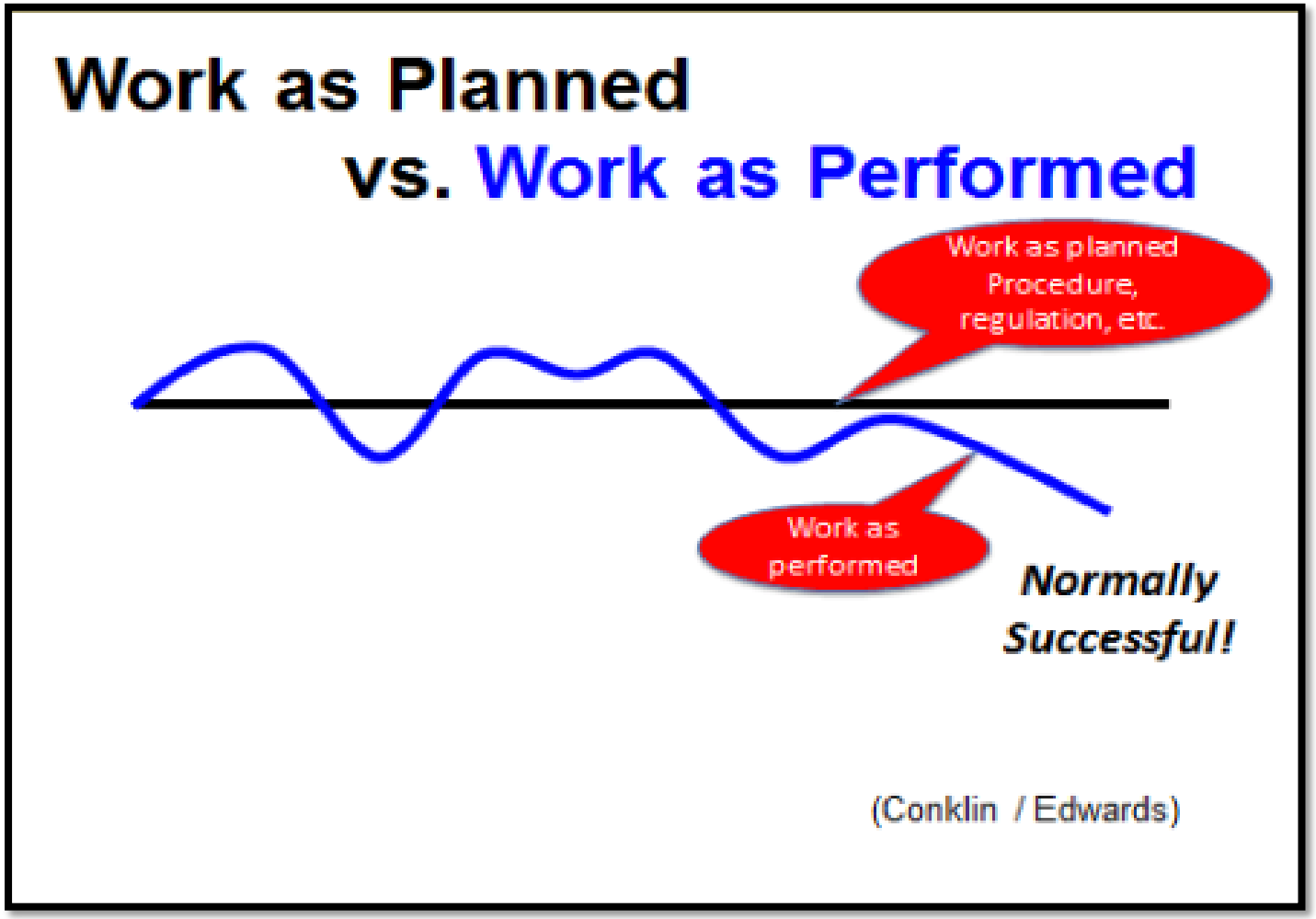
Socio-technical system

Socio-technical systems in healthcare are complex

- Pieces of the system interacting in ways unanticipated
- Dependency of different parts of the system on each other
- Changing contexts, rules
- Coupling: One part of the system can't act without another, inter-dependence
- Resonance: Risks are additive in a non-linear way
- Emergence: Risks appear with scarcity
- Drip: Safeguards themselves can be risks
- Human limitations in capability and capacity to do work
- Humans naturally drift or make micro-adjustments to account for failing systems (Safety 2, anti-fragility)

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

WAI is not WAD



WAI does not = WAD because of complexity

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Resiliency, not just reliability

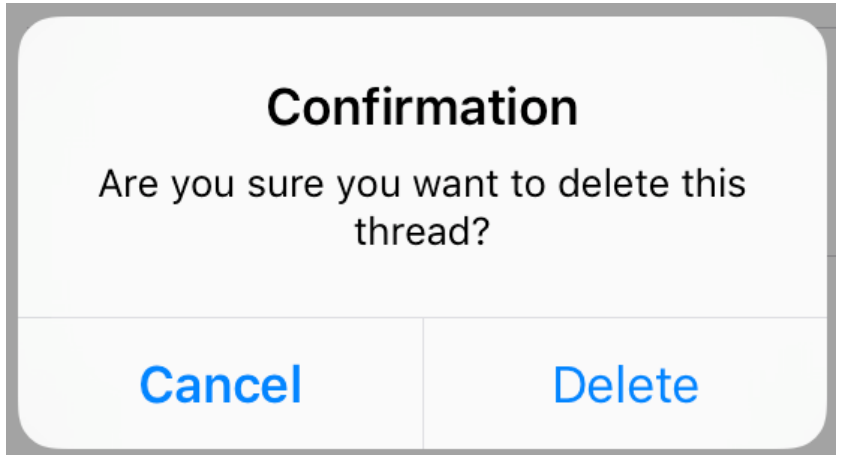
"In complex environments (i.e. where WAD is not WAI), resilience often spells success, while even the most brilliantly engineered fixed solutions are often insufficient or counterproductive."

- Gen Stanley McChrystal *Team of Teams* 2015

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Reliability

- Get it right the first time
- Avoid errors
- Optimizing a system to produce the intended results without failure more often than not
- Days without failure



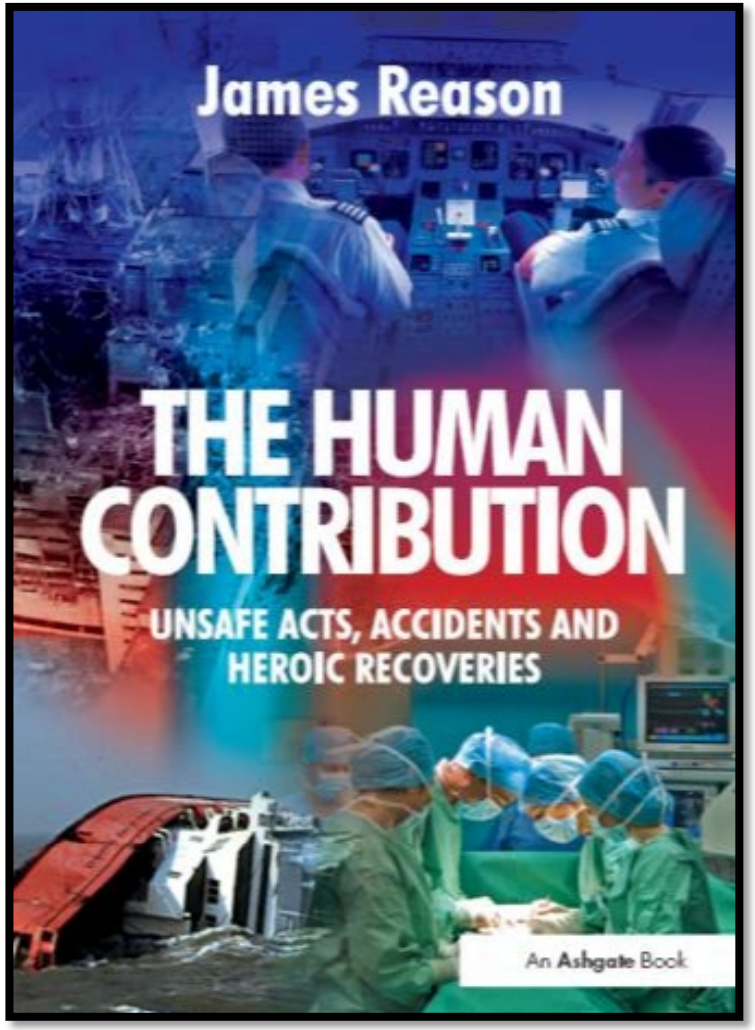
Resiliency

- Assumes you will NOT always get it right the first time
- Expects errors
- Anticipates errors will occur eventually
- Number of precursor errors Recognized
- Days with rescue

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Humans are a source of system resilience

Humans are a part of the S-T System that is healthcare. Their ability to recognize errors, adapt and compensate from errors turning into failure, to rescue and adjust is key to ***System Resiliency***, which enables the system to reach its outcomes.

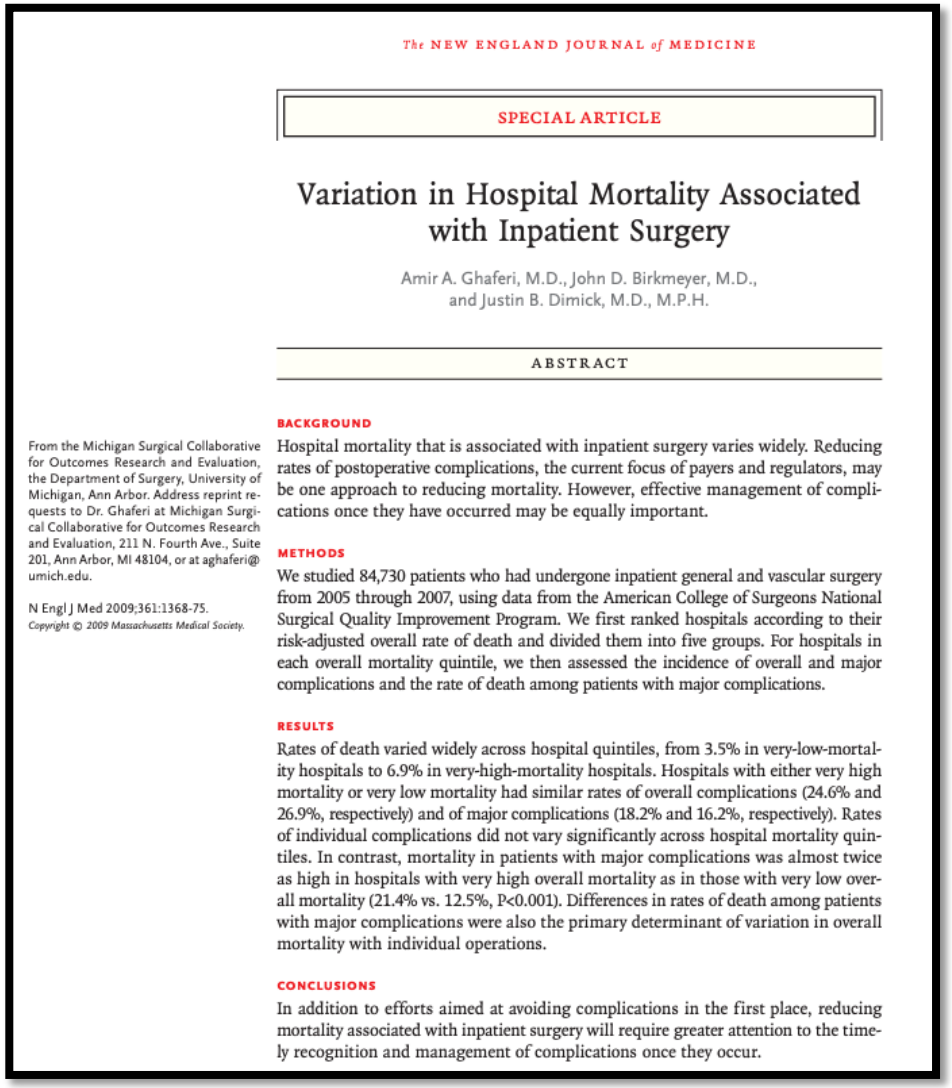


EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Making rescue easy is the key to safer outcomes

Resiliency

- Same complication rates
- Different surgical outcomes
- Attributed to ability to *rescue* patients from complications



The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL ARTICLE

Variation in Hospital Mortality Associated with Inpatient Surgery

Amir A. Ghaferi, M.D., John D. Birkmeyer, M.D., and Justin B. Dimick, M.D., M.P.H.

ABSTRACT

BACKGROUND

Hospital mortality that is associated with inpatient surgery varies widely. Reducing rates of postoperative complications, the current focus of payers and regulators, may be one approach to reducing mortality. However, effective management of complications once they have occurred may be equally important.

METHODS

We studied 84,730 patients who had undergone inpatient general and vascular surgery from 2005 through 2007, using data from the American College of Surgeons National Surgical Quality Improvement Program. We first ranked hospitals according to their risk-adjusted overall rate of death and divided them into five groups. For hospitals in each overall mortality quintile, we then assessed the incidence of overall and major complications and the rate of death among patients with major complications.

RESULTS

Rates of death varied widely across hospital quintiles, from 3.5% in very-low-mortality hospitals to 6.9% in very-high-mortality hospitals. Hospitals with either very high mortality or very low mortality had similar rates of overall complications (24.6% and 26.9%, respectively) and of major complications (18.2% and 16.2%, respectively). Rates of individual complications did not vary significantly across hospital mortality quintiles. In contrast, mortality in patients with major complications was almost twice as high in hospitals with very high overall mortality as in those with very low overall mortality (21.4% vs. 12.5%, P<0.001). Differences in rates of death among patients with major complications were also the primary determinant of variation in overall mortality with individual operations.

CONCLUSIONS

In addition to efforts aimed at avoiding complications in the first place, reducing mortality associated with inpatient surgery will require greater attention to the timely recognition and management of complications once they occur.

From the Michigan Surgical Collaborative for Outcomes Research and Evaluation, the Department of Surgery, University of Michigan, Ann Arbor. Address reprint requests to Dr. Ghaferi at Michigan Surgical Collaborative for Outcomes Research and Evaluation, 211 N. Fourth Ave., Suite 201, Ann Arbor, MI 48104, or at aghaferi@umich.edu.

N Engl J Med 2009;361:1368-75.

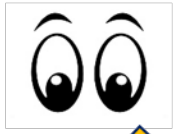
EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Resiliency engineering and 4Rs

Early Recognition and Rescue is the key to advancing safety in complex systems

Use case - CLABSI

Recognizing



Error, hazardous condition → Rescue → Failure → Restrict → Spread → Reverse → Catastrophic failure

ERROR
- Femoral line
- Line placed dirty
- No CHG bath
- No dressing Change

CLABSI

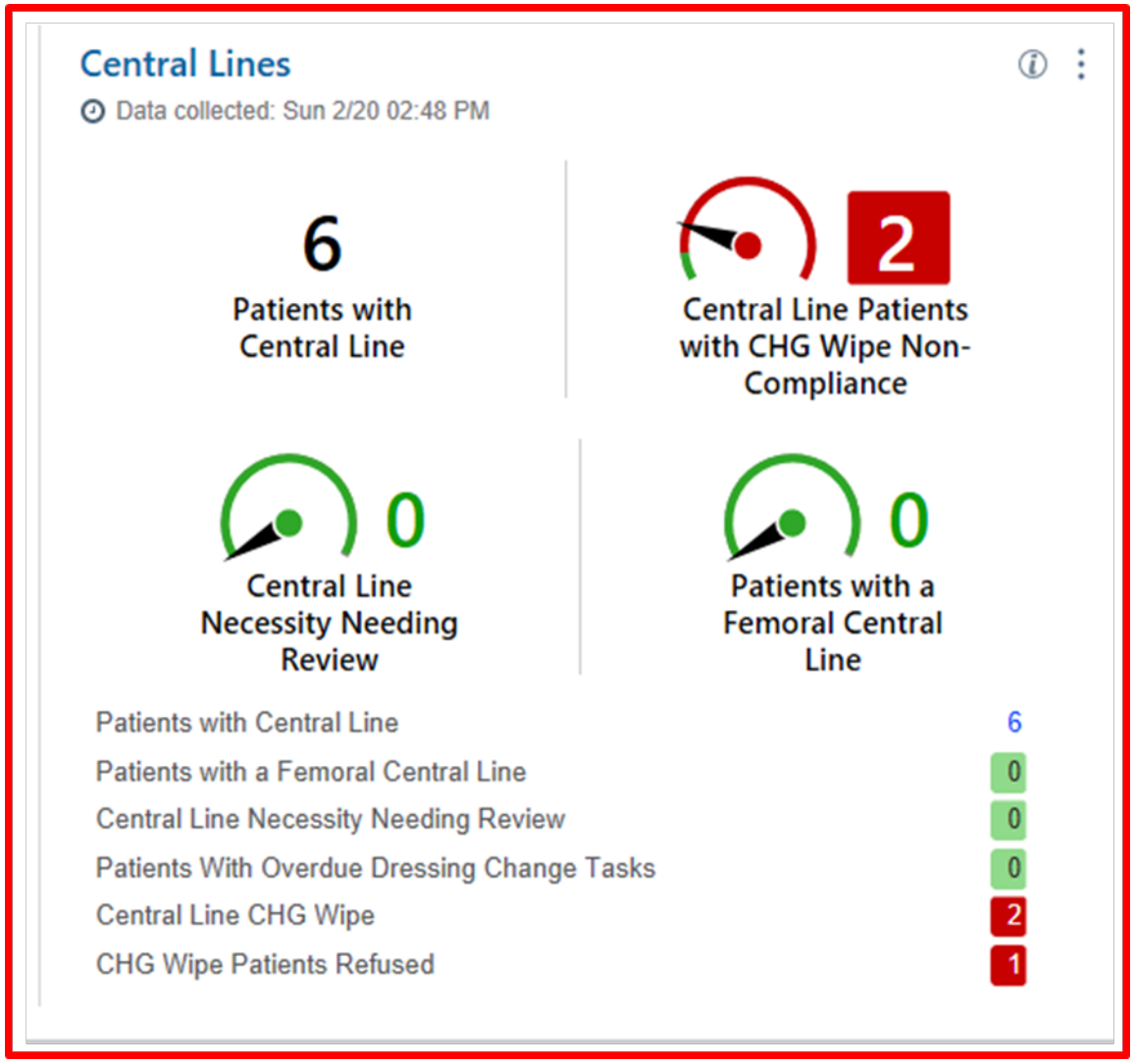
Line SEPSIS

Death

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Leverage EMR to increase detectability of errors that could lead to failure

- AM rounds—RNs with team
- Daily shift Change safety sweep 2x/day—
  - PM safety sweep
- Weekly staff meetings—RN manager
- Clinical education team deployed as a “clinical risk management team” to support frontline staff who are overwhelmed.
- Divisional and local safety huddles

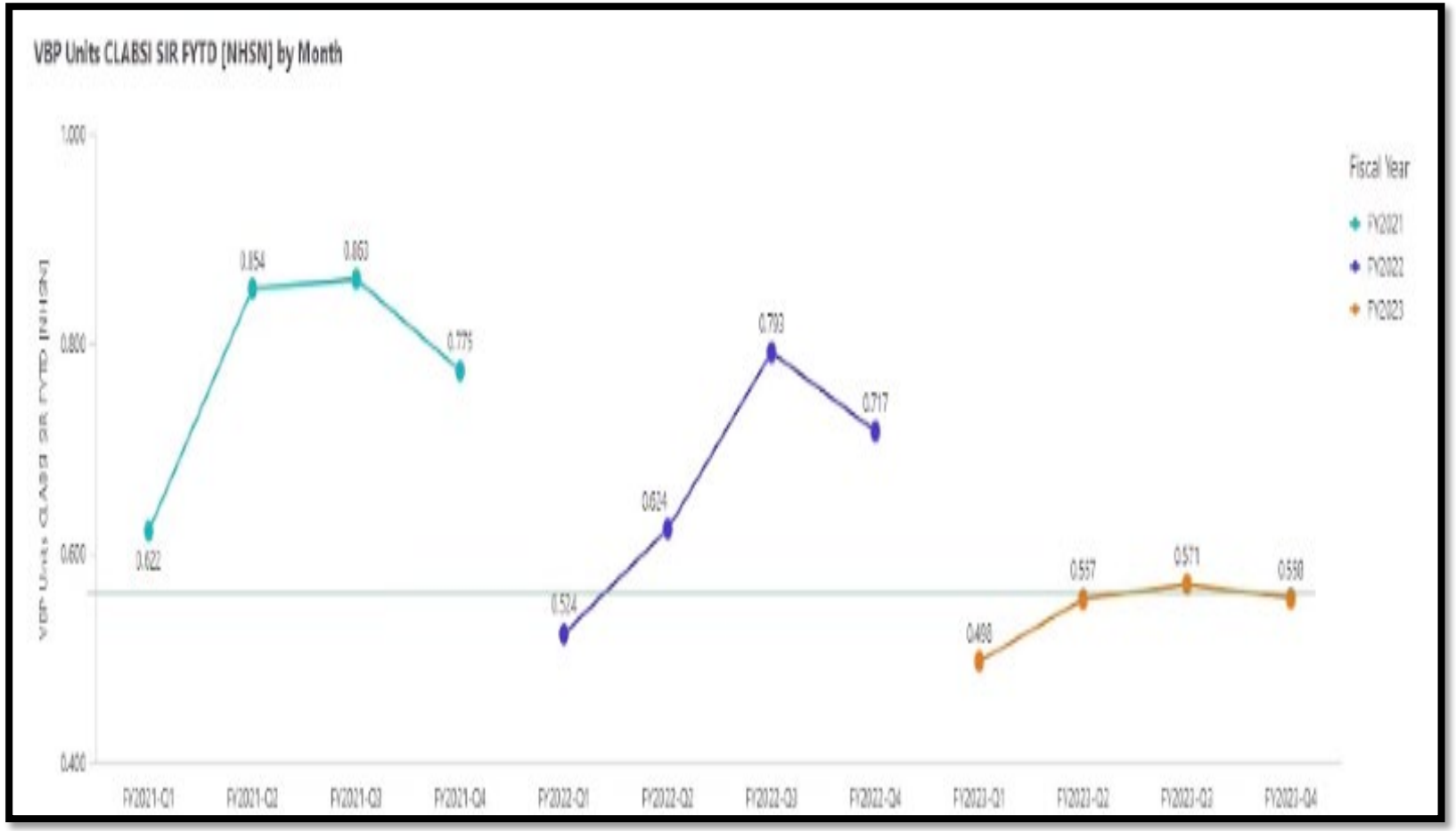


EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

CLABSI: Sustained improvement

Jan. 2020 to Dec. 2022 (through COVID)

- SIR went from 0.845 to 0.63
- 25% reduction (VBP units)
- Avoided 65 infections (O: 155, P or E: 220)
- Cost per infection: $45,814
- Total Cost Avoidance Savings: 65 * $45,814 = $2,977,910



EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

(reference: Zimlichman Et al. JAMA Internal Medicine December 9/23, 2013 Volume 173, Number 22, 2039-2046)

Key message #4

"Every system is perfectly designed to get the results it gets."

Stop asking the humans to do more, try harder, remember more, be more vigilant…

Instead, utilize human adaptation as a source of strength and identify broken systems and redesign.

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

- Quote by Paul Batalden, Patient Safety & Quality Healthcare blog on August 3, 2015,

Redesign Great Catch reporting

Great Catch Program

WHY DOES IT MATTER? By the numbers:

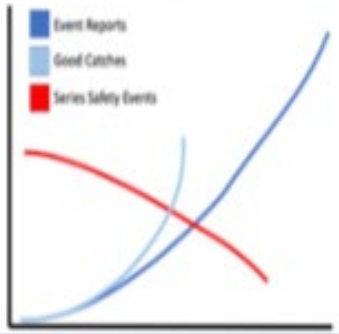
#3 — 3rd Leading Cause of Death Nationally is Iatrogenic harm from Healthcare Delivery

600 — 600 to 1. The number of small threats and system breakdowns that occur before a Serious Safety Event occurs to a patient.

The more feedback we receive the more we improve our system, the more harm that we can prevent.

WHAT DOES SUCCESS LOOK LIKE?

More Feedback = More Solutions = Less Harm



OUR ASK: Be a part of the solution by offering leadership, ideas, feedback and patience.

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Great Catch, Great Save and Mission Moment program expansion

Great Catch
=
System Fix

Great Catch: Identifying a failure BEFORE it reaches the patient and results in a *system or process fix, affecting many patients going forward.*

Great Save
=
Rescue

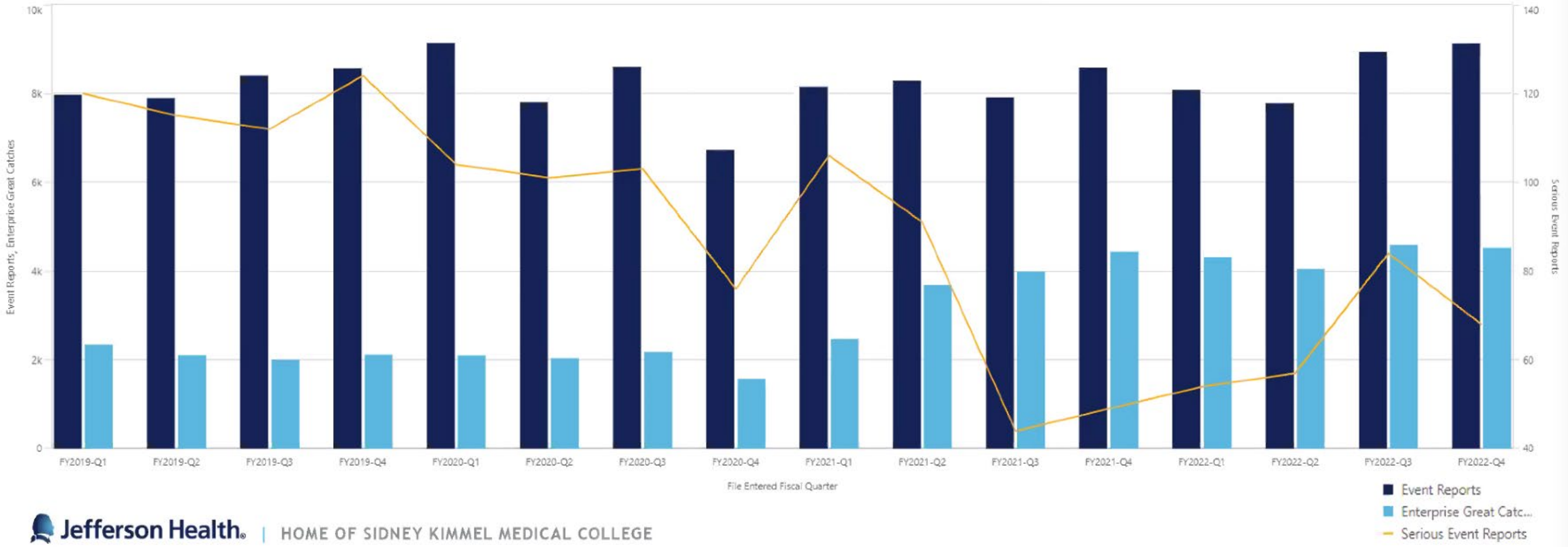
Great Save: Taking action to *rescue* a single patient from deterioration and/or harm

Mission Moment
=
Service Excellence

Mission Moment: Exceptional demonstration of *service excellence (i.e. compassion, caring, etc.).*

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

GC done differently: A proactive focus on system safety



Jefferson Health | HOME OF SIDNEY KIMMEL MEDICAL COLLEGE

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Key message #5

Any time a system exceeds human capability and/or capacity to do work, errors will occur.

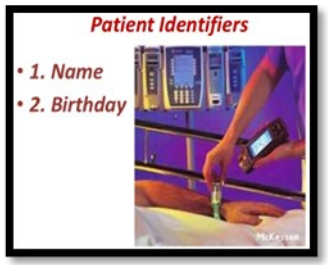
Train humans differently. Not just to avoid errors but to expect errors, to recognize errors, detect them early and enable them to rescue.

Operationalizing resiliency engineering in training

System reliability

Error avoidance

Forced functions



Constraints

System resiliency

Error management

Rescue

Restrict

Reverse

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Prevent errors

Error avoidance

- A learning strategy where the learner focuses on correct actions and does not pay much attention to error recognition.
- Examples of this are sequential step-by-step instructions or conventional tutorials.
- This approach aims to eliminate errors before they occur by placing barriers (forced functions, two-step verification, redundancy of critical resources, checklists) between steps that contribute to an error.
- In this model, errors are dealt with mostly after they have occurred, where recovery may or may not be discussed at all, and if so, is only focused on in relation to cataclysmic errors.
- Weaknesses:
  - Learners receive little training on how to recognize they are getting close to making errors or actual errors.
  - Learners receive little support on rescuing from failure and/or containing error.

Error management theory

- EMT is a brain-based learning strategy that utilizes active exploration and explicit encouragement of learners to make errors during training as an approach to more successful and resilient long-term learning.
- It sensitizes learners to what leads to error and what error looks like in its various forms so it can be recognized earlier, faster and more efficiently.
- Enables a framework to rescue error → failure and how to contain failure.
- This theory exploits the fact that learners are motivated to understand and learn from their mistakes.

Dror I. Medical Teacher, 2011, 33:1, 34-38

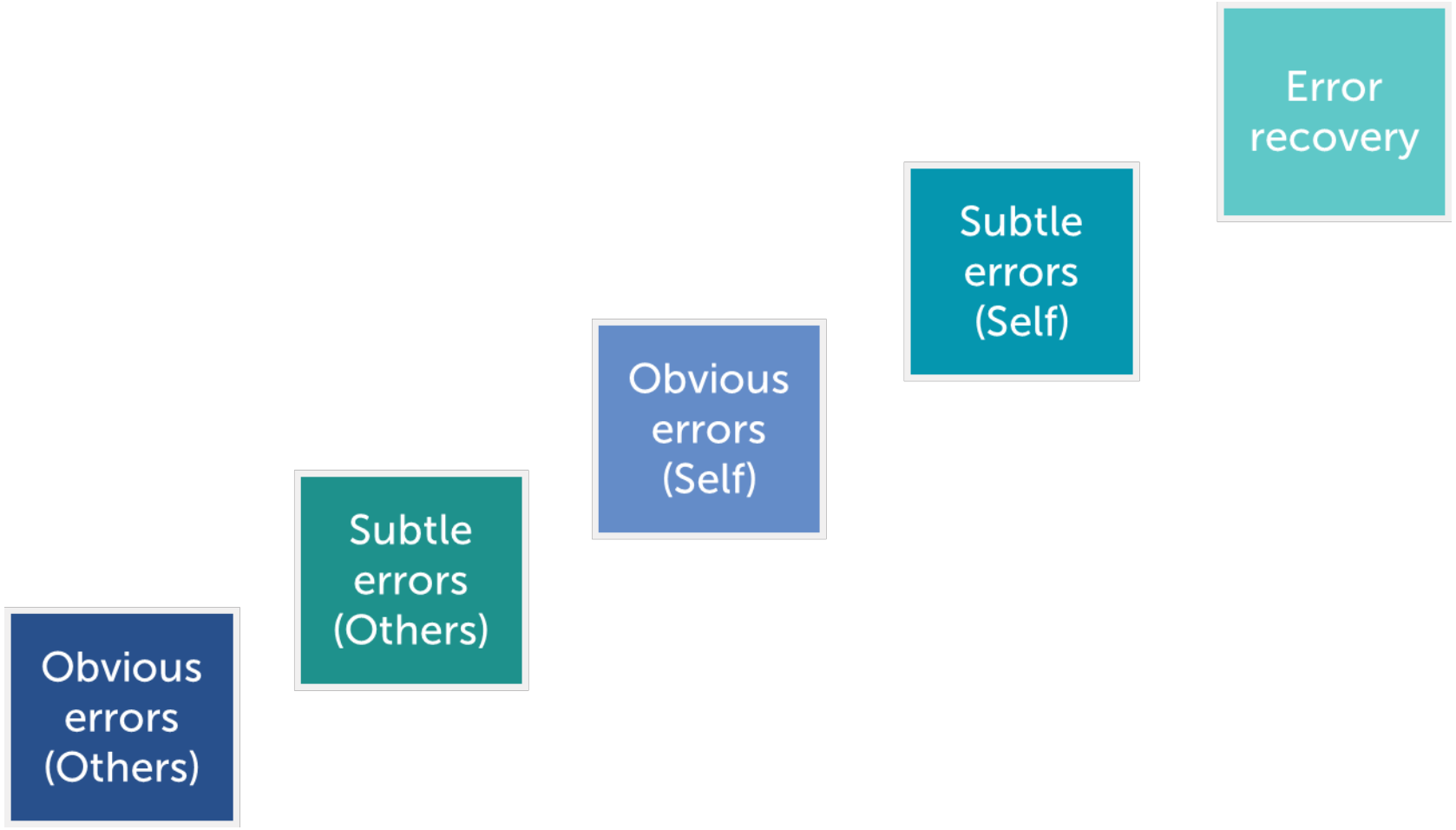
Error management theory cont'd

- A learning strategy that promises to improve long-term retention, emotional resiliency and contextualization of learning.
- Rather than avoid errors, learners are asked to embrace errors as part of the initial events of learning.
- Learners are asked to understand what "wrong is" or identify errors, ***error recognition*** and how best to manage the error, or ***error recovery.***
- ***Increases Level 3 Situational Awareness (Projection, Anticipation).***

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Dror I. Medical Teacher, 2011, 33:1, 34-38

Error management learning paradigm

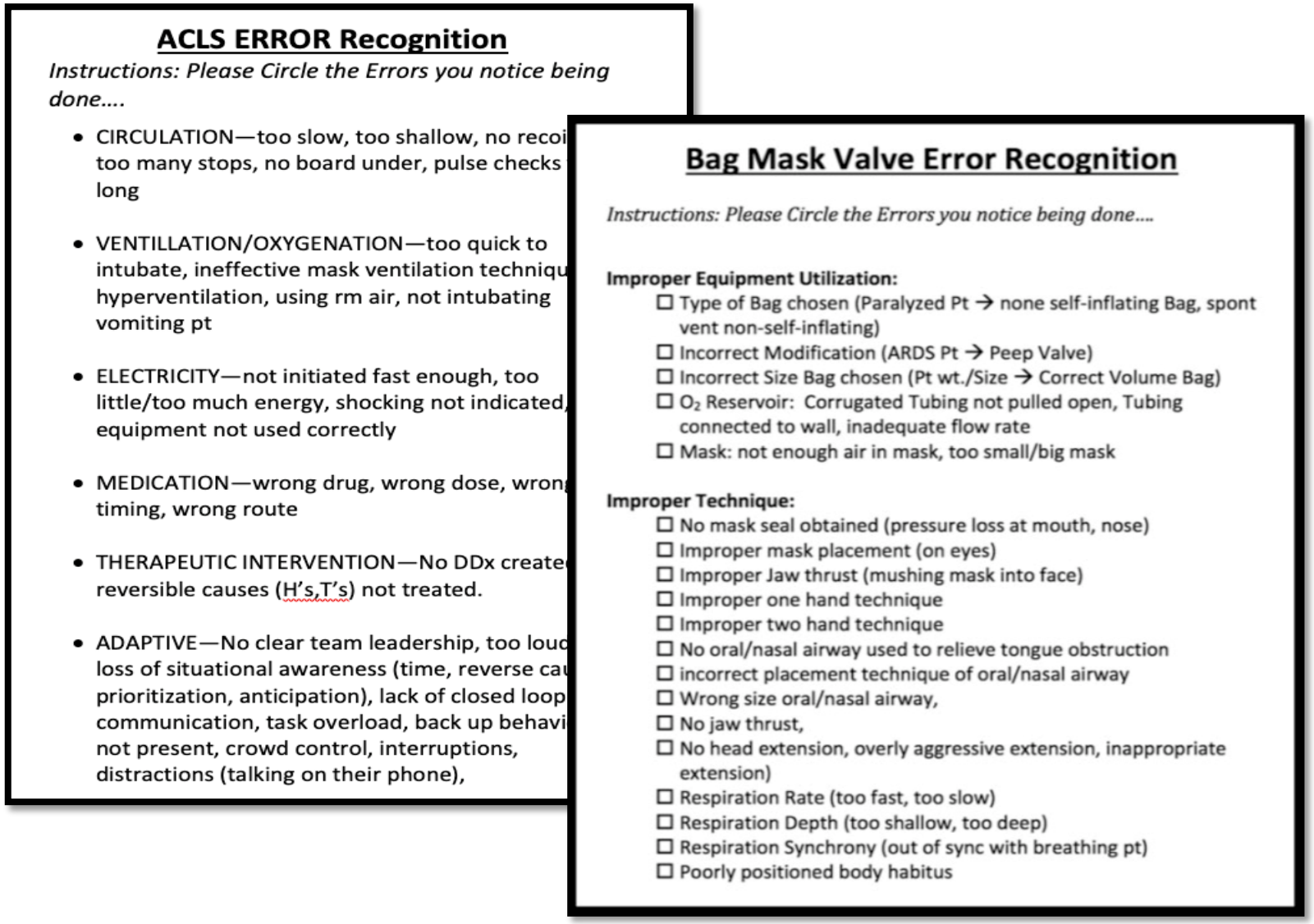


EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Dror I. Medical Teacher, 2011, 33:1, 34-38

Practical approach

- Just-in-time videos
- Simulation
- EMT checklist
  - obvious errors
  - subtle errors
- Recognition and rescue
- Contain



ACLS ERROR Recognition

Instructions: Please Circle the Errors you notice being done….

- CIRCULATION—too slow, too shallow, no recoi too many stops, no board under, pulse checks long
- VENTILLATION/OXYGENATION—too quick to intubate, ineffective mask ventilation techniqu hyperventilation, using rm air, not intubating vomiting pt
- ELECTRICITY—not initiated fast enough, too little/too much energy, shocking not indicated, equipment not used correctly
- MEDICATION—wrong drug, wrong dose, wron timing, wrong route
- THERAPEUTIC INTERVENTION—No DDx create reversible causes (H's,T's) not treated.
- ADAPTIVE—No clear team leadership, too loud loss of situational awareness (time, reverse cau prioritization, anticipation), lack of closed loop communication, task overload, back up behavi not present, crowd control, interruptions, distractions (talking on their phone),

Bag Mask Valve Error Recognition

Instructions: Please Circle the Errors you notice being done….

Improper Equipment Utilization:

- ☐ Type of Bag chosen (Paralyzed Pt → none self-inflating Bag, spont vent non-self-inflating)
- ☐ Incorrect Modification (ARDS Pt → Peep Valve)
- ☐ Incorrect Size Bag chosen (Pt wt./Size → Correct Volume Bag)
- ☐ O_2 Reservoir: Corrugated Tubing not pulled open, Tubing connected to wall, inadequate flow rate
- ☐ Mask: not enough air in mask, too small/big mask

Improper Technique:

- ☐ No mask seal obtained (pressure loss at mouth, nose)
- ☐ Improper mask placement (on eyes)
- ☐ Improper Jaw thrust (mushing mask into face)
- ☐ Improper one hand technique
- ☐ Improper two hand technique
- ☐ No oral/nasal airway used to relieve tongue obstruction
- ☐ incorrect placement technique of oral/nasal airway
- ☐ Wrong size oral/nasal airway,
- ☐ No jaw thrust,
- ☐ No head extension, overly aggressive extension, inappropriate extension)
- ☐ Respiration Rate (too fast, too slow)
- ☐ Respiration Depth (too shallow, too deep)
- ☐ Respiration Synchrony (out of sync with breathing pt)
- ☐ Poorly positioned body habitus

EQIC
EASTERN US QUALITY IMPROVEMENT COLLABORATIVE

Thank you.

Oren Guttman, MD, MBA
oren.guttman@jefferson.edu
310-595-6642

EQIC
EASTERN US QUALITY
IMPROVEMENT COLLABORATIVE