The Challenges and Applications of Implementing Complex Predictive Analytics In Health Care

Becker's HIT + RCM
October 12 , 2019

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MD Anderson patient died after getting contaminated blood

Todd Ackerman | June 25, 2019 | Updated: June 25, 2019 10:20 p.m.

A view of the outside of the MD Anderson Cancer Center in Houston, Texas.
Photo: Houston Chronicle

The event that triggered increased government oversight of MD Anderson Cancer Center was the death of a 23-year-old leukemia patient who received a contaminated blood product, according to a new report.

The report, issued Monday by the Centers for Medicare and Medicaid Services, notes the patient, a woman, died two days after receiving a transfusion tainted with a bacterial infection commonly acquired in hospitals but rarely found in blood transfusions. She had had serious complications prior to the transfusion,

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The New York Times

UNC Children's Hospital Suspends Most Complex Heart Surgeries

By Ellen Gabler

June 17, 2019

North Carolina Children's Hospital announced it would suspend heart surgeries for the most complex cases, some of which had a mortality rate approaching 50 percent in recent years, pending investigations by state and federal regulators and a group of outside experts.

In a statement on Monday, UNC Health Care, which runs the hospital and is affiliated with the University of North Carolina, also introduced several initiatives to "restore confidence in its pediatric heart surgery program." These include creating the external advisory board of medical experts to recommend improvements, and committing to publicly release mortality data for that program, which it has refused to do in past years.
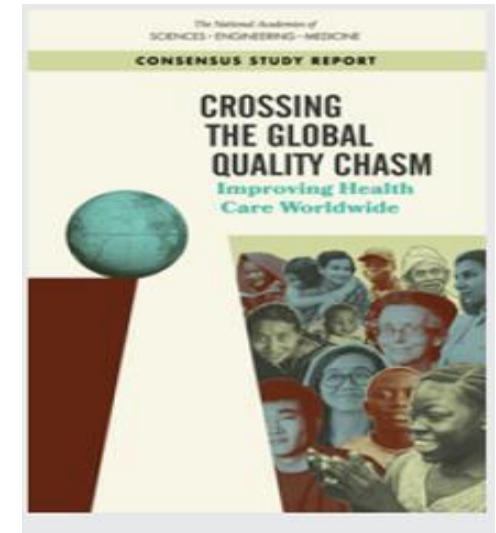
The actions are in response to a New York Times investigation last month into the medical institution, where cardiologists, department leaders and even the former head of the children's hospital expressed concerns about patients faring poorly after heart surgery there. Secret audio recordings provided to The Times captured doctors talking openly, some even saying they might not feel comfortable allowing their own children to have surgery at the hospital.

The Times sued for the program's mortality data and was still in a yearlong legal battle to obtain it when UNC Health Care released previously undisclosed statistics on Monday. The data shows that the mortality rate for heart surgery patients continued to rise after doctors warned administrators several years ago of possible problems.

Challenge-Implementation Gap 2019

- 1 in 10 patients harmed in hospital care/ between **5.7 and 8.4 million deaths** occurring annually from poor quality care

- **14** out of every 100 patients affected by HAIs

- **2%** patients subject to surgical complications for the 234 million surgical operations performed every year

- **20-40%** health spending wasted due to poor quality of care and safety failures

- **15%** of hospital costs being due to patient harms caused by adverse events

The National Academies of
SCIENCES · ENGINEERING · MEDICINE
CONSENSUS STUDY REPORT

CROSSING THE GLOBAL QUALITY CHASM
Improving Health Care Worldwide

THE ECONOMICS OF PATIENT SAFETY IN PRIMARY AND AMBULATORY CARE

Flying blind

OECD
BETTER POLICIES FOR BETTER LIVES
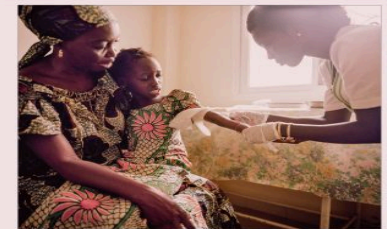
THE LANCET
Global Health

September, 2018   www.thelancet.com/lancetgh

High-quality health systems in the Sustainable Development Goals era: time for a revolution

"Providing health services without guaranteeing a minimum level of quality is ineffective, wasteful, and unethical"

A Commission by The Lancet Global Health

The Financial and Human Cost of Medical Error

… and How Massachusetts Can Lead the Way
on **Patient Safety**

- Medical errors are frequent, harmful and costly
- 62,000 errors identified over 12 months
- On-going, large-scale safety gaps in health care delivery
- Excess claim costs attributed to errors = $617 Million

"A proactive systems approach is needed to identify and address risks before patients are harmed."
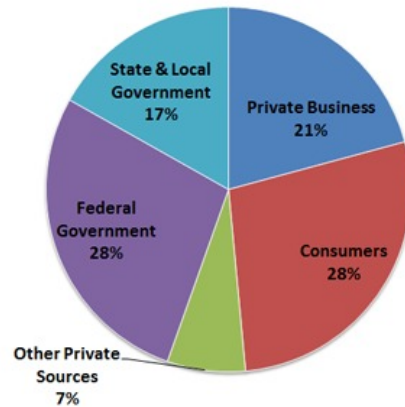
BETSY LEHMAN CENTER
for Patient Safety
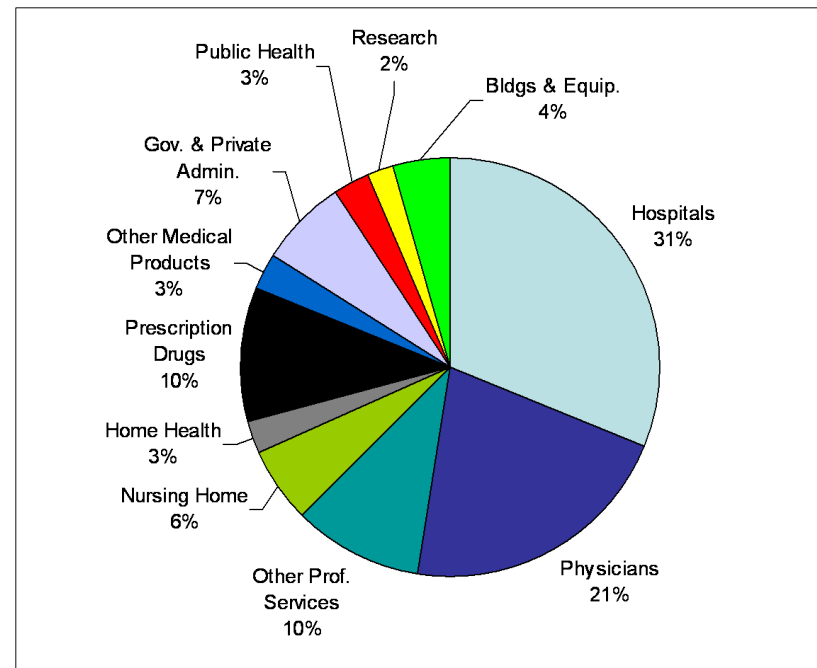
Healthcare Top-of-Mind Concerns

Reforms & Regulation

Costs & Risk
(who pays and for what)

Who Pays The $2.7 Trillion Bill?

- State & Local Government 17%
- Private Business 21%
- Federal Government 28%
- Consumers 28%
- Other Private Sources 7%

Source: Department of Health and Human Services 2011 data

- Public Health 3%
- Research 2%
- Bldgs & Equip. 4%
- Gov. & Private Admin. 7%
- Other Medical Products 3%
- Hospitals 31%
- Prescription Drugs 10%
- Home Health 3%
- Nursing Home 6%
- Other Prof. Services 10%
- Physicians 21%

Converting Market Drivers

R&D (% of Total Spend)

- Computing and Electronics 28%
- Healthcare 22%
- Auto 15%
- Industrials 10%
- Chemicals and Energy 7%
- Software and Internet 8%
- Aerospace and Defense 4%
- Consumer 3%
- Telecom 2%
- Other 1%

Digital & Data

Healthcare R&D

Shifting Financial Risk
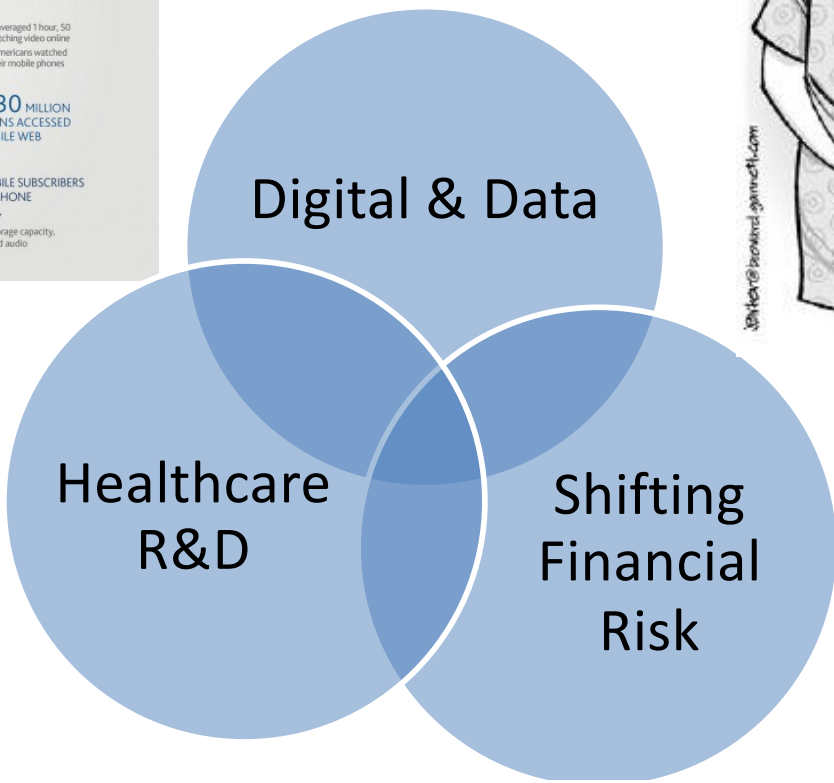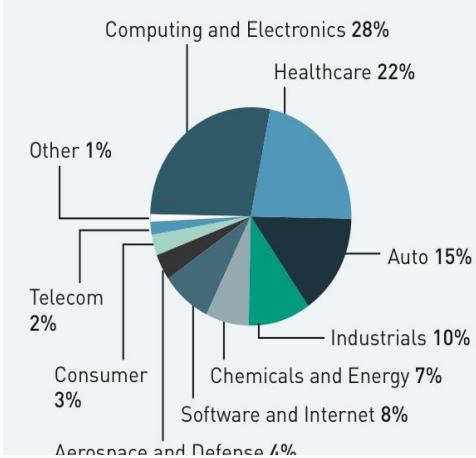
DATA and Exponential technologies are converging to transform and disrupt industries

Cognitive Computing
Augmenting or amplifying human cognition through advanced technologies such as artificial intelligence, machine learning, etc.

Robotics
Next generation robotics and automation technologies that can work alongside humans
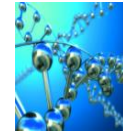
Synthetic Biology
The ability to produce synthetic tissues and organs creates new opportunities for surgical therapy and device production

Digital Medicine
Personalized sensing and remote monitoring of physiological metrics leveraging new digital paradigms

Additive Manufacturing
3D scanning, digital design, and 3D printing digitize the creation / distribution of products

Ambient Computing
Ecosystem of "things" that can intelligently respond in real time to business needs through connectivity and sensing
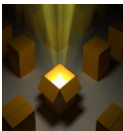
Incentive Competitions
Using a prize based competition to evoke a community to participate in solving a problem

DIY & the Maker Movement
The creativity unlocked when the public has access to the tools needed to create manufactured works themselves

Virtual / Augmented Reality
Additive technologies to better equip care providers in their day-to-day tasks and improve health outcomes through differentiated experiences

Gamification
Leveraging game mechanics to incentivize individual or group behaviors

Crowdsourcing
Involve communities to collaborate in solving complex, non-linear problems, calling upon diverse skillsets

Crowdfunding
Leveraging the public to fund the creation of a product or company

Blockchain
Distributed ledger technology that offers a new way of recording transactions or any digital interactions

Commercial UAVs (Drones)
Aerial robots to transform logistics relating to the delivery of goods and services

The Future of Medicine

- Without being prepared .. all stakeholders will come across human threats, ethical issues and serious trust problems.

- We can still prepare for the amazing yet uncertain future of medicine.

- What is definitely needed, such as new skills, is a robust **Public Discussion about the values of our societies** now.

Bertralan Mesko
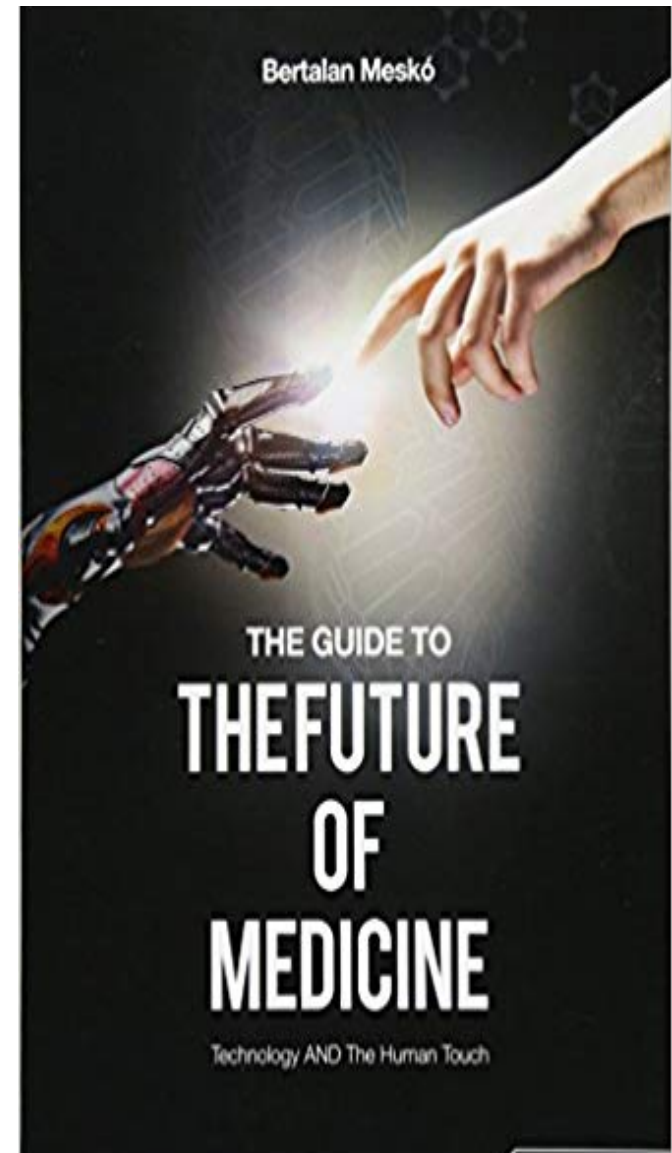
Quadruple Aim

- Enhancing the experience/safety/quality of care for patients
- Reducing the per capita cost of health care
- Engaged and joyful healthcare workers
- Improving the health of populations

- *"The overriding concern of hospital executives in 2019 is to assure safe and high-quality care,"* says Deborah J. Bowen, FACHE, CAE, president and CEO of ACHE.

Quadruple Aim
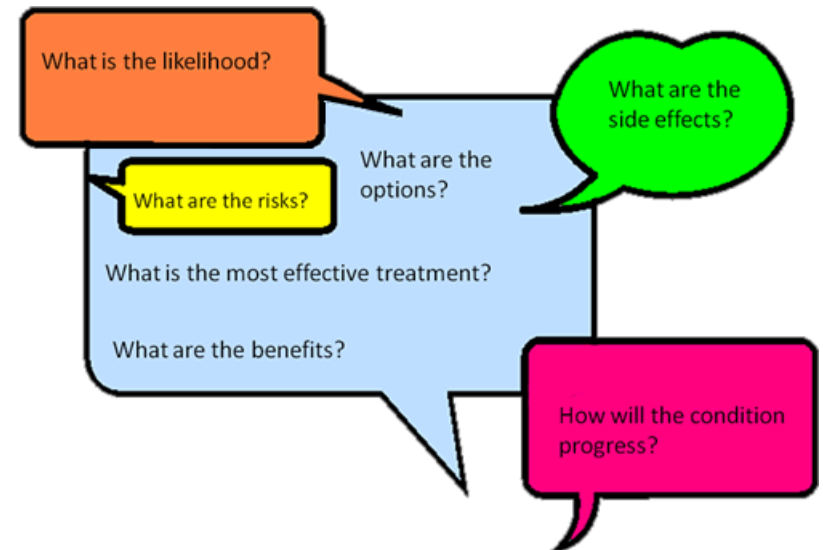
- Improved Population Health
- Satisfied Providers
- Satisfied Patients
- Reduced Care Cost
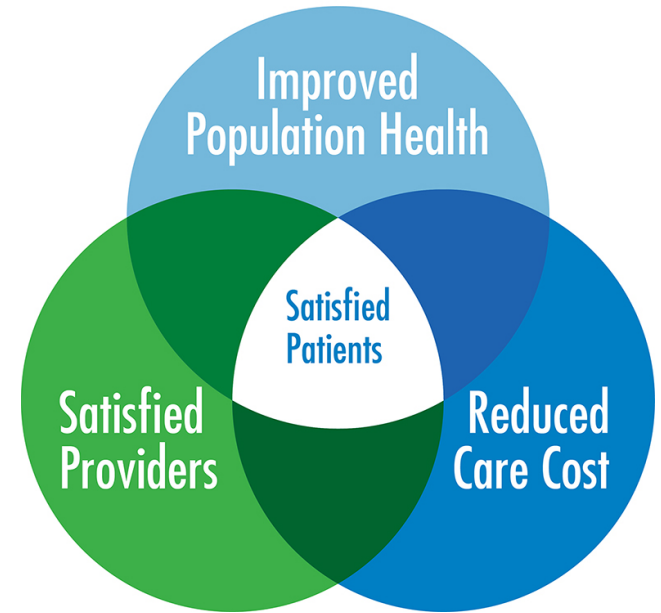
Types of Clinical Questions
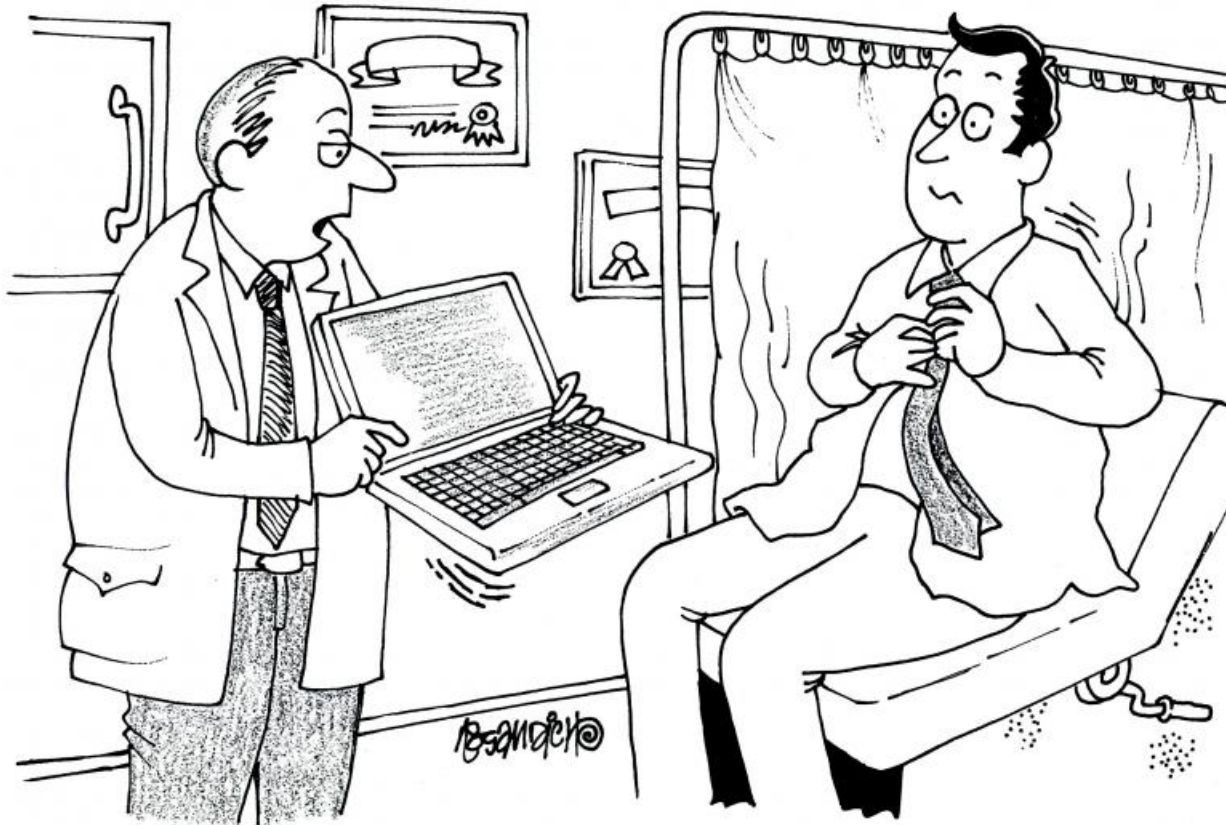
Data

Knowledge

Action

Benefits

- Therapy questions
- Diagnosis questions
- Prognosis questions
- Harm questions

Clinical Data-Six major types

- Electronic health records
- Administrative data
- Claims data
- Disease registries
- Health surveys
- Clinical trials data

Clinical Decision Support System

"If you want a second opinion, I'll ask my computer."

The FOUR V's of Big Data

From traffic patterns and music downloads to web history and medical records, data is recorded, stored, and analyzed to enable the technology and services that the world relies on every day. But what exactly is big data, and how can these massive amounts of data be used?

As a leader in the sector, IBM data scientists break big data into four dimensions: **Volume, Velocity, Variety and Veracity**

Depending on the industry and organization, big data encompasses information from multiple internal and external sources such as transactions, social media, enterprise content, sensors and mobile devices. Companies can leverage data to adapt their products and services to better meet customer needs, optimize operations and infrastructure, and find new sources of revenue.

By 2015
4.4 MILLION IT JOBS
will be created globally to support big data, with 1.9 million in the United States

Volume
SCALE OF DATA

40 ZETTABYTES
[43 TRILLION GIGABYTES]
of data will be created by 2020, an increase of 300 times from 2005

2005
2020

6 BILLION PEOPLE
have cell phones

WORLD POPULATION: 7 BILLION

It's estimated that
2.5 QUINTILLION BYTES
[2.3 TRILLION GIGABYTES]
of data are created each day

Most companies in the U.S. have at least
100 TERABYTES
[100,000 GIGABYTES]
of data stored

Velocity
ANALYSIS OF STREAMING DATA

The New York Stock Exchange captures
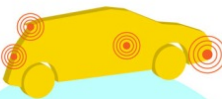**1 TB OF TRADE INFORMATION**
during each trading session

By 2016, it is projected there will be
18.9 BILLION NETWORK CONNECTIONS
– almost 2.5 connections per person on earth

Modern cars have close to
100 SENSORS
that monitor items such as fuel level and tire pressure

Variety
DIFFERENT FORMS OF DATA

As of 2011, the global size of data in healthcare was estimated to be
150 EXABYTES
[161 BILLION GIGABYTES]

30 BILLION PIECES OF CONTENT
are shared on Facebook every month

By 2014, it's anticipated there will be
420 MILLION WEARABLE, WIRELESS HEALTH MONITORS

4 BILLION+ HOURS OF VIDEO
are watched on YouTube each month

400 MILLION TWEETS
are sent per day by about 200 million monthly active users

Veracity
UNCERTAINTY OF DATA

1 IN 3 BUSINESS LEADERS
don't trust the information they use to make decisions

27% OF RESPONDENTS
in one survey were unsure of how much of their data was inaccurate

Poor data quality costs the US economy around
$3.1 TRILLION A YEAR

IBM

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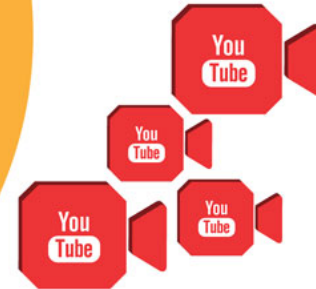
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Velocity

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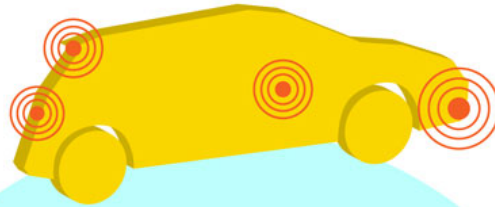
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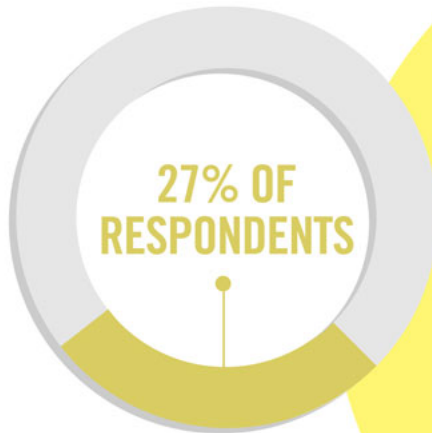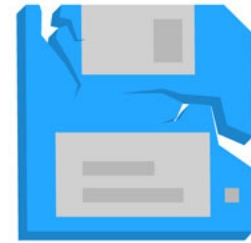
– almost 2.5 connections per person on earth

1 IN 3 BUSINESS LEADERS

don't trust the information they use to make decisions

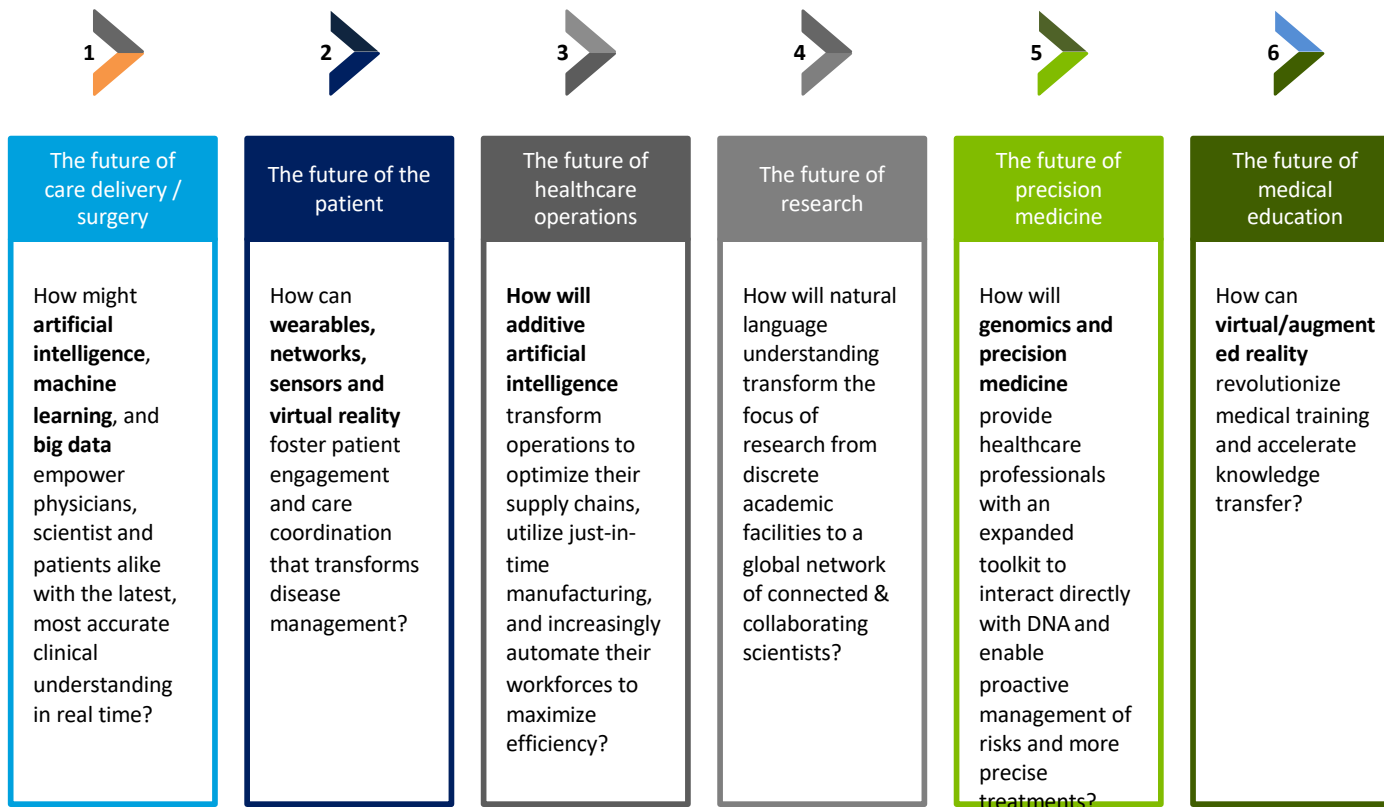Poor data quality costs the US economy around

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Veracity

UNCERTAINTY OF DATA
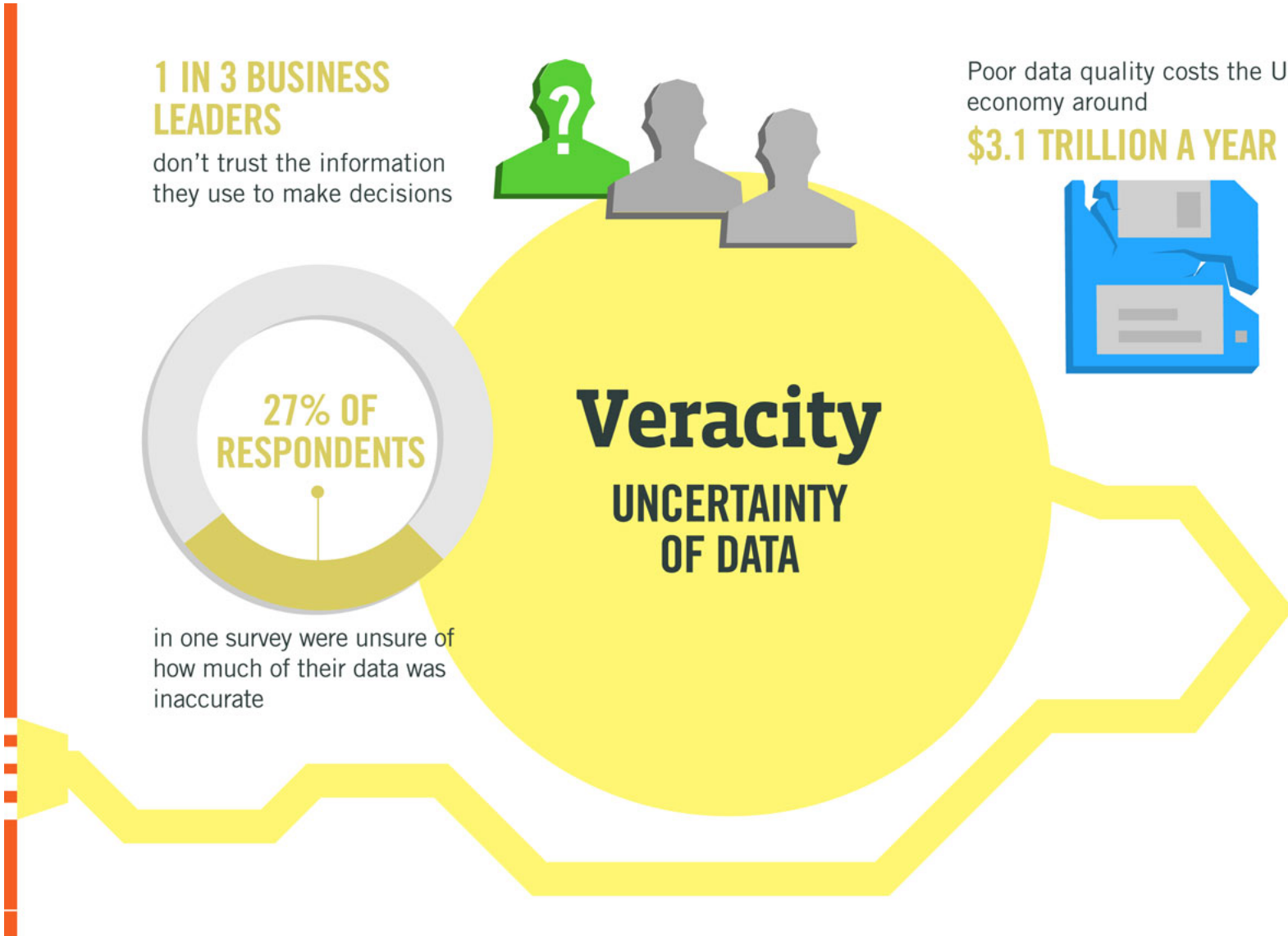
Transform the entire value chain with data and Exponentials

1	2	3	4	5	6
The future of care delivery / surgery	**The future of the patient**	**The future of healthcare operations**	**The future of research**	**The future of precision medicine**	**The future of medical education**
How might **artificial intelligence**, **machine learning**, and **big data** empower physicians, scientist and patients alike with the latest, most accurate clinical understanding in real time?	How can **wearables, networks, sensors and virtual reality** foster patient engagement and care coordination that transforms disease management?	**How will additive artificial intelligence** transform operations to optimize their supply chains, utilize just-in-time manufacturing, and increasingly automate their workforces to maximize efficiency?	How will natural language understanding transform the focus of research from discrete academic facilities to a global network of connected & collaborating scientists?	How will **genomics and precision medicine** provide healthcare professionals with an expanded toolkit to interact directly with DNA and enable proactive management of risks and more precise treatments?	How can **virtual/augmented reality** revolutionize medical training and accelerate knowledge transfer?

Deloitte.

The future of care delivery

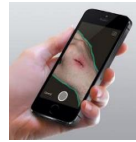Transforming the who, what, and where of care delivery

Sample Use Cases

When Care is Delivered

Retina Selfie – Retina self-imaging allows patients to monitor for diseases such as multiple sclerosis and detect early warning signs

Where Care is Delivered

Healogram – Mobile platform that helps providers remotely monitor patients post-surgical procedure

Who Care is Delivered by

iDAvatars – Virtual avatar, Sophie, uses artificial intelligence and natural language processing to remotely monitor patients

Drivers of Disruption

✓ Artificial Intelligence

✓ Robotics

✓ Augmented Reality

✓ Personalized Medicine

✓ Additive Manufacturing

Sample Market Signals

Healogram+

iDAvatars

MEDICAL MODELING
The Tactile Imaging Solutions Company™

PHILIPS

organovo™

| The future of care delivery / surgery | The future of the patient | The future of healthcare operations | The future of research | The future of precision medicine | The future of medical education |

The future of surgery

Transforming what surgeons see, know, and do
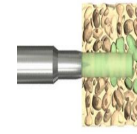
Sample Use Cases

What We See

SNAP Surgical Theater – augments surgeons' reality with CT/MRI scans to see behind arteries and other critical structures

What We Know

Oculus Rift – improves training by allowing medical students to watch surgeries from the lead surgeon's point of view

What We Do

BoneWelding – stronger bonds and improved osseo-integration enable new implant designs & surgical methods

Drivers of Disruption

- ✓ Artificial Intelligence
- ✓ Augmented Reality
- ✓ Personalized Medicine
- ✓ Additive Manufacturing
- ✓ Networks & Sensors
- ✓ Nanotechnology
- ✓ Robotics

Sample Market Signals

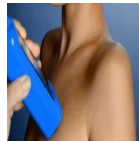| The future of care delivery / surgery | The future of the patient | The future of healthcare operations | The future of research | The future of precision medicine | The future of medical education |

The future of the patient

Transitioning from a passive role to an active role in health

Sample Use Cases

Tools for Self-Service

Tyto Care – handheld device that patients can use to self-examine their mouth, throat, eyes, heart, lungs, skin, and temperature

New Ways to Engage

Deloitte Cognitive Engagement – designed to boost patient involvement in care and expand the type of alerts and interactivity offered online

The Quantified Self

Ginger.io – aggregates cellphone data to monitor patient' mental health and alert caregivers when symptoms are problematic

Drivers of Disruption

- ✓ Networks & Sensors
- ✓ Wearables
- ✓ Artificial Intelligence
- ✓ Digital Medicine
- ✓ Robotics

Sample Market Signals

Google

fitbit

omada

USC Institute for Creative Technologies

Healogram

| The future of care delivery / surgery | The future of the patient | The future of healthcare operations | The future of research | The future of precision medicine | The future of medical education |

The future of healthcare operations

Automating labor and JIT manufacturing

Sample Use Cases

Efficient Administration

Care at Hand – Helps to prevent readmissions by deploying nursing staff skills to maximum efficiency

Improved Productivity

Aethon TUG Robots – Smart, autonomous robots substitute for the labor needed to haul and transport materials & clinical supplies

Workforce Augmentation

Evena – Technician glasses provide high-definition, real-time images of vascular anatomy to enable fast, precise IV access

Drivers of Disruption

- ✓ Additive Manufacturing
- ✓ Robotics
- ✓ Artificial Intelligence
- ✓ Automation
- ✓ Nanotechnology

Sample Market Signals

MODERNIZING MEDICINE · vocera V · VEEBOT · XENEX GERM-ZAPPING ROBOTS · evena MEDICAL · AETHON

| The future of care delivery / surgery | The future of the patient | The future of healthcare operations | The future of research | The future of precision medicine | The future of medical education |

The future of research

Changing the how and who perform research

Sample Use Cases

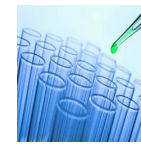### Scientific Breakthroughs

Illumina – reached milestone of making it feasible to read someone's genome for $1000, down from $95.3 Million in 2001

New Collaboration Models

Foldit – predicts the structure of a protein by taking advantage of humans' puzzle-solving intuitions through an online game

Operational Efficiency

IBM and **Mayo Clinic** – using artificial intelligence to more accurately match patients with appropriate clinical trials

Drivers of Disruption

✓ Synthetic Biology

✓ Additive Manufacturing

✓ Genomics

✓ Personalized Medicine

✓ Nanotechnology

Sample Market Signals

CrowdMed

NIH Big Data to Knowledge (BD2K)

HUMAN LONGEVITY, INC.

kaggle

INNOCENTIVE

CLARITAS GENOMICS

M2GEN

The future of care delivery / surgery

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The future of research
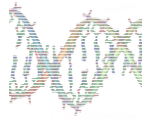
The future of precision medicine

The future of medical education

The future of precision medicine
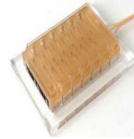
Enabling proactive and precise treatments

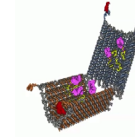## Sample Use Cases

Preventative Measures

Human Longevity Inc. – building the world's most comprehensive database on human genotypes

New Research / Treatment Methods

LiverChip – Dynamic 3-D cell culture platform can exactly mimic the architecture and physiology of the human liver

Increased Precision

Wyss Institute – Harvard scientists built a nano-robot from designer DNA to deliver drug dosages to specific cell types

Drivers of Disruption

- ✓ Genomics
- ✓ Personalized Medicine
- ✓ Nanotechnology

Sample Market Signals

HUMAN LONGEVITY, INC.

APX LABS

Google

illumina

CISCO

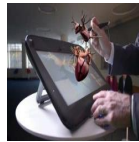| The future of care delivery / surgery | The future of the patient | The future of healthcare operations | The future of research | The future of precision medicine | The future of medical education |

The future of medical education

Revolutionizing medical training

Sample Use Cases
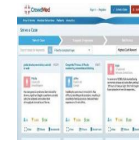
Expanded Perspective

Dassault Systemes – Augmented reality allows for enhanced visualizations and simulations

New Learning Forums

Pop Up Labs –creates in-house maker spaces to enable/accelerate medical professionals' best practices and creation

Increased Collaboration

CrowdMed – Medical professionals across the globe collaborate on cases and learn of new treatment methods

Drivers of Disruption

- ✓ Virtual / Augmented Reality
- ✓ Additive Manufacturing
- ✓ Maker Movement
- ✓ Crowdsourcing

Sample Market Signals

POP UP Labs

CrowdMed

Oculus VR

DASSAULT SYSTEMES

MEDICAL MODELING
The Tactile Imaging Solutions Company

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ONLINE FIRST

Special Communication

October 7, 2019

Waste in the US Health Care System
Estimated Costs and Potential for Savings

William H. Shrank, MD, MSHS[1]; Teresa L. Rogstad, MPH[1]; Natasha Parekh, MD, MS[2]

❯ Author Affiliations | Article Information

Abstract

Importance The United States spends more on health care than any other country, with costs approaching 18% of the gross domestic product (GDP). Prior studies estimated that approximately 30% of health care spending may be considered waste. Despite efforts to reduce overtreatment, im-

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The New York Times

THE NEW HEALTH CARE

A study finds evidence for how to reduce some of it, but also a large blind spot on how to remove the rest.

By **Austin Frakt**

Oct. 7, 2019

Even a divided America can agree on this goal: a health system that is cheaper but doesn't sacrifice quality. In other words, just get rid of the waste.

A new study, published Monday in JAMA, finds that roughly 20 percent to 25 percent of American health care spending is wasteful. It's a startling number but not a new finding. What is surprising is how little we know about how to prevent it.

William Shrank, a physician who is chief medical officer of the health insurer Humana and the lead author of the study, said, "One contribution of our study is that we show that we have good evidence on how to eliminate some kinds of waste, but not all of it."

Following the best available evidence, as reviewed in the study, would eliminate only one-quarter of the waste — reducing health spending by about 5 percent.
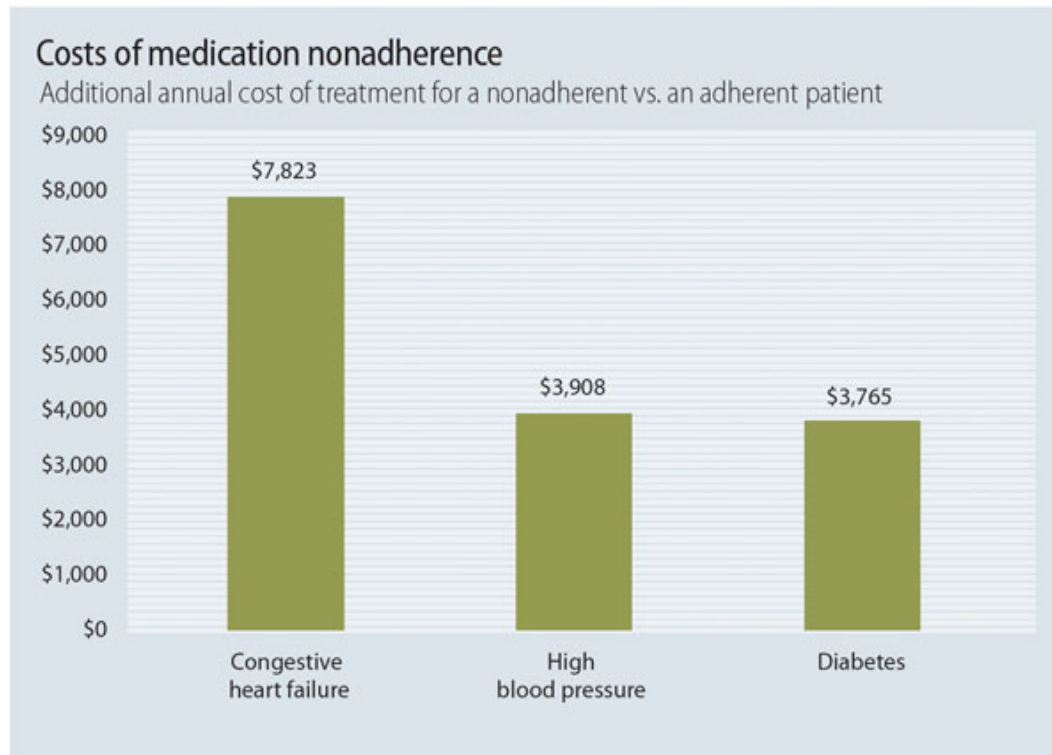
TERESA ROGSTAD OF HUMANA AND NATASHA PAREKH, A PHYSICIAN WITH THE UNIVERSITY OF PITTSBURGH, WERE CO-AUTHORS OF THE STUDY, WHICH COMBED THROUGH 54 STUDIES AND REPORTS PUBLISHED SINCE 2012 THAT ESTIMATED THE WASTE OR SAVINGS FROM CHANGES IN PRACTICE AND POLICY.

BECAUSE AMERICAN HEALTH SPENDING IS SO HIGH — ALMOST 18 PERCENT OF THE ECONOMY AND OVER $10,000 PER PERSON PER YEAR — EVEN SMALL PERCENTAGES IN SAVINGS TRANSLATE INTO HUGE DOLLARS.

THE ESTIMATED WASTE IS AT LEAST $760 BILLION PER YEAR. THAT'S COMPARABLE TO GOVERNMENT SPENDING ON MEDICARE AND EXCEEDS NATIONAL MILITARY SPENDING, AS WELL AS TOTAL PRIMARY AND SECONDARY EDUCATION SPENDING.
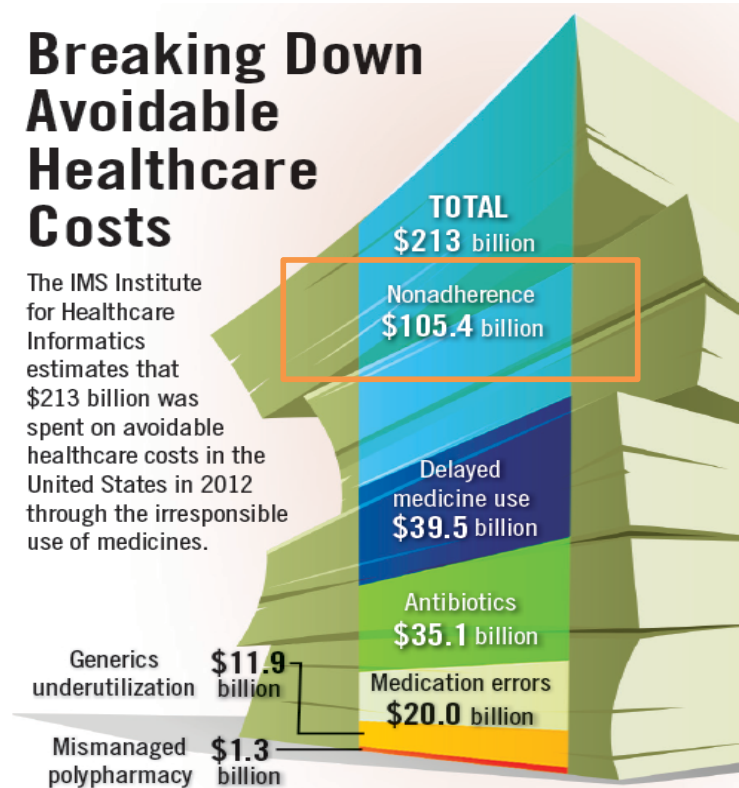
IF WE FOLLOWED THE EVIDENCE AVAILABLE, WE WOULD SAVE ABOUT $200 BILLION PER YEAR, ABOUT WHAT IS SPENT ON THE MEDICAL CARE FOR VETERANS, THE DEPARTMENT OF EDUCATION AND THE

Search + Patterns……

Costs of medication nonadherence
Additional annual cost of treatment for a nonadherent vs. an adherent patient

Source: Medication Adherence Leads To Lower Health Care Use And Costs Despite Increased Drug Spending, Health Affairs (2011)

http://viewer.zmags.com/publication/644753a2#/644753a2/25

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Breaking Down Avoidable Healthcare Costs

The IMS Institute for Healthcare Informatics estimates that $213 billion was spent on avoidable healthcare costs in the United States in 2012 through the irresponsible use of medicines.

TOTAL $213 billion

Nonadherence $105.4 billion

Delayed medicine use $39.5 billion

Antibiotics $35.1 billion

Generics underutilization $11.9 billion

Medication errors $20.0 billion
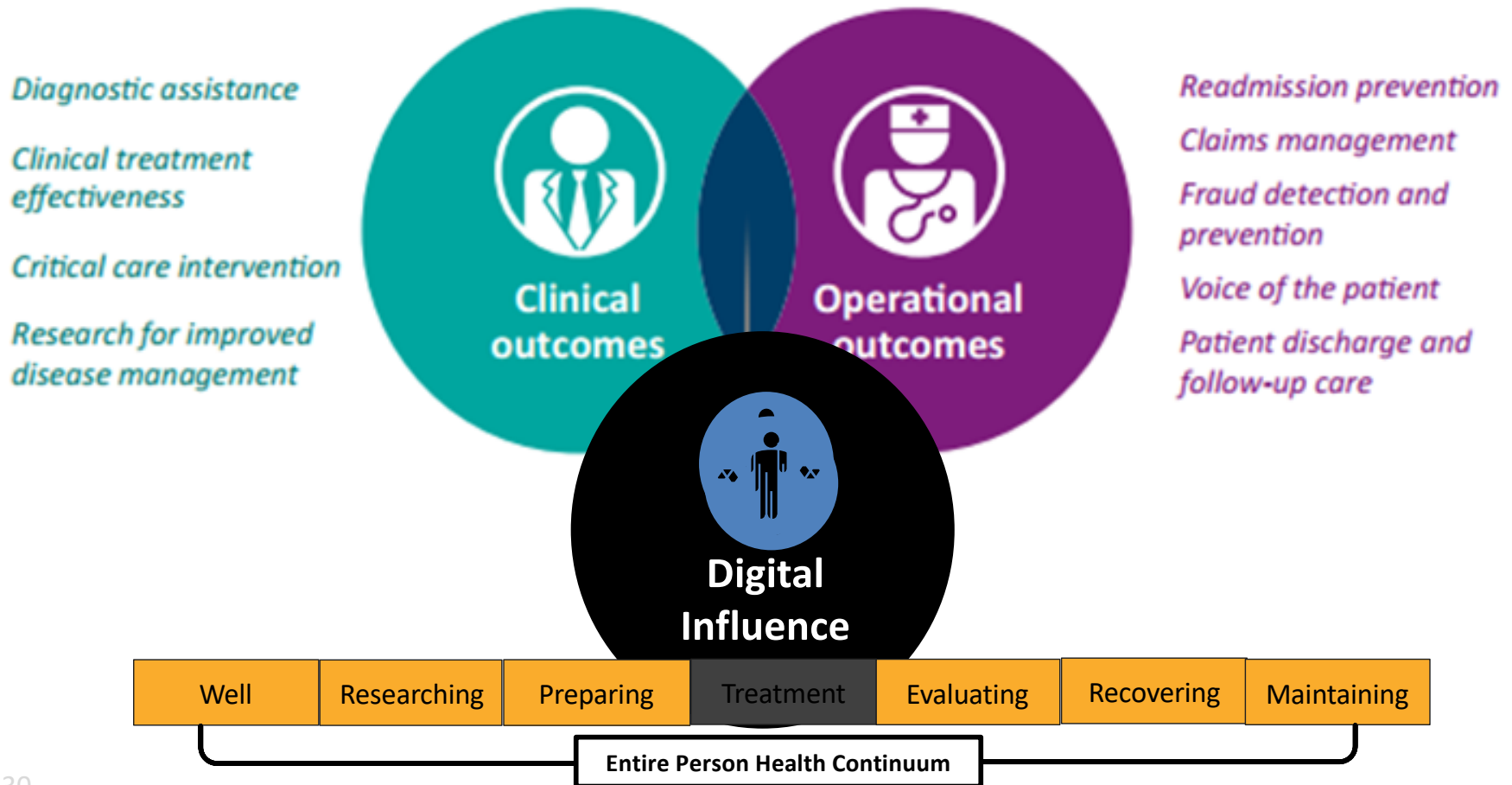
Mismanaged polypharmacy $1.3 billion

Source: Adapted from: IMS Institute for Healthcare Informatics. Avoidable costs in healthcare study. Available at www.imshealth.com/deployedfiles/imshealth/Global/Content/Corporate/IMS%20Institute/RUOM-2013/Avoidable_Costs_Infographic.pdf.

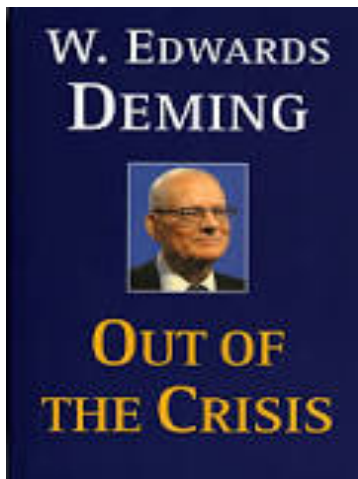# Competing Organizational and Financial Priorities

Managing Patient Outcomes

Diagnostic assistance

Clinical treatment effectiveness

Critical care intervention

Research for improved disease management

Clinical outcomes

Operational outcomes

Readmission prevention

Claims management

Fraud detection and prevention

Voice of the patient

Patient discharge and follow-up care

Digital Influence

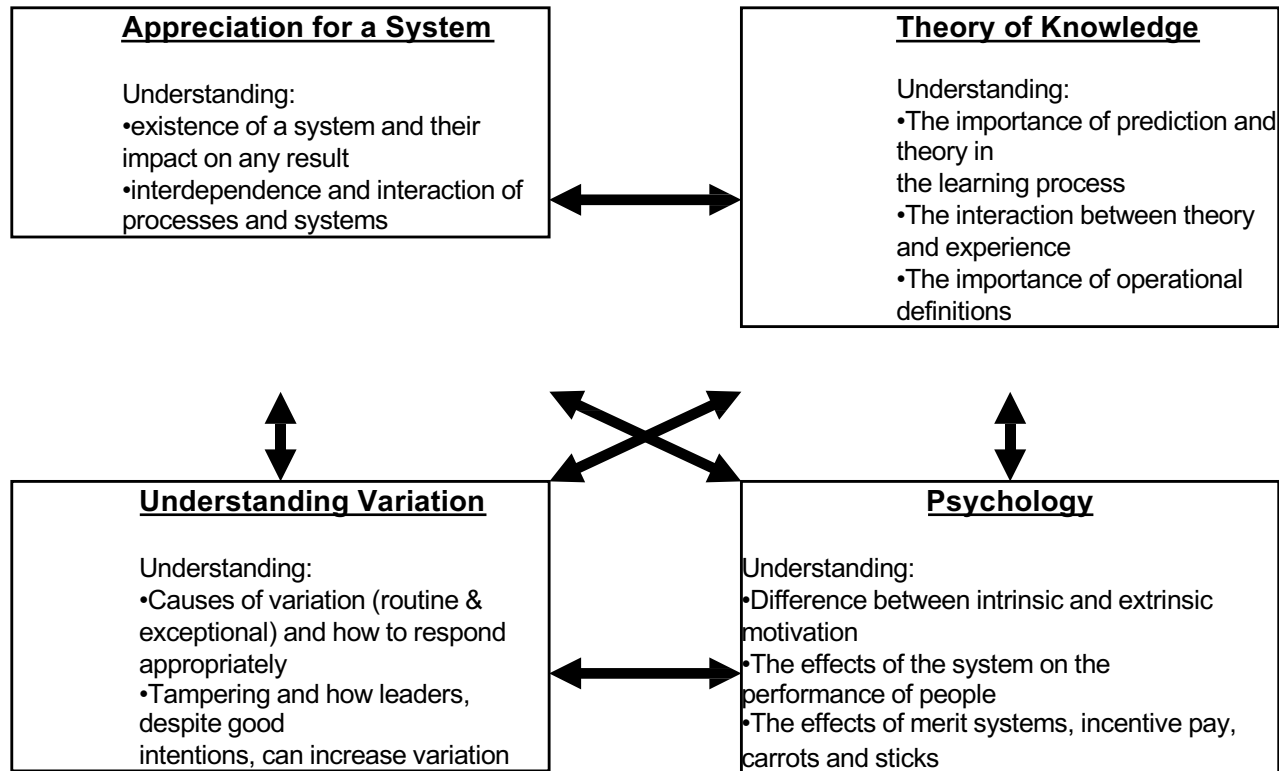| Well	Researching	Preparing	Treatment	Evaluating	Recovering	Maintaining

Entire Person Health Continuum

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Dr. W. Edwards Deming:
System of Profound Knowledge (and Learning)

- Appreciation of a complex social system

- Understanding Variation as the <u>main cause</u> for process, harm and outcome failures

- Theory of Change Knowledge

- Leadership Psychology

A System of Profound Knowledge

Appreciation for a System

Understanding:
- existence of a system and their impact on any result
- interdependence and interaction of processes and systems

Theory of Knowledge

Understanding:
- The importance of prediction and theory in the learning process
- The interaction between theory and experience
- The importance of operational definitions

Understanding Variation

Understanding:
- Causes of variation (routine & exceptional) and how to respond appropriately
- Tampering and how leaders, despite good intentions, can increase variation

Psychology

Understanding:
- Difference between intrinsic and extrinsic motivation
- The effects of the system on the performance of people
- The effects of merit systems, incentive pay, carrots and sticks

Source: W. Edwards Deming & Peter Scholtes

The Power of Human Factors

"If an error is possible, someone will make it. The designer must assume that all possible errors will occur and design so as to minimize the chance of the error in the first place, or its effects once it gets made"

Norman, The Design of Everyday Things, 2001

Powerful head of the Electronics Department DTU
Atomenergikomissionens Forsøgsanlæg Risø
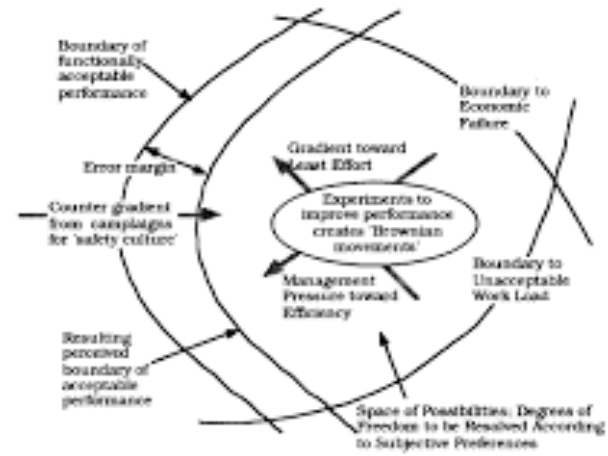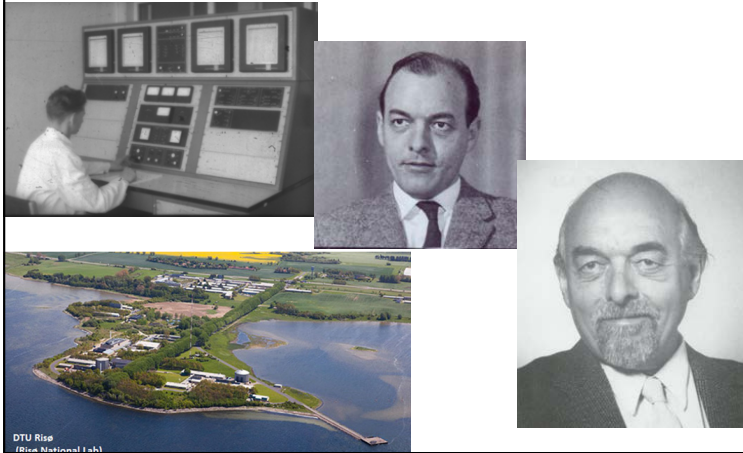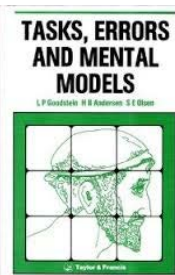**/ Risø National Laboratory**
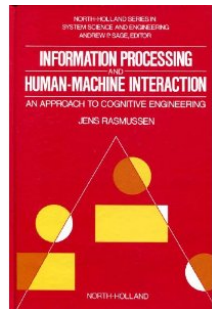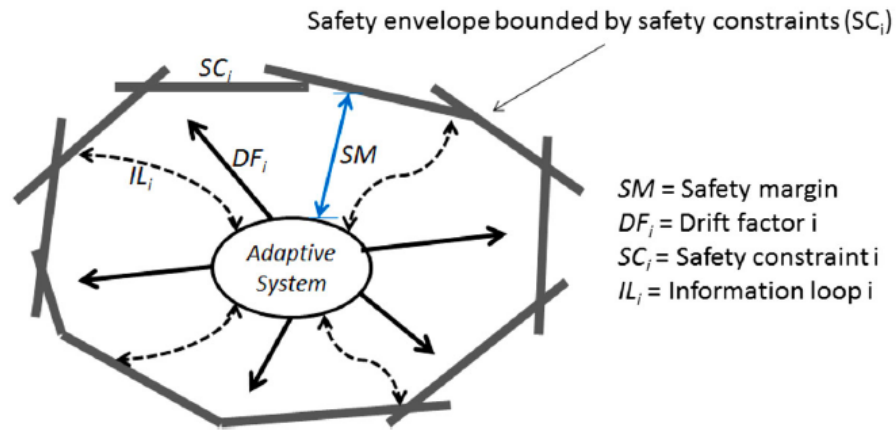

DTU Risø
(Risø National Lab)

Fig. 3. Under the presence of strong gradients behaviour will very likely migrate toward the boundary of acceptable performance.

INFORMATION PROCESSING AND HUMAN-MACHINE INTERACTION
AN APPROACH TO COGNITIVE ENGINEERING
JENS RASMUSSEN
NORTH-HOLLAND

TASKS, ERRORS AND MENTAL MODELS
L P Goodstein H B Andersen S E Olsen

NEW TECHNOLOGY AND HUMAN ERROR
Edited by JENS RASMUSSEN, KEITH DUNCAN and JACQUES LEPLAT

Cognitive Systems Engineering

Proactive Risk Management in a Dynamic Society

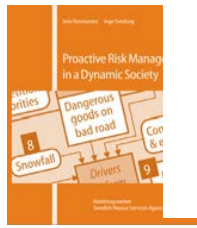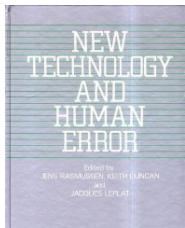Safety envelope bounded by safety constraints (SC$_i$)

SM = Safety margin
DF_i = Drift factor i
SC_i = Safety constraint i
IL_i = Information loop i

Figure 1. The safety of an adaptive system is bounded and controlled by safety constraints (inspired by [6, 7]).
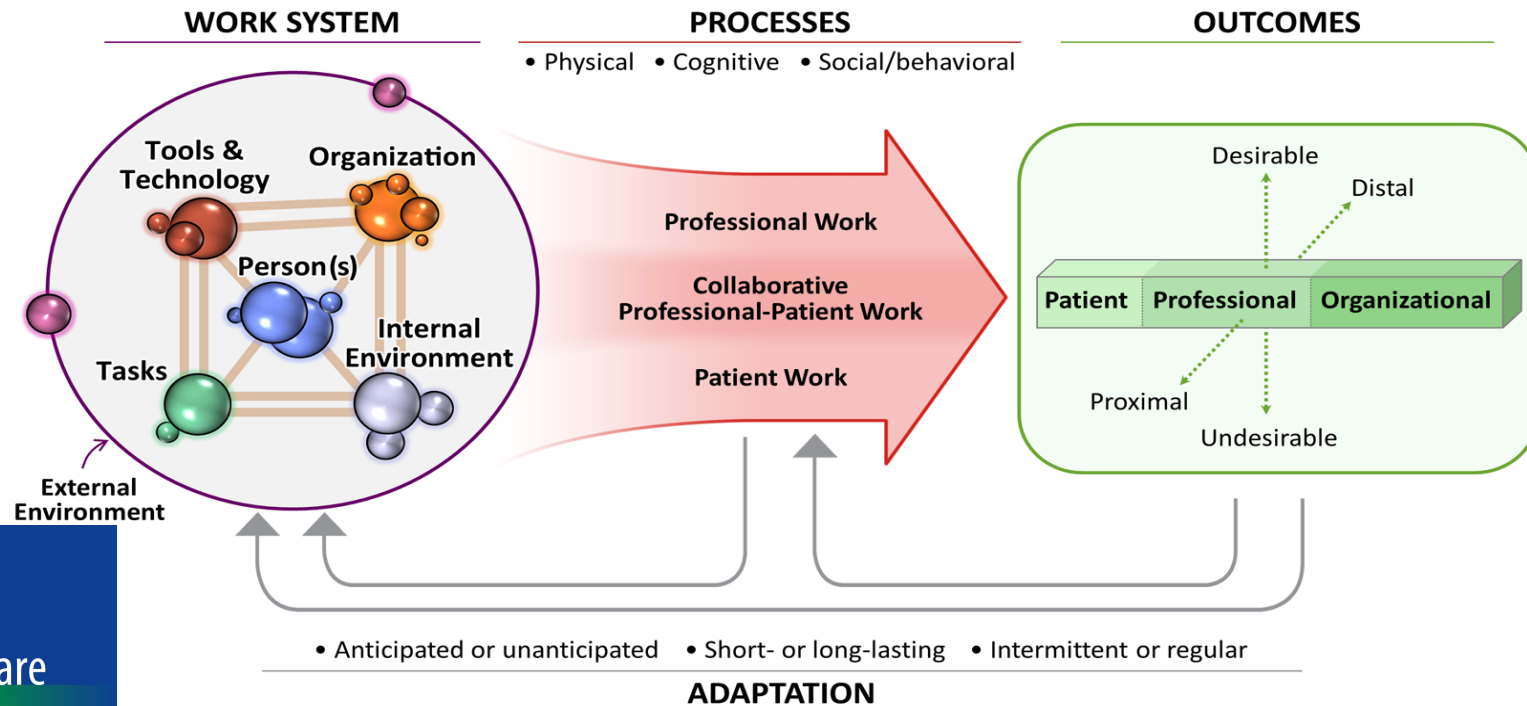
Healthcare Safety Management System

WORK SYSTEM

Tools & Technology
Organization
Person(s)
Internal Environment
Tasks
External Environment

PROCESSES
• Physical • Cognitive • Social/behavioral

Professional Work

Collaborative Professional-Patient Work

Patient Work

OUTCOMES

Desirable
Distal

Patient | Professional | Organizational

Proximal
Undesirable

• Anticipated or unanticipated • Short- or long-lasting • Intermittent or regular

ADAPTATION

re 1.
S 2.0 model.

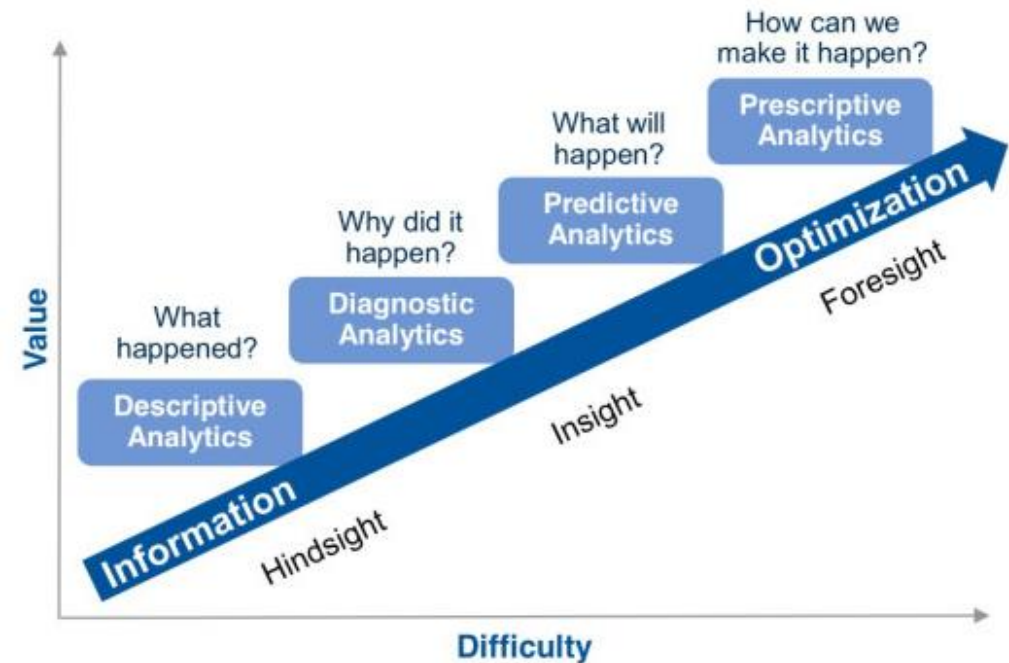SEIPS 2.0, after Carayon.

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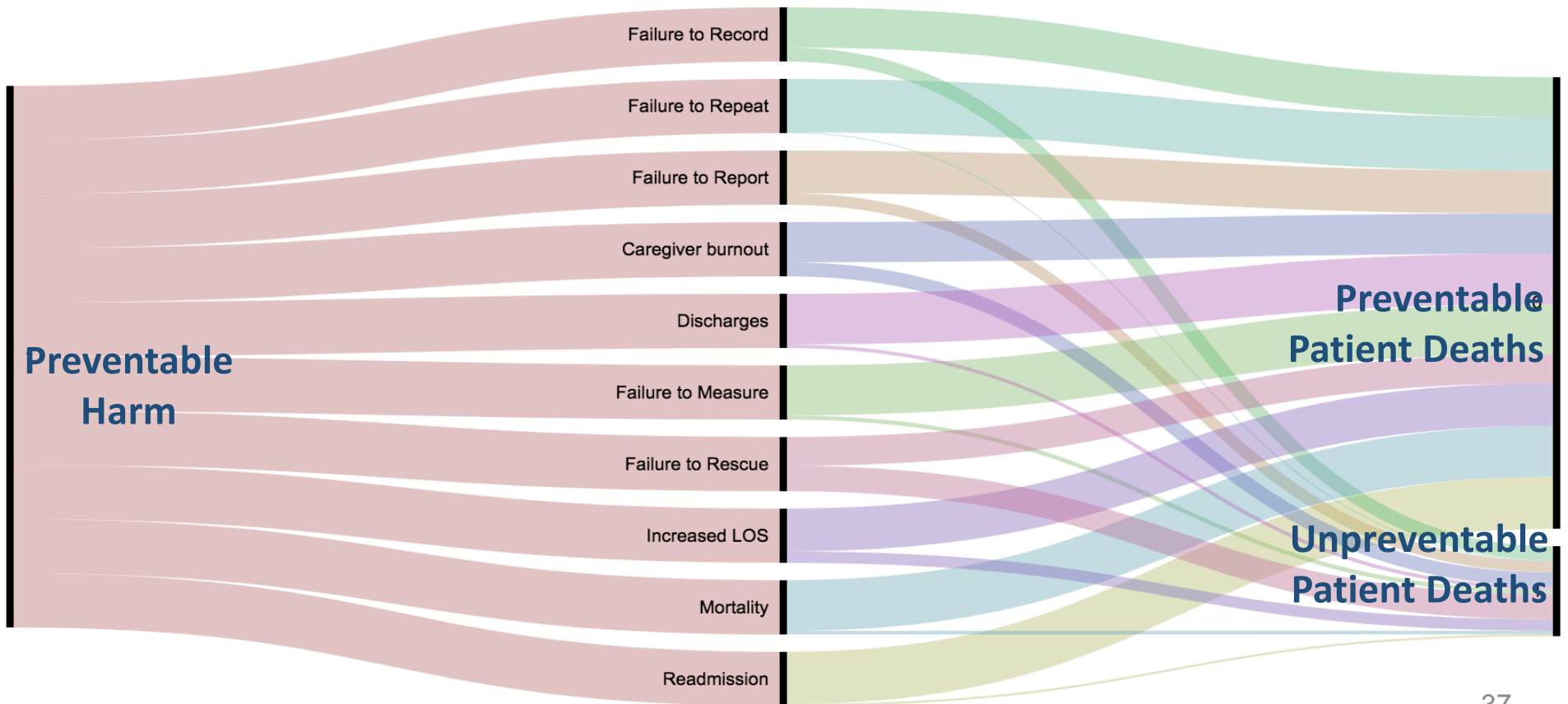# 3 Levels of Data Analytics

- _____
  - Standard types of report that describe current situations and problems

- _____
  - Simulation and modeling techniques that identify trends and portend outcomes of action taken
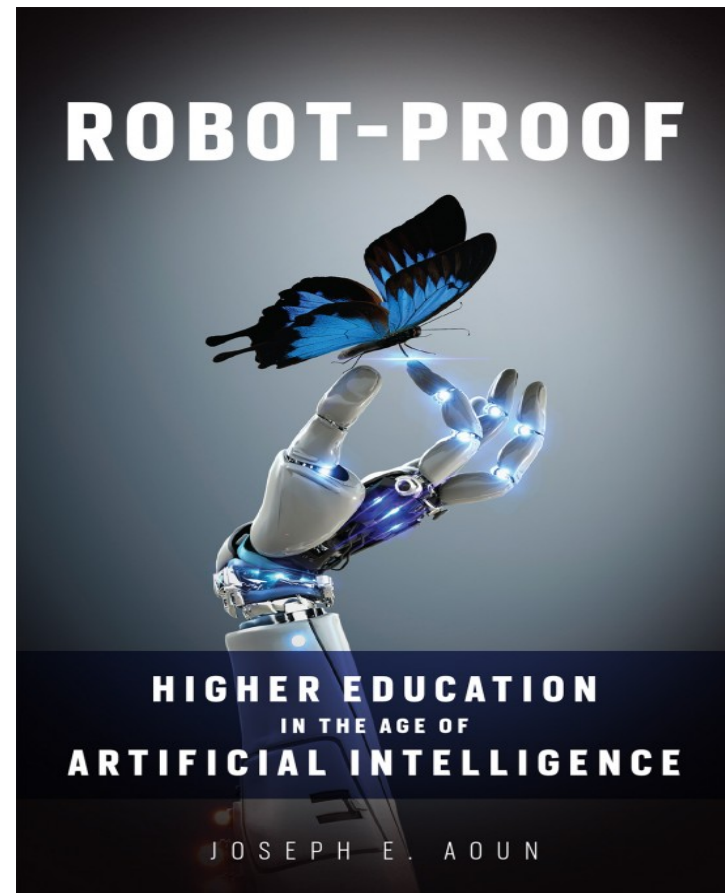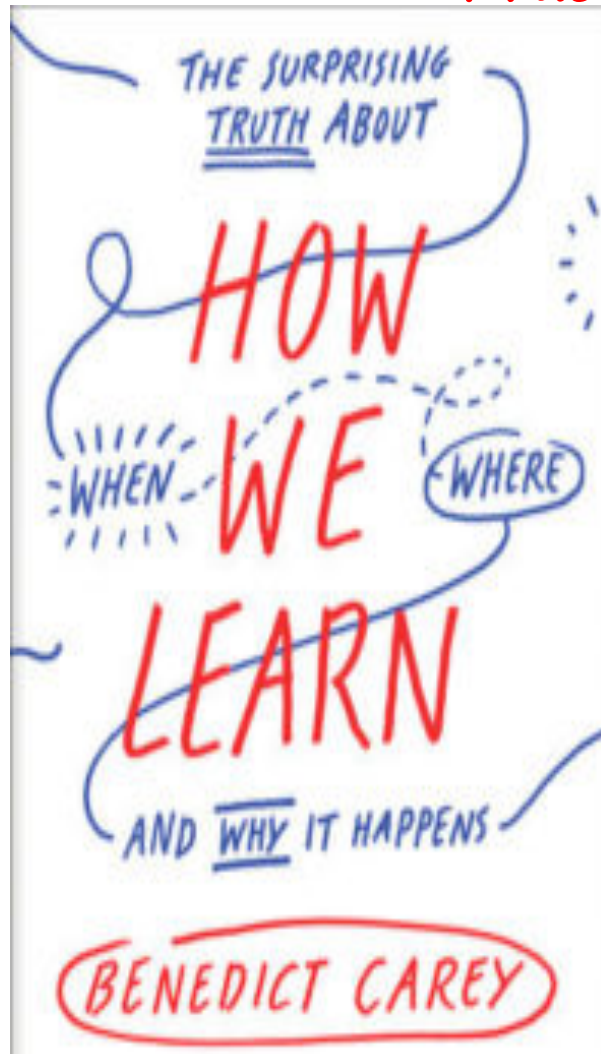
- _____
  - Optimizing clinical, financial, and other outcomes

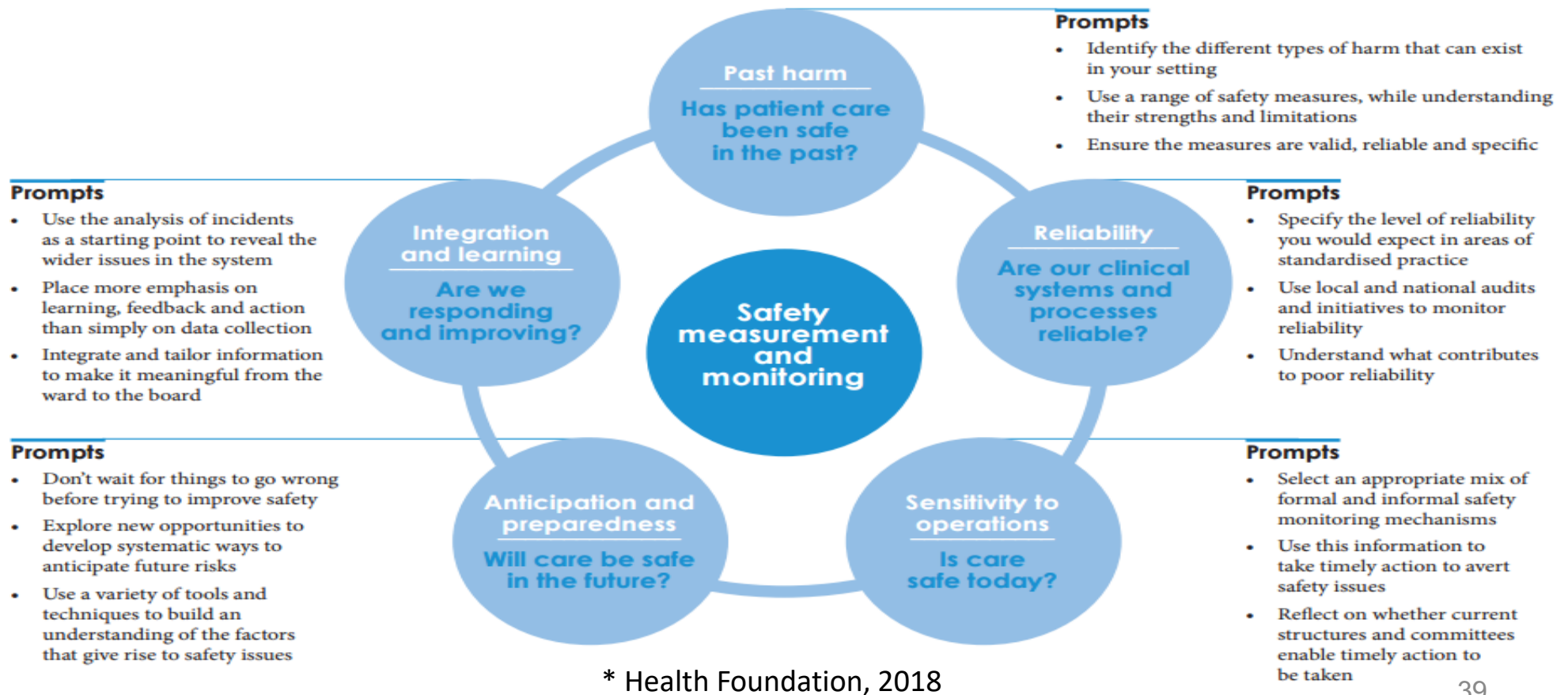# Preventable Harm & Error Causal Factors

Practical Pedagogy–How Can We Better Learn

THE SURPRISING TRUTH ABOUT
HOW WE LEARN
WHEN WHERE AND WHY IT HAPPENS
BENEDICT CAREY

ROBOT-PROOF

HIGHER EDUCATION
IN THE AGE OF
ARTIFICIAL INTELLIGENCE

JOSEPH E. AOUN

Safety and Learning Management System
A Framework for Measuring and Monitoring Safety*

Prompts
- Identify the different types of harm that can exist in your setting
- Use a range of safety measures, while understanding their strengths and limitations
- Ensure the measures are valid, reliable and specific

Past harm

Has patient care been safe in the past?

Prompts
- Use the analysis of incidents as a starting point to reveal the wider issues in the system
- Place more emphasis on learning, feedback and action than simply on data collection
- Integrate and tailor information to make it meaningful from the ward to the board

Integration and learning

Are we responding and improving?

Safety measurement and monitoring

Reliability

Are our clinical systems and processes reliable?

Prompts
- Specify the level of reliability you would expect in areas of standardised practice
- Use local and national audits and initiatives to monitor reliability
- Understand what contributes to poor reliability

Prompts
- Don't wait for things to go wrong before trying to improve safety
- Explore new opportunities to develop systematic ways to anticipate future risks
- Use a variety of tools and techniques to build an understanding of the factors that give rise to safety issues

Anticipation and preparedness

Will care be safe in the future?

Sensitivity to operations

Is care safe today?

Prompts
- Select an appropriate mix of formal and informal safety monitoring mechanisms
- Use this information to take timely action to avert safety issues
- Reflect on whether current structures and committees enable timely action to be taken

* Health Foundation, 2018

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MEDICINE AND SOCIETY

TEAMWORK — PART 2
Debra Malina, Ph.D., *Editor*

# Cursed by Knowledge — Building a Culture of Psychological Safety

Lisa Rosenbaum, M.D.

Feb l 2019

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Engage in Dialogue – Even Disagreement!

Dysfunction: Fear of Conflict

"When team members do not openly debate and disagree about important ideas, they often turn to back-channel personal attacks, which are far nastier and more harmful than any heated argument over issues." (pg 203)

Results

Accountability

Commitment

Fear of Conflict

Absence of trust
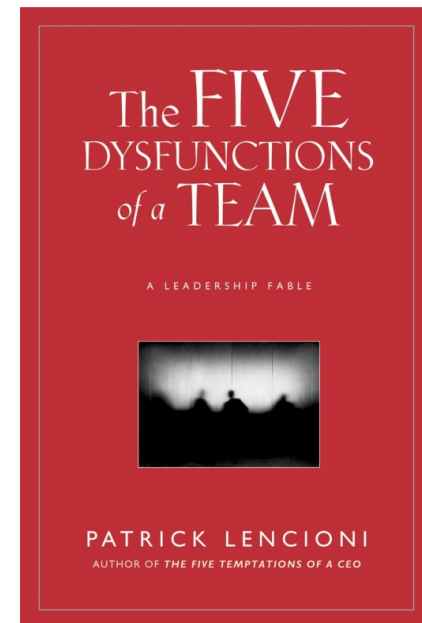
Association of Coworker Reports About Unprofessional Behavior by Surgeons With Surgical Complications in Their Patients

William O. Cooper, MD, MPH[1]; David A. Spain, MD[2]; Oscar Guillamondegui, MD, MPH[3]; et al

» Author Affiliations

Effective Leadership of Surgical Teams: A Mixed Methods Study of Surgeon Behaviors and Functions

Juliana L. Stone, MS,* Emma-Louise Aveling, PhD, Molly Frean, BA, Morgan C. Shields, MS, Cameron Wright, MD, Francesca Gino, PhD, Thoralf M. Sundt, MD, and Sara J. Singer, PhD

Department of Health Research and Policy, Harvard T. H. Chan School of Public Health, Boston, Massachusetts; Cambridge Centre for Health Services Research, University of Cambridge, Cambridge, United Kingdom; Health Care Management Department, The Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania; Institute for Behavioral Health, The Heller School for Social Policy and Management, Brandeis University, Waltham, Massachusetts; Department of Surgery, Massachusetts General Hospital, Boston, Massachusetts; and Negotiation, Organizations & Markets, Harvard Business School, Boston, Massachusetts

Background. The importance of effective team leadership for achieving surgical excellence is widely accepted, but we understand less about the behaviors that achieve this goal. We studied cardiac surgical teams to identify leadership behaviors that best support surgical teamwork.

Methods. We observed, surveyed, and interviewed cardiac surgical teams, including 7 surgeons and 116 team members, from September 2013 to April 2015. We documented 1,926 surgeon/team member interactions during 22 cases, coded them by behavior type and valence (ie, positive/negative/neutral), and characterized them by leadership function (conductor, elucidator, delegator, engagement facilitator, tone setter, being human, and safe space maker) to create a novel framework of surgical leadership derived from direct observation. We surveyed nonsurgeon team members about their perceptions of individual surgeon's leadership effectiveness on a 7-point Likert scale and correlated survey measures with individual surgeon profiles created by calculating percentage of behavior types, leader functions, and valence.
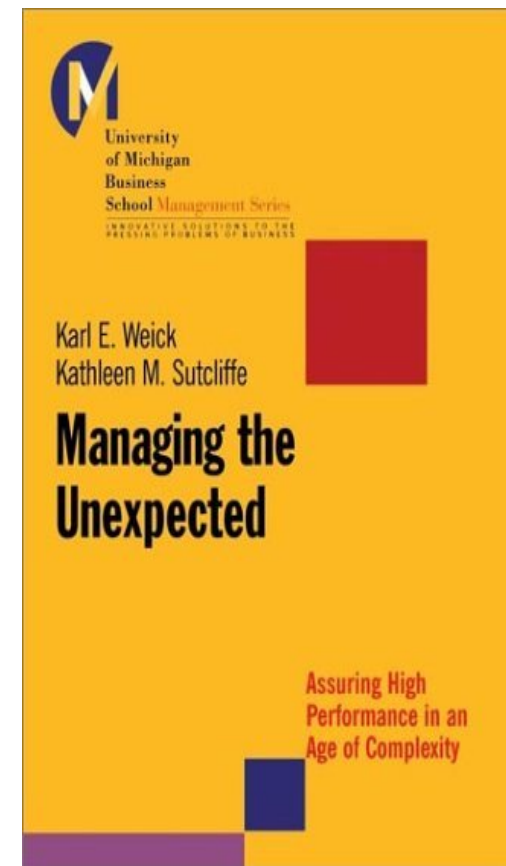
Results. Surgeon leadership was rated by nonsurgeons from 4.2 to 6.2 (mean, 5.4). Among the 33 types of behaviors observed, most interactions constituted elucidating (24%) and tone setting (20%). Overall, 66% of interactions (range, 43%–84%) were positive and 11% (range, 1%–45%) were negative. The percentage of positive and negative behaviors correlated strongly ($r = 0.85$ for positive and $r = 0.75$ for negative, $p < 0.05$) with nonsurgeon evaluations of leadership. Facilitating engagement related most positively ($r = 0.80$; $p = 0.03$) and negative forms of elucidating, ie, criticism, related most negatively ($r = -0.81$; $p = 0.03$).
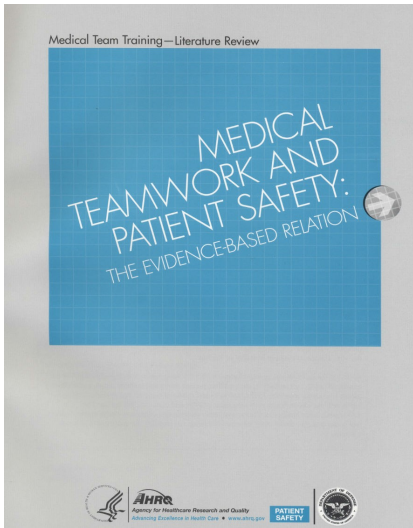
Conclusions. We identified 7 surgeon leadership functions and related behaviors that impact perceptions of leadership. These observations suggest actionable opportunities to improve team leadership behavior.
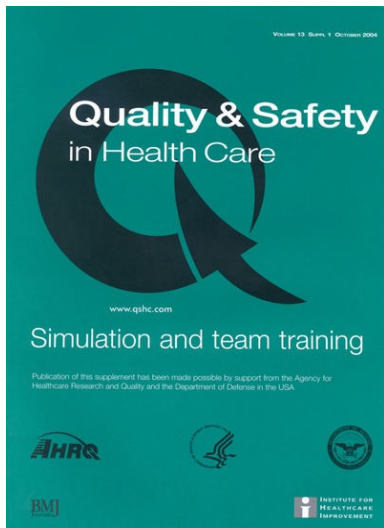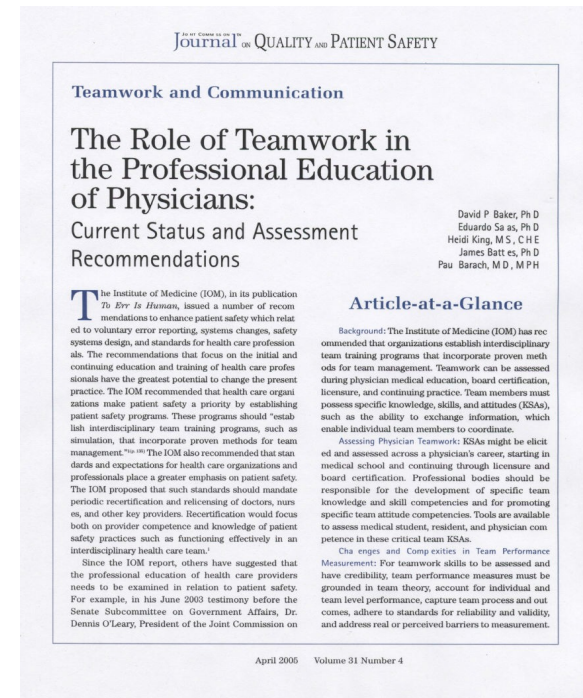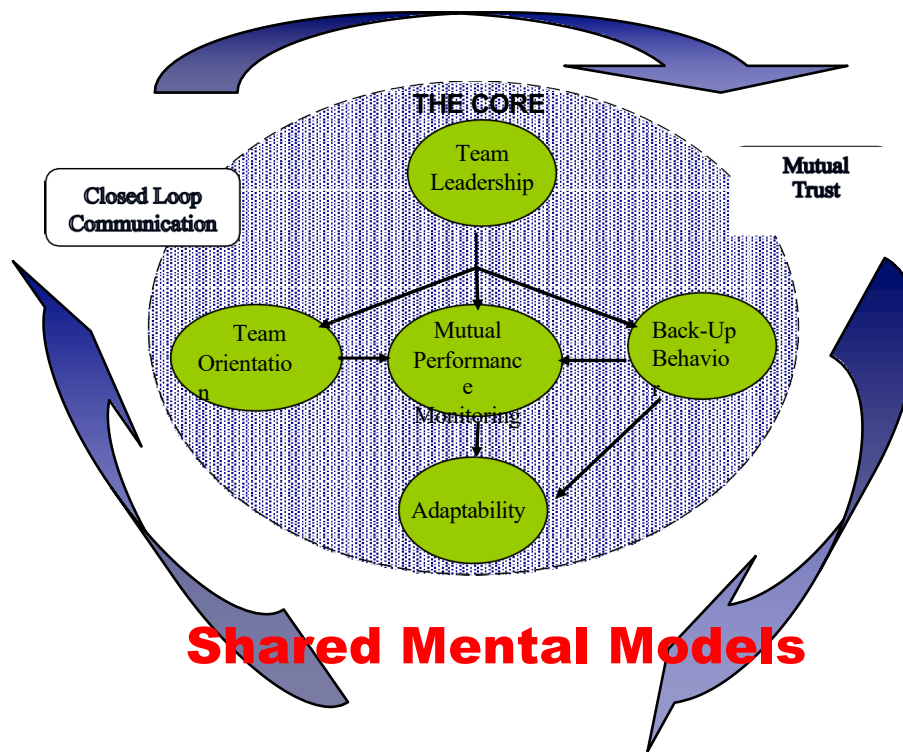
(Ann Thorac Surg 2017;■:■–■)

High Reliabilituy, Mindfulness and Safety Management in Healthcare

1. Preoccupation with failure

    Regarding small, inconsequential errors as a symptom that something is wrong; finding the half-event

2. Sensitivity to operations

    Paying attention to what's happening on the front line at the shop floor

3. Reluctance to simplify

    Encouraging diversity in experience, perspective, and opinion

4. Commitment to resilience

    Developing capabilities to detect, contain, and bounce-back from events that do occur

5. Deference to expertise

    Pushing decision making down to the person with the most related knowledge and expertise

University of Michigan Business School Management Series
INNOVATIVE SOLUTIONS TO THE PRESSING PROBLEMS OF BUSINESS

Karl E. Weick
Kathleen M. Sutcliffe

Managing the Unexpected

Assuring High Performance in an Age of Complexity

TeamSTEPPS Model of "Big 5" Teamwork

Baker, Salas, King, Battles, Barach, 2006; 2007; Barach and Cosman, 2015

Association Between Implementation of a Medical Team Training Program and Surgical Mortality

Julia Neily, RN, MS, MPH

Peter D. Mills, PhD, MS

Yinong Young-Xu, ScD, MA, MS

Brian T. Carney, MD

Priscilla West, MPH

David H. Berger, MD, MHCM

Lisa M. Mazzia, MD

Douglas E. Paull, MD

James P. Bagian, MD, PE

ADVERSE EVENTS RELATED TO surgery continue to occur despite the best efforts of clinicians.[1] Teamwork and effective communication are known determinates of surgical safety.[2-6] Previous efforts at demonstrating the efficacy of patient safety initiatives have been limited because of the inability to study a control group.[7] For example, the use of the World Health Organization Safe Surgery checklist has been evaluated, but its overall efficacy remains uncertain because no control group was studied to clearly demonstrate this instrument's effectiveness.[6]

The Veterans Health Administration (VHA) is the largest national in-

Context There is insufficient information about the effectiveness of medical team training on surgical outcomes. The Veterans Health Administration (VHA) implemented a formalized medical team training program for operating room personnel on a national level.

Objective To determine whether an association existed between the VHA Medical Team Training program and surgical outcomes.

Design, Setting, and Participants A retrospective health services study with a contemporaneous control group was conducted. Outcome data were obtained from the VHA Surgical Quality Improvement Program (VASQIP) and from structured interviews in fiscal years 2006 to 2008. The analysis included 182 409 sampled procedures from 108 VHA facilities that provided care to veterans. The VHA's nationwide training program required briefings and debriefings in the operating room and included checklists as an integral part of this process. The training included 2 months of preparation, a 1-day conference, and 1 year of quarterly coaching interviews
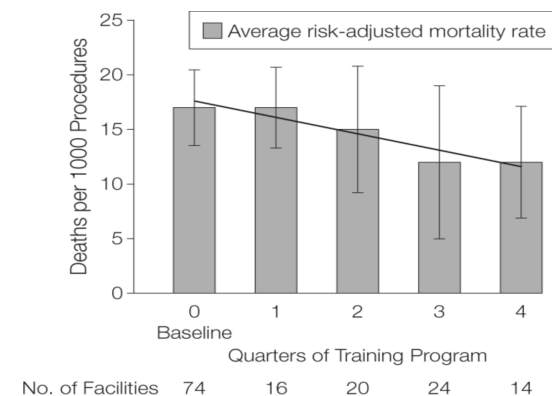
Main Outcome Measure The rate of change in the mortality rate 1 year after facilities enrolled in the training program compared with the year before and with non-training sites.
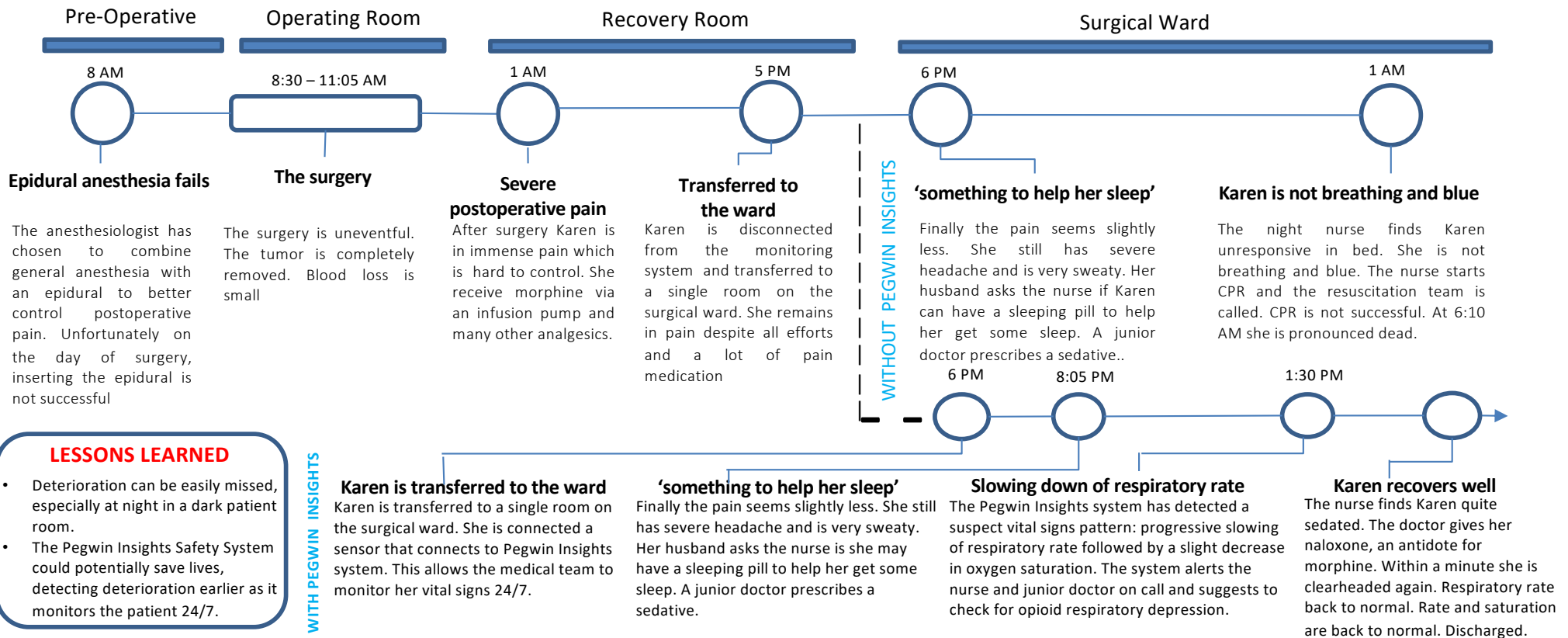
Results The 74 facilities in the training program experienced an 18% reduction in annual mortality (rate ratio [RR], 0.82; 95% confidence interval [CI], 0.76-0.91; P=.01) compared with a 7% decrease among the 34 facilities that had not yet undergone training (RR, 0.93; 95% CI, 0.80-1.06; P=.59). The risk-adjusted mortality rates at baseline were 17 per 1000 procedures per year for the trained facilities and 15 per 1000 procedures per year for the nontrained facilities. At the end of the study, the rates were 14 per 1000 procedures per year for both groups. Propensity matching of the trained and nontrained groups demonstrated that the decline in the risk-adjusted surgical mortality rate was about 50% greater in the training group (RR,1.49; 95% CI, 1.10-2.07; P=.01) than in the nontraining group. A dose-response relationship for additional quarters of the training program was also demonstrated: for every quarter of the training program, a reduction of 0.5 deaths per 1000 procedures occurred (95% CI, 0.2-1.0; P=.001).

TeamSTEPPS
"The 74 facilities in the training program experienced an 18% reduction in annual mortality (rate ratio [RR], 0.82; 95% confidence interval [CI], 0.76-0.91; P = .01) compared with a 7% decrease among the 34 facilities that had not yet undergone training (RR, 0.93; 95% CI, 0.80-1.06; P = .59)".

| No. of Facilities | 74 | 16 | 20 | 24 | 14 |

When a patient stops breathing ....

My name is Karen, I'm 36 years old. I work as a realtor. I was recently diagnosed with a painful benign kidney tumor. This is my story.

Pre-Operative

8 AM

Epidural anesthesia fails

The anesthesiologist has chosen to combine general anesthesia with an epidural to better control postoperative pain. Unfortunately on the day of surgery, inserting the epidural is not successful

Operating Room

8:30 – 11:05 AM

The surgery

The surgery is uneventful. The tumor is completely removed. Blood loss is small

Recovery Room

1 AM

Severe postoperative pain

After surgery Karen is in immense pain which is hard to control. She receive morphine via an infusion pump and many other analgesics.

5 PM

Transferred to the ward

Karen is disconnected from the monitoring system and transferred to a single room on the surgical ward. She remains in pain despite all efforts and a lot of pain medication

Surgical Ward

WITHOUT PEGWIN INSIGHTS

6 PM

'something to help her sleep'

Finally the pain seems slightly less. She still has severe headache and is very sweaty. Her husband asks the nurse if Karen can have a sleeping pill to help her get some sleep. A junior doctor prescribes a sedative..

1 AM

Karen is not breathing and blue

The night nurse finds Karen unresponsive in bed. She is not breathing and blue. The nurse starts CPR and the resuscitation team is called. CPR is not successful. At 6:10 AM she is pronounced dead.

WITH PEGWIN INSIGHTS

6 PM

Karen is transferred to the ward
Karen is transferred to a single room on the surgical ward. She is connected a sensor that connects to Pegwin Insights system. This allows the medical team to monitor her vital signs 24/7.

8:05 PM

'something to help her sleep'
Finally the pain seems slightly less. She still has severe headache and is very sweaty. Her husband asks the nurse is she may have a sleeping pill to help her get some sleep. A junior doctor prescribes a sedative.

Slowing down of respiratory rate
The Pegwin Insights system has detected a suspect vital signs pattern: progressive slowing of respiratory rate followed by a slight decrease in oxygen saturation. The system alerts the nurse and junior doctor on call and suggests to check for opioid respiratory depression.

1:30 PM

Karen recovers well
The nurse finds Karen quite sedated. The doctor gives her naloxone, an antidote for morphine. Within a minute she is clearheaded again. Respiratory rate back to normal. Rate and saturation are back to normal. Discharged.

LESSONS LEARNED

- Deterioration can be easily missed, especially at night in a dark patient room.
- The Pegwin Insights Safety System could potentially save lives, detecting deterioration earlier as it monitors the patient 24/7.

Why We Choose To Do What We Do

63% of preventable harm and death are attributable to a <u>failure to rescue</u> by a registered nurse or physician

(HealthGrades, Inc: April 2006).

70% of the postmortem examination of patient records shown evidence of postoperative deterioration within <u>eight hours</u>.

90% of solutions based on early warning scores (EWS) triggered alerts inducting "<u>alert fatigue</u>" due to lack of sensitivity and adaptability to a patient's variation and care location needs.

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Cost of Harm (CoH)

Harm Type Bayshore Medical Center CCN# 450097	Preventable Adverse Events (PAE) (Current CMS Reporting)	Added Cost per PAE (JAMA & HCUP)	Avg. Extended LOS (Days)	Total PAE Financial Impact
CLABSI: HAI 1	0	45814	5 - 20	$0
CAUTI: HAI 2	9	896	2 - 4	$8,064
SSI-Colon: HAI 3	3	20785	13	$62,355
SSI-Abdominal: HAI 4	3	20785	10	$62,355
MRSA: HAI 5	3	42300	12	$126,900
C.diff: HAI 6	49	112825	3 - 16	$552,965
Pressure sores: PSI-3	40	19632	1.95	$776,650
Collapsed lung due to medical treatment: PSI-6	29	15692	2.49	$448,052
Infections from a large venous catheter: PSI-7	14	38682	8.75	$536,502
Serious blood clots after surgery: PSI-12	57	40277	7.07	$2,278,486
Blood stream infection after surgery: PSI-13	12	48769	8.64	$588,564
A wound that splits open after surgery: PSI-14	4	48423	8.62	$189,198
Accidental cut or tear: PSI-15	95	25900	2.99	$2,464,289
Readmin hospital wide	319	13433	na	$4,282,655
Events	635			$12,377,035
Per year	256			$4,667,438

635 PAE's
CMS: 2013-15

$12M CoH

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Return on Investment (ROI)

- $4.6M/yr. CoH impact to Net Patient Operating Income
  - Implement Predictive analytics and HRO coaching
    - $0.33M investment per year
  - Reduce patient harm by 65% in 24 months
    - $3M improvement to income per year
- Simple ROI (yr. 3): Income Recovery / $ Invested
  - $9M/$1M = 9:1

BAYSHORE MEDICAL CENTER
NET PATIENT OPERATING INCOME $MILLIONS

$30		
$25		$28
$20	$19	
$15		
$10		
$5		
$0	$2	($2)
	2012 2013 2014 2015 2016	
($5)		
($10)	($10)	
($15)		

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Serious Preventable Complications and Deaths, TEXAS

PSI - 11 Postoperative Respiratory Failure Rate (Observed)*

Number of cases: 237,747

Number of Complications: 1,459

Observed Rate: 0.61%

Mean Charge per Case: $86,702

Potentially avoidable cost related to PSI 11 in state of Texas is USD $20.1 Billion.
***2016**

Sources:
1. https://www.medicare.gov/hospitalcompare/Data/Serious-Complications.html
2. https://dshs.texas.gov/thcic/publications/hospitals/Patient-Safety-Indicators/Patient-Safety-Indicators-With-Diagnosis-Present-on-Admission-(POA)-2016/

Serious Preventable Complications and Deaths, TEXAS

PSI - 04 Death Rate among Surgical Inpatients with Serious Treatable Conditions"

Number of cases: 20,260

Number of complications: 2,980

Observed rate: 14.71%

Mean charge per case: $261,348

Potentially avoidable cost related to PSI 04 in the State of Texas is USD $5.3 Billion

* 2016
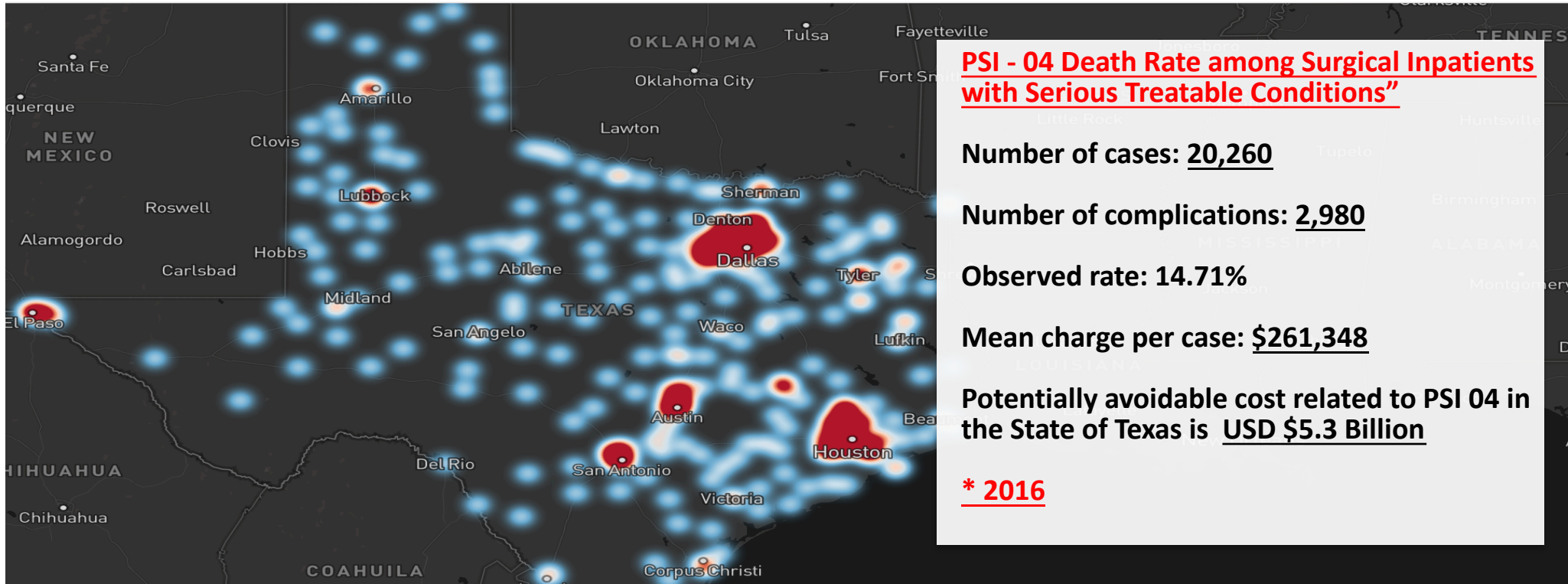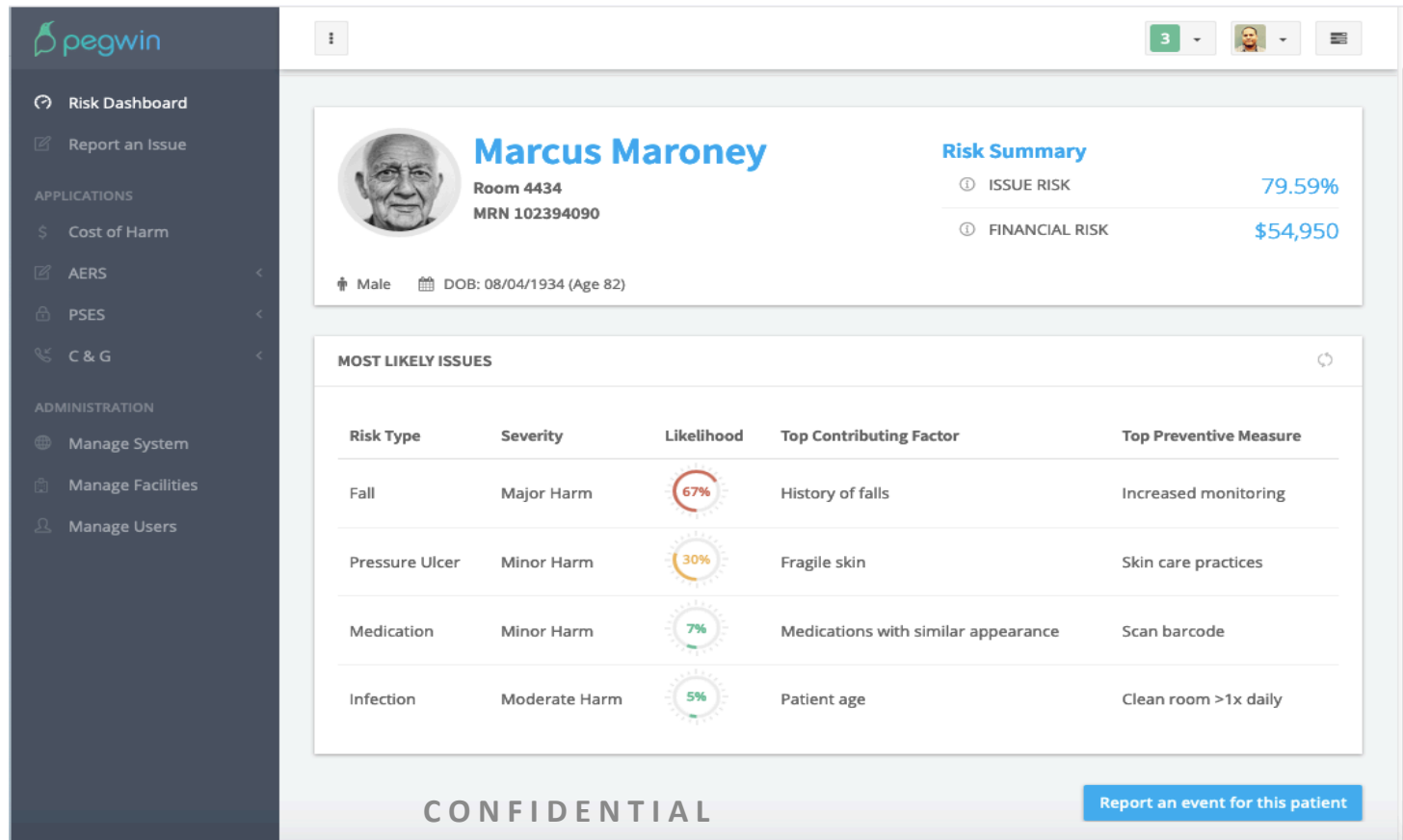
Sources:
1. https://www.medicare.gov/hospitalcompare/Data/Serious-Complications.html
2. https://dshs.texas.gov/thcic/publications/hospitals/Patient-Safety-Indicators/Patient-Safety-Indicators-With-Diagnosis-Present-on-Admission-(POA)-2016/

Learning Solutions can Make a Difference

- LEARNING tools and solutions to reduce Preventable Medical Harm in hospitals

- Based on applying and developing patient safety, human factors and systems engineering solutions.

- Using and surfacing near-miss, process and outcome data and integrating into ongoing operations.

- Eliminating harm from two leading causes: PSI-11 and PSI-04

Pegwin Insights Patient Risk Profile

The Product-Safety Management System

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The 3-Click Solution

pegwin
Patient Safety Innovation

Immediate Hospital Benefits:

- Pegwin's EZ-EHR 3-Click Solution can immediately save a 300-bed hospital 3,500 hours of billable clinician time filling out federally required reports on Preventable Medical Harm (20 minutes/report).

- That translates to more than $210,000 per year in additional billable revenue.

Ancillary Benefit:

- Reports are immediately labeled as Patient Safety Work Product (PSWP) and kept in a Patient Safety Evaluation System (PSES) for analysis and action.

- Information in the Common Formats PSES can be sent to the PSO and cannot be discovered during lawsuits.[*]

Ongoing Benefits:

- Data collected is analyzed and used to avoid future Preventable Medical Harm.

- Much more data is collected from incidences, near misses and unsafe conditions.

- Hospitals can address contributing factors.

[*]Included in Patient Safety and Quality Improvement Act of 2005

Office of HHS National Coordinator (ONC) recognized Pegwin as the winner of two awards in *two* ONC prize challenges (2016, 2018)
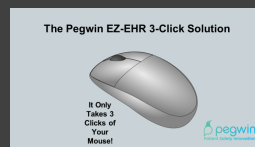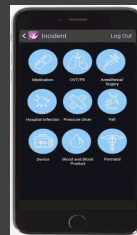
1. Patient Safety Reporting Challenge

2. EZ - EHR Issue Reporting Challenge

Value Story-Case Study in Texas

AF Ablation Complication rate 6.29% in patients undergoing AF ablation
(Deshmukh A, et al. Circulation. 2013;128:2104–2112)

Without complications	Postoperative Respiratory Failure (PS-11)	Failure To Rescue (PSI-04)

① Ablation
Procedure performed in an outpatient setting (typically in a procedure lab in a hospital)

② Physician Submits Claim to Medicare or Private Insurer

Claim documentation includes:

ICD-10-CM codes
Diagnosis: I48.91

CPT code 93656 intracardiac catheter ablation by pulmonary vein isolation for the treatment of AF

③ Facility Submits Claim

Claim documentation includes:

ICD-10-CM codes as above

CPT code 93656 intracardiac catheter ablation by pulmonary vein isolation for the treatment of AF

④ Insurer Processes Claim and Reimburses Physician and Hospital

Medicare Payment Levels:

Physician (from Physician Fee Schedule): $1,153.49

Hospital (APC 8000 for cardiac electrophysiologic evaluation and ablation composite): $13,115.06

Private insurer reimbursement levels may be higher

Revenue at risk without Pegwin

Annual Number of Avoidable cases 3,427

Lost Revenue
3,427 x $ 56.6K per patient
@$ 194 Million Dollar

Additional Revenue at risk without Pegwin

Annual Number of Avoidable cases 186

Lost Revenue
186 x $ 142K per patient
@$ 26.4 Million Dollar

MS-DRG 273,274 AVG COST $16.22K	AVG COST $ 56.6K	AVG COST $142K

Sources:
1. https://dshs.texas.gov/thcic/publications/hospitals/Patient-Safety-Indicators/Patient-Safety-Indicators-With-Diagnosis-Present-on-Admission-(POA)-2016/
2. https://europe.medtronic.com/content/dam/medtronic-com/01_crhf/afs/pdfs/201406308eEN_CathAblation_Coding_Reimburse_Gd_p5_FINAL_091218.pdf
3. https://www.ahajournals.org/doi/10.1161/CIRCULATIONAHA.113.003862

CONFIDENTIAL

Previous Studies and Results (Retrospective)

METHODS:

- The preliminary study performed on >15M randomized observations (SMART DST2; SMART STU3;
- Dataset: MIT-Harvard Data Consortium, Beth Israel and Boston Children Hospitals) showed completeness, computability, and accuracy of the raw data sources (FHIR).

RESULTS:

- Cross-validated (70/30) AI-Driven model demonstrated good discrimination for unplanned ICU Admission - AUC 0.90; 95% CI, 0.76-0.94) and performed as well, or better than the current models (C statistic ranges: 0.56–0.74) .
- The model calibration across different risk categories showed a close association of predicted and observed outcomes (PSI11; PSI04)
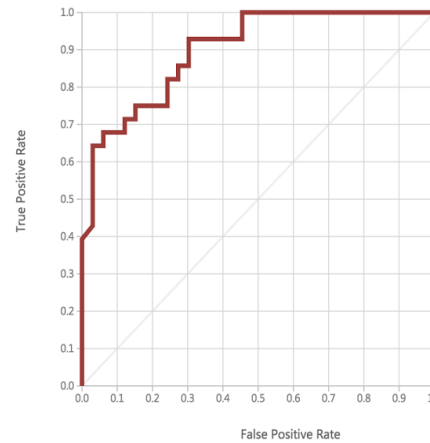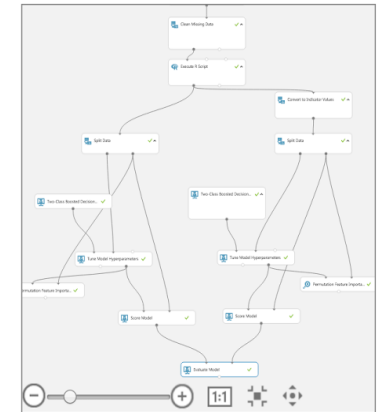
		Accuracy	Precision	Threshold	AUC
True Positive	False Negative	0.820	0.947	0.65	0.900
18	10				
False Positive	True Negative	Recall	F1 Score		
1	32	0.643	0.766		
Positive Label	Negative Label				
1	0				

Score Bin	Positive Examples	Negative Examples	Fraction Above Threshold	Accuracy	F1 Score	Precision	Recall	Negative Precision	Negative Recall	Cumulative AUC
(0.900,1.000]	14	1	0.246	0.754	0.651	0.933	0.500	0.696	0.970	0.012
(0.800,0.900]	3	0	0.295	0.803	0.739	0.944	0.607	0.744	0.970	0.012
(0.700,0.800]	0	0	0.295	0.803	0.739	0.944	0.607	0.744	0.970	0.012

Data citations:
- http://dx.doi.org/10.13026/C2XW26
- http://dx.doi.org/10.1155/2014/781670

Continuous Health Data Monitoring in Opioids Induced Respiratory Depression in Post Operative Patients

Primarily focused on patients:

- All admissions
- In risk meeting OSA criteria
- Likely to result FTR indicators
- Likely to result in a RRT being called.
- likely to be readmitted within 30 days

Clinical Drivers:

- Pneumonia
- Sepsis
- Cardiac Arrest
- Respiratory Distress
- Pulmonary embolism
- DVT

Advanced Data-Driven Rapid Response System

QUALITY & SAFETY MANAGEMENT LIMB

ADMIN LIMB

Rapid Responsive System
Lee, A; Bishop, G; Hillman, KM; Daffurn, K (April 1995)

PROSPECTIVE COHORT

HL7 → Data in Motion

FHIR

Raw Data [HIS]

RETROSPECTIVE COHORT

ETL → Data at Rest

CSV

Data factory: move data, orchestrate, schedule and monitor of data pipes.

Data Ingest: Event Hubs, TMP Storage, HD Insight

Tidy data

Analyze, Validation, Performance Evaluation

Artifacts Publish FTR02-04

Visualize high risk patients

Administration Oversees All functions. Proactive intervention

AFFERENT LIMB

Anomaly Detection

Urgent unmet patient need → Event Detection → Trigger

EFFERENT LIMB

MET / RRT / CCO

Crisis Resolved
Yes / No

Specialized Resources

Data Transformation

Data Acquisition Point FTR02-04

Continuous Learning

Real Time identification of the patients with early signs of clinical deterioration on non intensive care units

Post-efficacy monitoring of Patient Data for further case management, utilization reviews, research, etc.

pegwin

Conclusions

Why Transformation Efforts Fail?

- Lack of *urgency* (complacency)-HCA Burning platform?
- Failure to create a powerful *coalition*
- Failure to create a compelling *vision*
  - Competing visions (money vs. safety; frontline vs. leadership)
- Failure to *communicate* the vision clearly
- Failure to *remove obstacles*
- Failure to achieve *early wins*
- Failure to *anchor change* in the culture
- Declaring *victory* too soon

AN ACTION PLAN FROM THE WORLD'S
FOREMOST EXPERT ON BUSINESS LEADERSHIP

Leading Change

John P. Kotter

HARVARD BUSINESS SCHOOL PRESS

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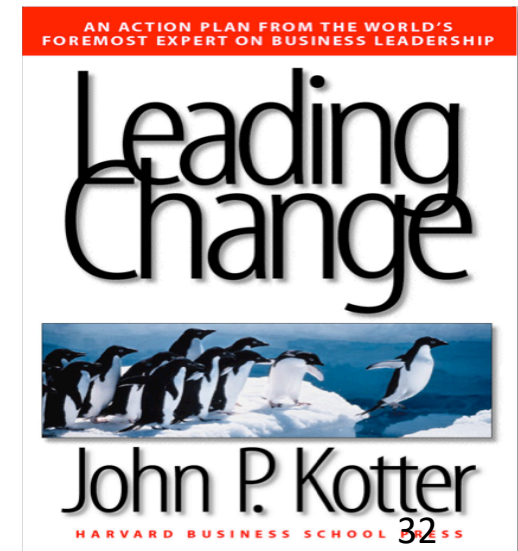
STAT

Medical devices for pain, other conditions have caused more than 80,000 deaths since 2008

By Associated Press

November 25, 2018

After having a spinal cord stimulator implanted in his back in 2014, 45-year-old Jim Taft West Columbia, S.C., is now virtually paralyzed, a prisoner in his own bed, barely able to get to the bathroom by himself.

COLUMBIA, South Carolina — Desperate for relief after years of agony, Jim Taft listened intently as his pain management doctor described a medical device that could change his life.

The Ethical Code of Hammurabi
Babylonian code of law 1754 BC

Taylor & Francis
Taylor & Francis Group

Check for updates

DECLARATION

The Seoul Declaration: A Manifesto for Ethical Medical Technology*

Preamble

Intersection of medicine, humanity and technology

It is often held that technology itself is incapable of possessing moral or ethical qualities, since "technology" is merely tool making.[1] But many clinicians and researchers believe that each piece of healthcare technology is endowed with affordances that can impact and challenge ethical values and commitments all the time. The technology's "values" and artificial intelligence are embedded in the devices and implements by those that design them, and those that decide how it must be made, marketed and used. This is at the heart of the moral challenges surrounding the use of medical devices, AI and information technology.

We recognize that unsafe medical technology and avoidable patient harm represent a serious challenge to health care service delivery globally. The significant level of preventable human suffering, the considerable strain on health system finances, and the loss of trust by patients and society in health systems and in their governments is of great concern. The recent related reports around unsanctioned gene editing of embryos, biased AI data algorithms, and the Food and Drug Administration (FDA) and CE flawed certifications of devices often based on false or incomplete information provided by the vendors, raises many legitimate and ethical questions about medical device oversight systems. These reports extend from vaginal meshes to hip replacements to surgical endoscopes and more, make it seem that the oversight mechanisms are bent too far toward making it easier for industry rather than making protection of public health the primary goal.[2,3] The International Consortium of Investigative Journalists reported that "Health authorities across the globe have failed to protect millions of patients from poorly tested implants that can damage organs, deliver errant shocks to the heart, rot bones and poison blood, spew overdoses of opioids and cause other needless harm."[4]

Sadly, technology companies do not police themselves nor learn in a systematic and transparent manner and often only do the minimum of what the legislation demands. Recent reports suggest that the FDA granted medical device makers special "exemptions" creating a vast and hidden repository of reports on device-related injuries and malfunctions hidden from doctors and from public view.[5] Since 2016, at least 1.1 million incidents have flowed into this internal "alternative summary reporting" repository including deaths, serious injury and malfunction reports for about 100 medical devices, many implanted in patients or used in countless surgeries including minimally invasive and robotic-assisted. For example, the FDA has just alerted clinicians about an increasing number of medical device reports (MDRs) associated with the use of surgical staplers for internal use and implantable surgical staples reporting from 41,000 individual MDRs including 366 deaths, more than 9000 serious injuries, and more than 32,000 malfunctions. These reports speak to a profound crisis of public confidence in how medical devices and AI technologies are regulated.

New AI technologies and automation now entering health care as outlined in the MITAT AI special issue 2019 how to best raise questions about the downsides of all the automation, voice our concerns constructively, design more thoughtful technology assessments and experiments done under real world conditions, and demand more transparency about financial conflicts of interest and device failures during the development, marketing and post marketing surveillance periods. Patient safety isn't just a matter of the technical risk, it is also about the public perception of risk. The recent Boeing Max 737 suggest that as with aviation, in AI and widespread automation acceptance depend on the public trusting the industry and in some cases that requires us to be extra cautious. Ultimately, regulators and policy makers will force upon medicine a more rigid and onerous risk avoidance accountability if we do not appreciate and actively address the highly coupled intersection of medicine, humanity and technology.

The goal of the *Seoul Declaration: A Manifesto for Ethical Medical Technology* is to be a clarion call for the ethical, research and policy issues that surround the development and implementation of new medical and AI technologies. We mean to not scare anyone from promoting and implementing new technologies based on sound human factors design that promotes patient safety and can improve service delivery systems, at all levels of health care and in all health care settings. We believe there is a global and urgent need for a robust public debate to address the trade-offs of automation vs safety

Presented and signed during iSMIT 2018 at grand wakerhill Seoul, November 10, 2018 (Figure 1)
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Shaping the environment for Staff and Management engagement and loyalty
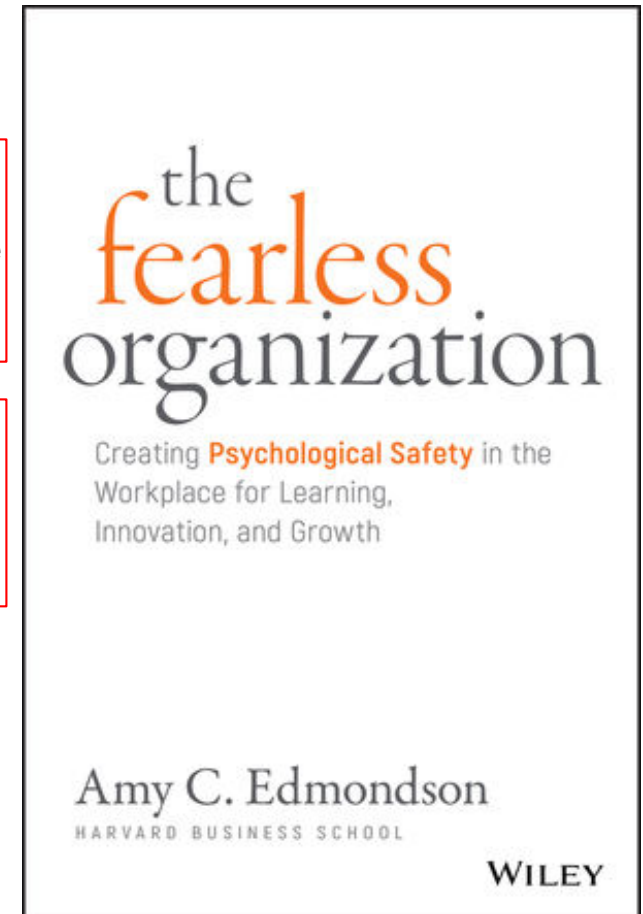
Accountability

Safety

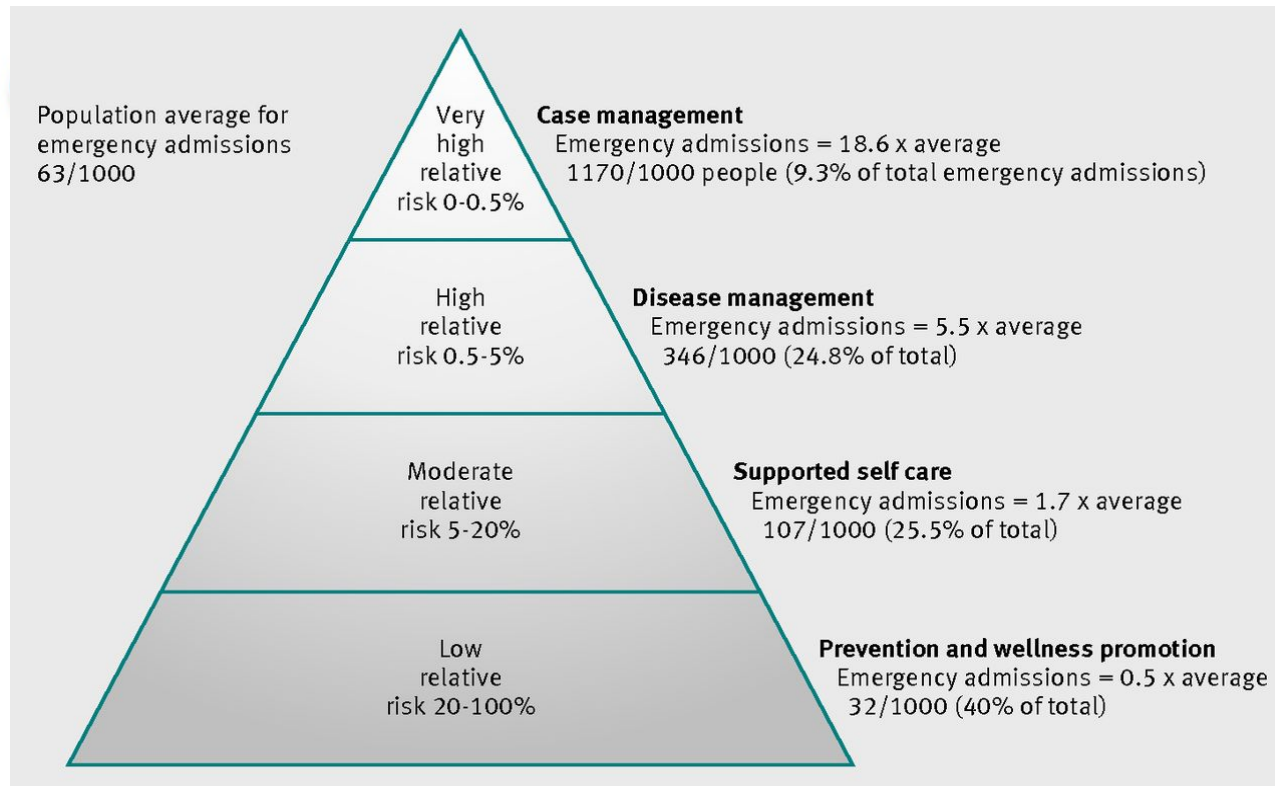| | Employees really enjoy working with one another but don't feel particularly challenged. | Here the focus is on collaboration and learning in the service of high-performance outcomes. |
| Employees tend to be apathetic and spend their time jockeying for position. | People fear to offer tentative ideas, try new things, or ask colleagues for help. |

the
fearless
organization

Creating **Psychological Safety** in the
Workplace for Learning,
Innovation, and Growth

Amy C. Edmondson
HARVARD BUSINESS SCHOOL

WILEY

"To call in the *statistician after the experiment* is done may be no more than asking him to perform a *post-mortem examination*: s/he *may be* able to say what the experiment died of."

Ronald Fisher, Cambridge U, 1938

Trust, Transparency,Relationships & Risk Modeling

Hospital Readmission Risk

Population average for emergency admissions 63/1000

Very high relative risk 0-0.5%
Case management
Emergency admissions = 18.6 x average
1170/1000 people (9.3% of total emergency admissions)

High relative risk 0.5-5%
Disease management
Emergency admissions = 5.5 x average
346/1000 (24.8% of total)

Moderate relative risk 5-20%
Supported self care
Emergency admissions = 1.7 x average
107/1000 (25.5% of total)

Low relative risk 20-100%
Prevention and wellness promotion
Emergency admissions = 0.5 x average
32/1000 (40% of total)

The Power of Patients/Consumers:
Strategic and Personalized Outreach

AFFECT

PLAN
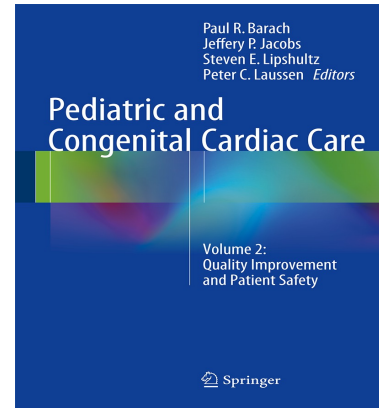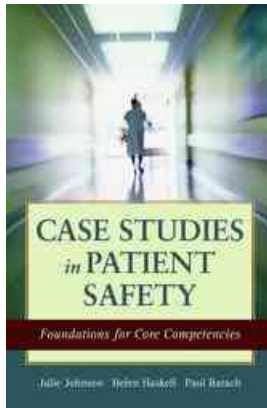
PREDICT

Hospital Staff Perspective
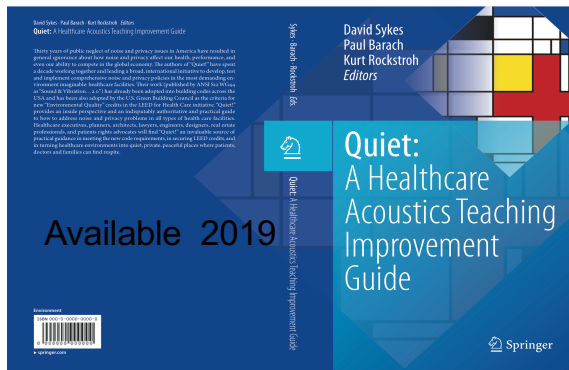
Market Disruptions are Shifting Risk
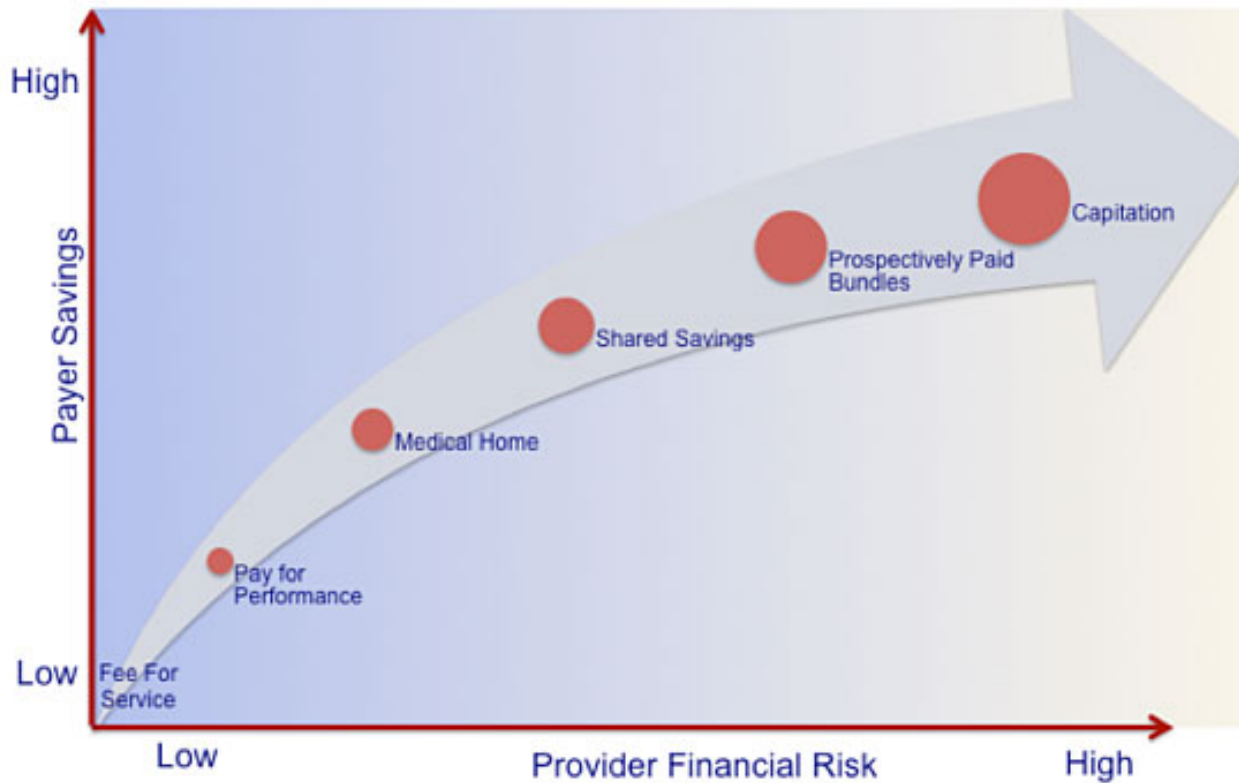
- Irrespective of the payment model, hospitals will increasingly be evaluated and paid for by what occurs "Beyond the Four Walls"

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Conclusions

- We must create care physical and organizational environments that support trust, patient and provider's needs to support professional and respectful interactions.
- Engaging clinicians, patients and the community in the design and operational process remains <u>the biggest obstacle</u> in addressing the growing implementation gap in providing cost effective and reliable care.
- Information analytics design affects the design of how people work, and what processes, systems and technologies they will require to support the functioning of the work environment ("Culture").
- Challenging individuals without also engaging their values and their overall care environment is not sustainable.
- Culture Eats Strategy"—Peter Drucker

Case Studies in Patient Safety: Foundations for Core Competencies
Julie Johnson · Helen Haskell · Paul Barach

Paul R. Barach
Jeffery P. Jacobs
Steven E. Lipshultz
Peter C. Laussen *Editors*

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Pediatric and Congenital Cardiac Care

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