ADVANCING SAFETY, QUALITY AND LEARNING WITH ELECTRONIC HEALTH RECORDS

Jonathan B. Perlin, MD, PhD, MSHA, MACP, FACMI
President and CEO
The Joint Commission Enterprise

1 December 2023

Joint Commission International

1

Agenda

1. Setting the Stage
2. JCI, NQF, and Singapore MOH Collaboration
3. From the EHR to Connected Care: Infrastructure
4. Learning Healthcare / Evidence-Based Decision-Making
5. Q & A

Joint Commission International

2

Singapore Healthcare: Much for the World to Admire !!!

Great Policy Successes
Paul 't Hart (ed.), Mallory Compton (ed.)

Search in this book

Contents

- Front Matter
- 1 How to 'See' Great Policy Successes: A Field Guide to Spotting Policy Successes in the Wild
- 2 Brazil's *Bolsa Família* Programme
- **3 The Remarkable Healthcare Performance in Singapore**
  - Introduction

CHAPTER

3 The Remarkable Healthcare Performance in Singapore

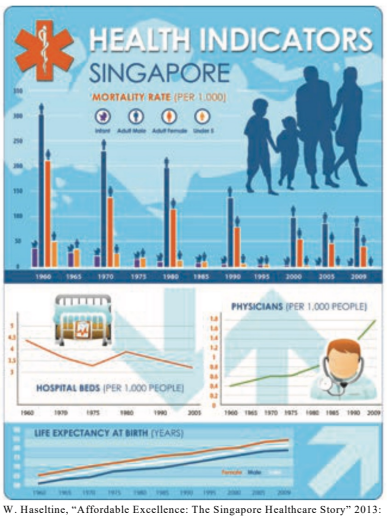
M. Ramesh, Azad Singh Bali

https://doi.org/10.1093/oso/9780198843719.003.0003 Pages 42–62
Published: September 2019

PDF | Split View | Annotate | Cite | Permissions | Share

Abstract

Singapore's healthcare system ranks among the best in the world in terms of infant mortality rate, longevity, disability adjusted years, and so on. What is most remarkable, however, is that it achieved these fine outcomes at less than half the costs in comparable countries. The achievement of high healthcare outcomes at low costs is what constitutes 'success' in the case of Singapore. While the factors underlying the success are wide-ranging, a lot of the credit must be attributed to the government's policy. In this chapter, the evolution of the policy measures since Independence will be tracked, along with their impact on improving healthcare services while containing costs. The measures have evolved with epidemiological and technological shifts as well as the rising expectations of a more prosperous and contestable society. The future continuation of the salutary trajectory will depend on the technical merits of the policy measures in the face of changing circumstances as much as their



W. Haseltine, "Affordable Excellence: The Singapore Healthcare Story" 2013: Brookings Institution Press, Washington, DC.

3

Worldwide Challenges in Quality & Safety

- Airline Safety: > 99.999999
- Airline Baggage Handling: > 99.999
- B-Blocker p STEMI: 99%
- Immunization: 55 – 94%
- MD Hand Hygiene in ICU: 3 – 40%

		10^{-1}		10^{-2}		10^{-3}		10^{-4}		10^{-5}	10^{-6}
σ	0σ	1σ		2σ	3 σ		4 σ		5 σ		6 σ
DPMO	933K	691K		309K	66.8K		6.2K		233		3.4
%	7	31		69	93.3		99.4		99.98		99.99

Frequency of Failures Occurring

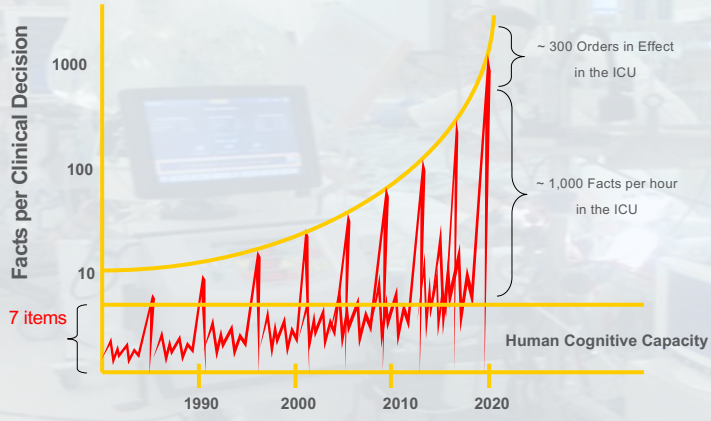
4

Decision-making is Difficult for Complex Patients . . .

5

Why Do We Need Real-Time Decision Support ?

Data Volume Exceeds Human Cognitive Capacity*



*William Stead, IOM, 8 October 2007, Growth in facts affecting provider decisions versus human cognitive capacity

The Joint Commission

6

Why Do We Need Real-Time Decision Support ?

Factorial (!) Relationship:
The Number of Combinations of Variables . . .

7! = ???
7! = 1 x 2 x 3 x 4 x 5 x 6 x 7 = 5,040
1, 2, 6, 24, 120, 720

1,300! = ???
1,300! = 3.159519021 E+3485

The Joint Commission

7

Agenda

1. Setting the Stage
2. JCI, NQF, and Singapore MOH Collaboration
3. From the EHR to Connected Care: Infrastructure
4. Learning Healthcare / Evidence-Based Decision-Making
5. Q & A

Joint Commission International

8

The Joint Commission Enterprise

Leading Global, Not-for-profit, Healthcare Organization Dedicated To Advancing Patient Safety And Quality Care

The Joint Commission

Joint Commission Resources

Joint Commission International

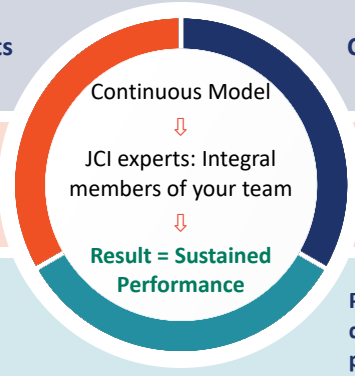
NATIONAL QUALITY FORUM

Joint Commission International

9

Evolving JCI Accreditation Program

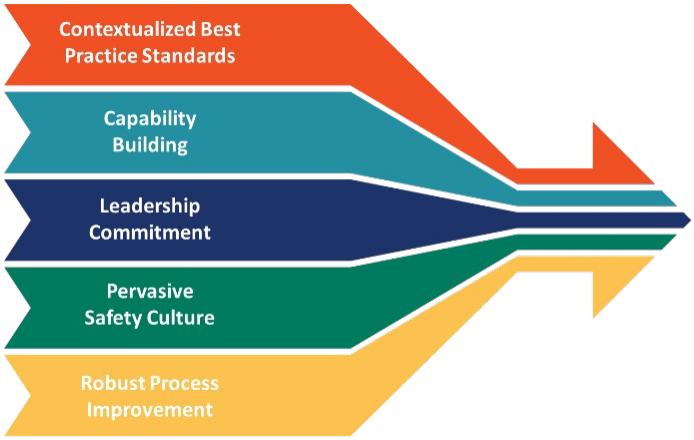
Current Accreditation Program	Future Accreditation Program
Episodic engagements	Continuous engagement
Survey readiness focus	Focus on quality at all times
Transactional relationship	Partnership – Coaching, data driven insights, best practices sharing



Joint Commission International

10

Ensure Safer Systems Program | JCI-MOH Partnership



Zero Harm

PROJECT COMMITMENT

5 Year Collaboration with JCI 2021 - 2026

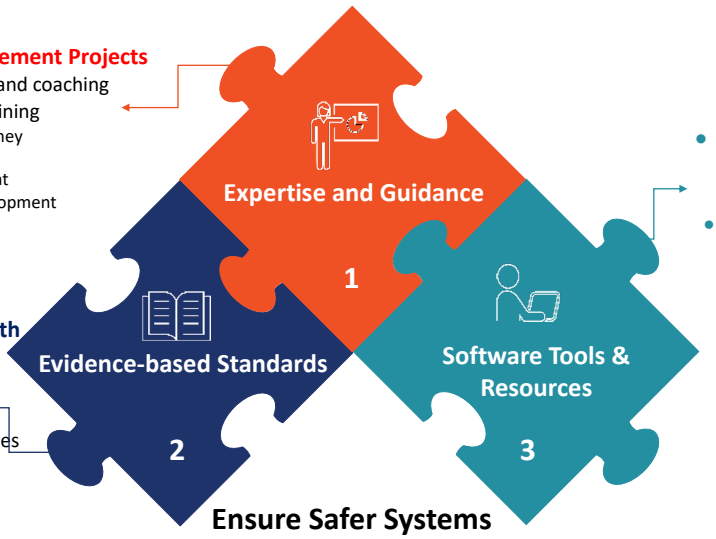
Joint Commission International

11

Ensure Safer Systems Program | JCI-MOH Partnership

Supporting Singapore MOH Journey To Zero Patient Harm . .

- **Focused Quality Improvement Projects**
  - Ongoing assessments and coaching
  - Capability building/training
    - High Reliability journey
    - Leadership
    - Change management
    - Safety culture development



- **JCI AMP Tracer for ongoing self-assessment and compliance**
  - Real-time system-wide data analytics and intelligence

- **Following Singapore Health Systems lead to adapt JCI worldwide standards**
  - Implementation and Integration into daily practices

Ensure Safer Systems (ESS) Program

Joint Commission International

12

TJC National Quality Forum & Singapore MOH Project

Helping To drive Value Based Performance

MOH Request:

- Assess current state of MOH Quality and Performance Management Systems
- Provide strategic advice and recommendations
- Areas of focus include:
  - Financing structure
  - Incentive structures
  - Performance measurement framework
  - Cluster-level accountability and performance
  - Healthier SG initiatives
  - Data and data systems required

Joint Commission International

13

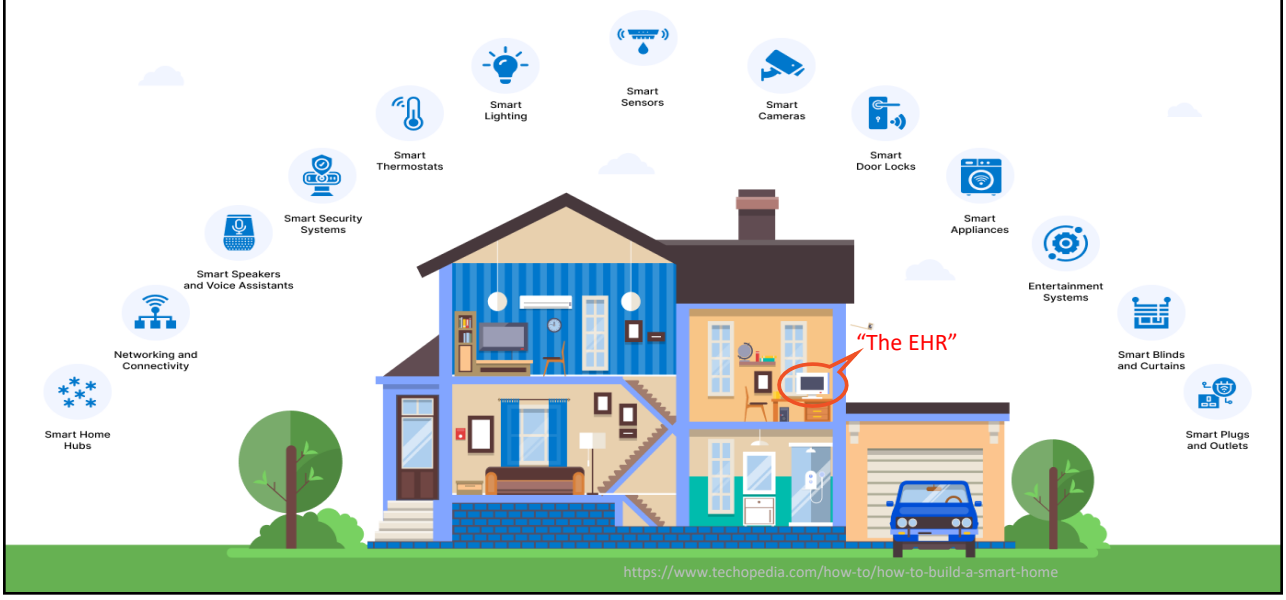
Agenda

1. Setting the Stage
2. JCI, NQF, and Singapore MOH Collaboration
3. From the EHR to Connected Care: Infrastructure
4. Learning Healthcare / Evidence-Based Decision-Making
5. A Framework for High Performance
6. Q & A

Joint Commission International

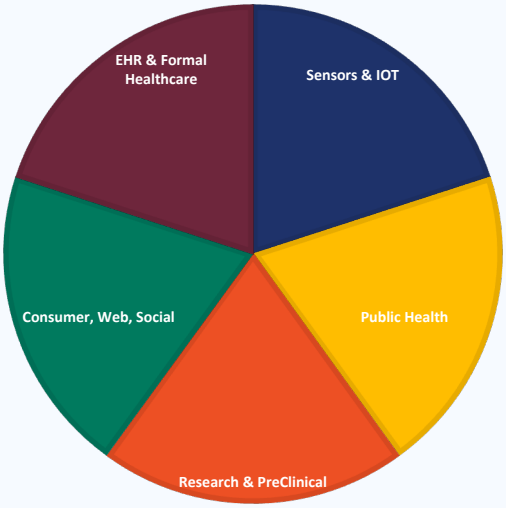
14

EHR is to Connected Health as a Computer is to a Smart House



15

From the EHR to Connected Care



The Joint Commission

16

The EHR & "Formal" Healthcare

The NEHR receives and consolidates key health summary (not doctor's notes) from various healthcare institutions and national registries into a holistic health record

- Patient demographics
- Admission and visit history
- Discharge summaries
- Laboratory test results
- Radiology results
- Medication history
- History of surgeries or procedures
- Allergies and adverse drug reactions

https://www.synapxe.sg/healthtech/national-programmes/national-electronic-health-record-nehr

The Joint Commission

17

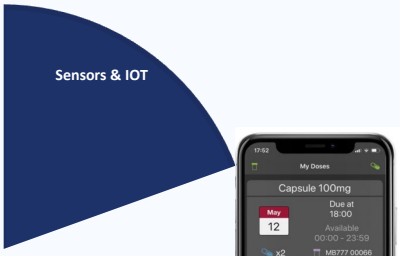
Sensors & the "Internet-of-Things" (IOT)

Increasingly, health data from sensors can be accumulated by smart devices

- Smart Phones & watches (transmit PROMs)
- Exercise equipment & Fitness apps/devices

But also, currently novel sources

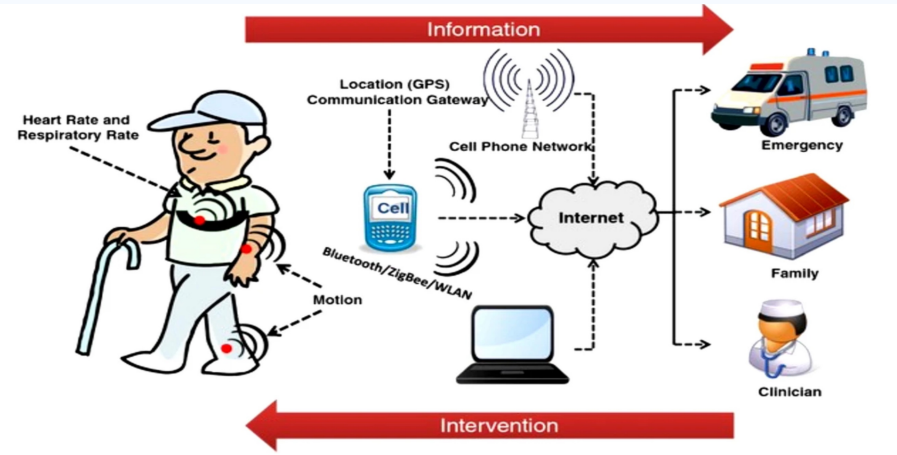
- Smart refrigerators
- Smart pill bottles



The Joint Commission

18

Sensing Data in the Healthcare Ecosystem



Smith, A.A., Li, R. & Tse, Z.T.H. Reshaping healthcare with wearable biosensors. *Sci Rep* **13**, 4998 (2023). https://doi.org/10.1038/s41598-022-26951-z

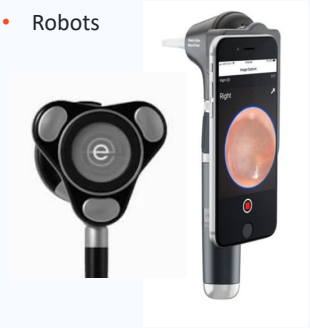
The Joint Commission

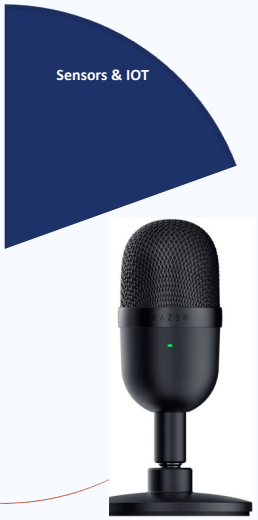
19

Sensors in the Practice Environment

And, from the instruments used clinically in medical practice . . .

- Stethoscopes
- Otoscopes & Ophthalmoscopes
- Ambient Awareness
- Robots

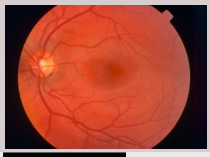
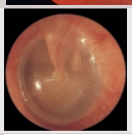
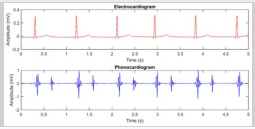




The Joint Commission

20

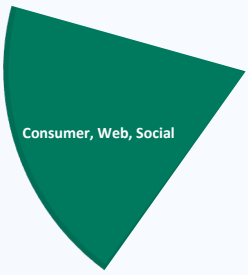
The Self-Generating Electronic Health Record

Patient:	Tan, Alex M.	
Eye Exam	Both eyes were visualized by ophthalmoscope with normal findings. No cupping, nicks, hemorrhages, or plaques.	
Ear Exam	Both ears were visualized by otoscope with normal findings. No bulging or erythema noted.	
Cardiac Exam	Heart and carotids were auscultated. Regular rate, rhythm. No murmurs, gallops or rubs noted.	

The Joint Commission

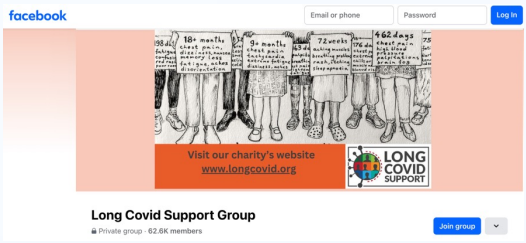
21

Consumer, Web & Social "Health Data"



Consumer and online activities lead a trail of health-related data

- Internet searches for health conditions
- Affinity cards for grocery stores and pharmacies tightly associate purchase history with individuals or families
- Social network feeds

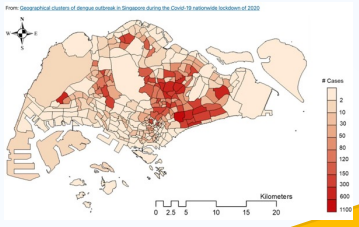


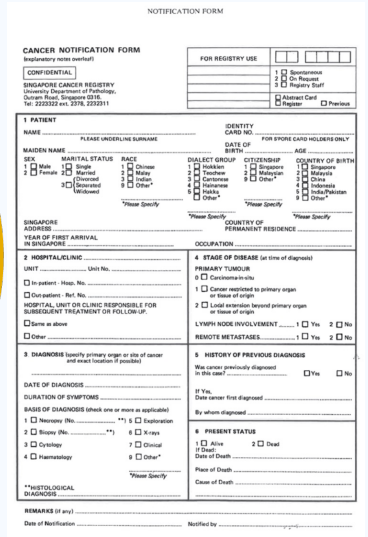
The Joint Commission

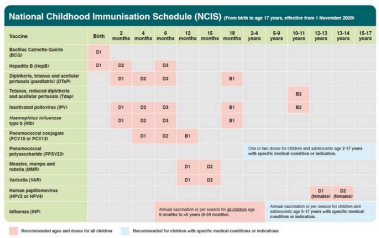
22

Connecting with Public Health

- Integration of public health data
  - Vital records
  - Disease registries
  - Disease surveillance
  - Immunization







Public Health

The Joint Commission

23

Bringing Research & Pre-Clinical Data to Practice

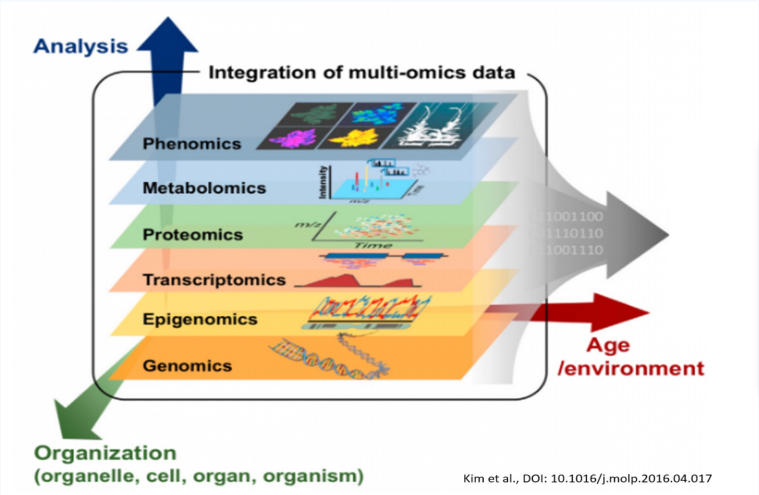
- Information helpful to clinical course of a patient from
  - Research journals & review articles
    - What evidence informs my patient's care?
  - Clinical Trials
    - What trials would a patient benefit from?
  - Poly-omics
    - What might we want to be aware of?

Research & PreClinical

The Joint Commission

24

. . . Including Poly-omics



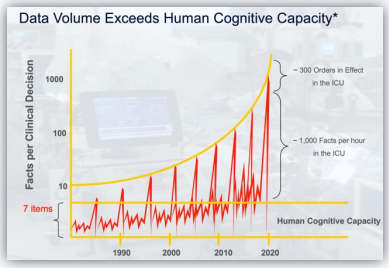


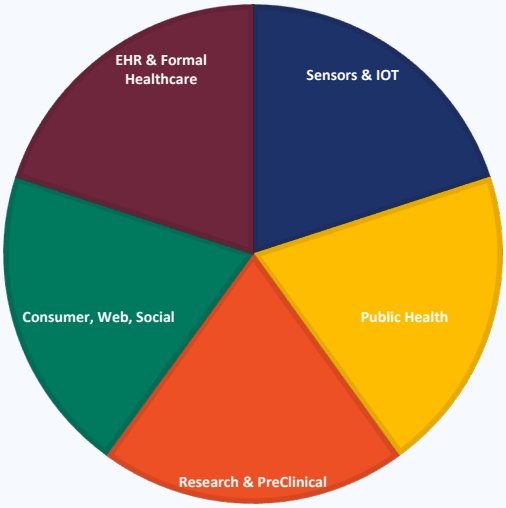
Figure 2: Multi-omics data can help provide a more complete picture of how an individual's complex biology impacts their health profile. (Kim et. al, Mol. Plant. [9] 2016)

https://smartamerica.org/teams/closed-loop-healthcare/

The Joint Commission

25

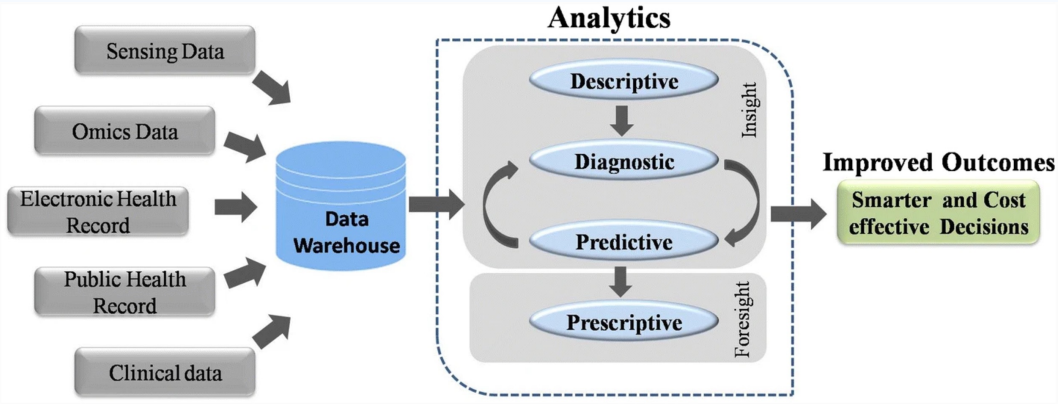
Putting the Pieces Together



The Joint Commission

26

The Pieces Drive Improved Outcomes



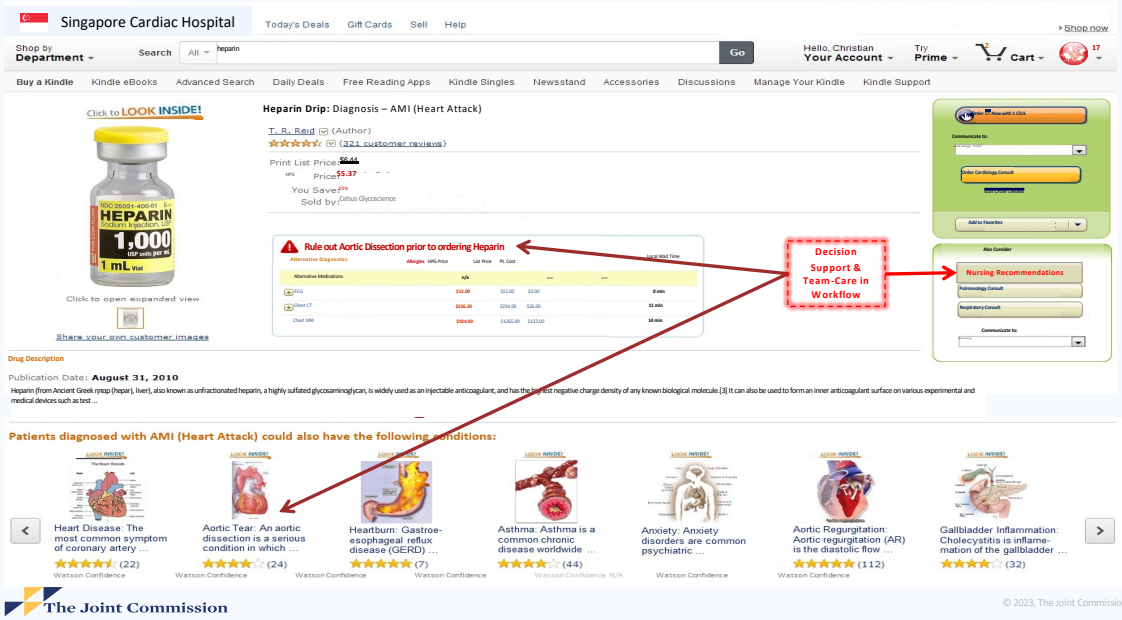
Workflow of Big data Analytics. Data warehouses store massive amounts of data generated from various sources. This data is processed using analytic pipelines to obtain smarter and affordable healthcare options

Dash, S., Shakyawar, S.K., Sharma, M. *et al.* Big data in healthcare: management, analysis and future prospects. *J Big Data* **6**, 54 (2019). https://doi.org/10.1186/s40537-019-0217-0

The Joint Commission

27

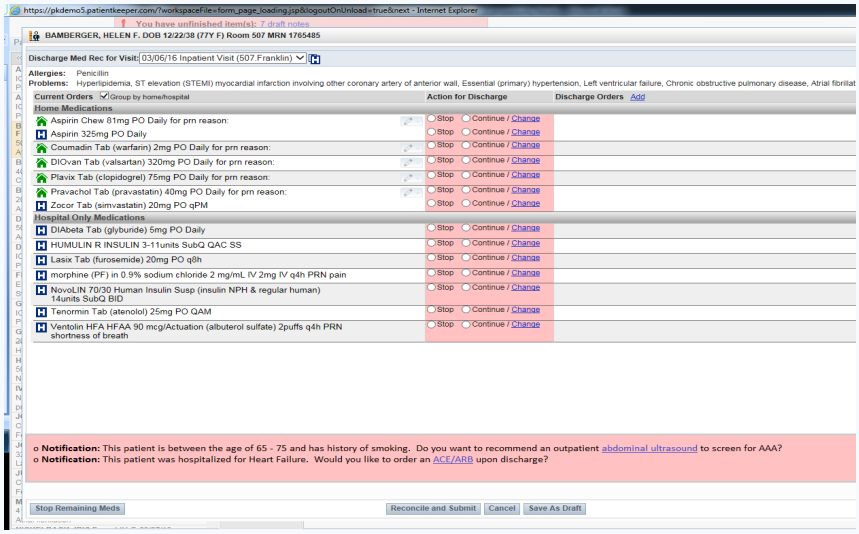
Our Model: What if Amazon* Made Clinician Order Entry ?



The Joint Commission

28

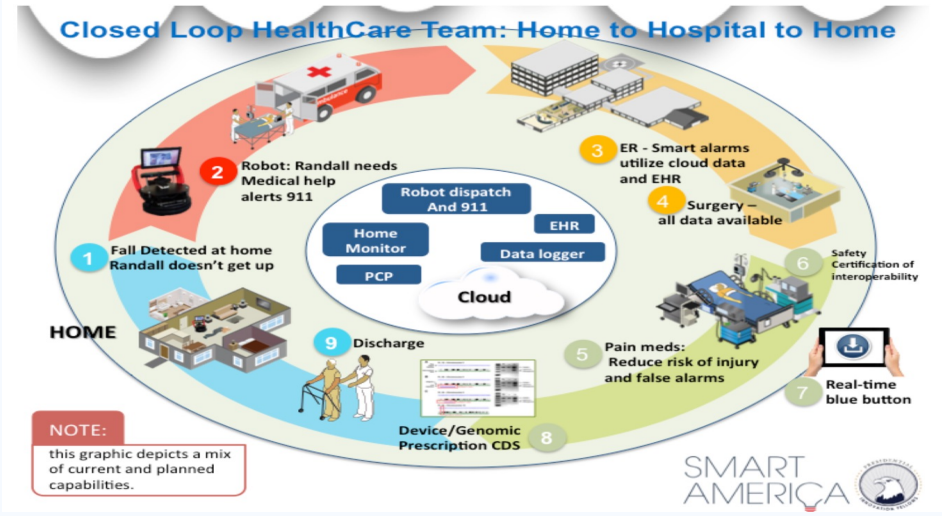
Not Quite Amazon®, but a Similar Idea . . .



The Joint Commission

29

The Informed Healthcare Ecosystem



https://smartamerica.org/teams/closed-loop-healthcare/

The Joint Commission

30

Agenda

1. Setting the Stage
2. JCI, NQF, and Singapore MOH Collaboration
3. From the EHR to Connected Care: Infrastructure
4. Learning Healthcare / Evidence-Based Decision-Making
5. Q & A

Joint Commission International

31

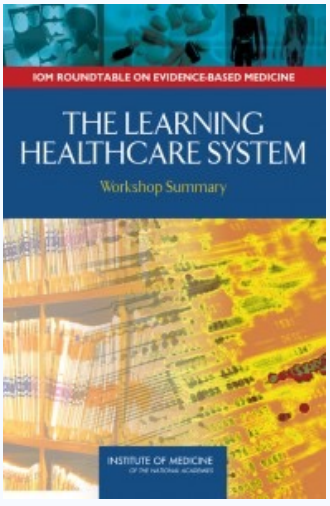
L earning Healthcare . . .

Learning Health System*

A system in which data created as a product of care are used not only for care but also for continuous improvement of care of all patients, the improvement of operations and the acceleration of discovery

- ***Accelerated with use of algorithms, AI . . .***

*Modified from Institute of Medicine, 2007



The Joint Commission

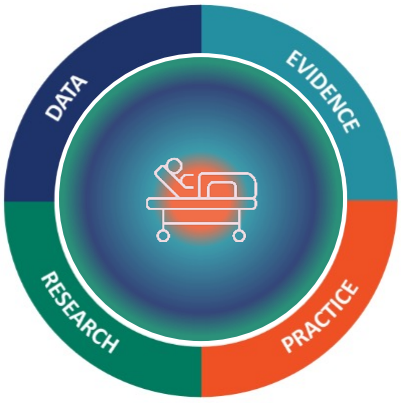
32

Benefits of a Learning Health System

DEFINITION

"Health system in which internal data and experience are systematically integrated with external evidence, and that knowledge is put into practice."

Agency for Healthcare Research and Quality (AHRQ), https://www.ahrq.gov/learning-health-systems/about.html



- Foster a **culture of continual learning and improvement**
- **Gather and apply real-time evidence** to guide care
- Promotes **inclusion of patients** as vital members of the learning team
- Collect and analyze data to **improve care experiences**
- Continuously assess, refine, and create a **feedback cycle for improvement**
- **Real-time evidence-deliver for clinicians to improve decision-making**

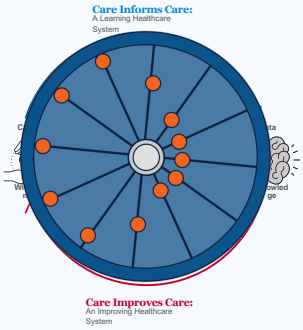
Joint Commission International

33

What if we had a Learning Health System ?

Could we Harvest a "Digital Dividend" from Electronic Health Records?

Light



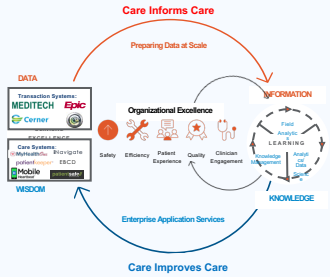
Heat

The Joint Commission

34

What if we had a Learning Health System ?

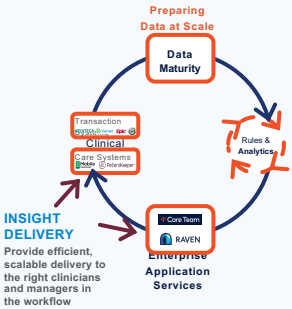
Can Healthcare Be Wired for Learning at-Speed & at-Scale ?

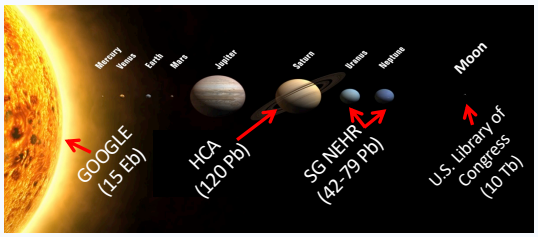


The Joint Commission

35

The "Engine" Generates Lots of Data . . .





The Joint Commission

36

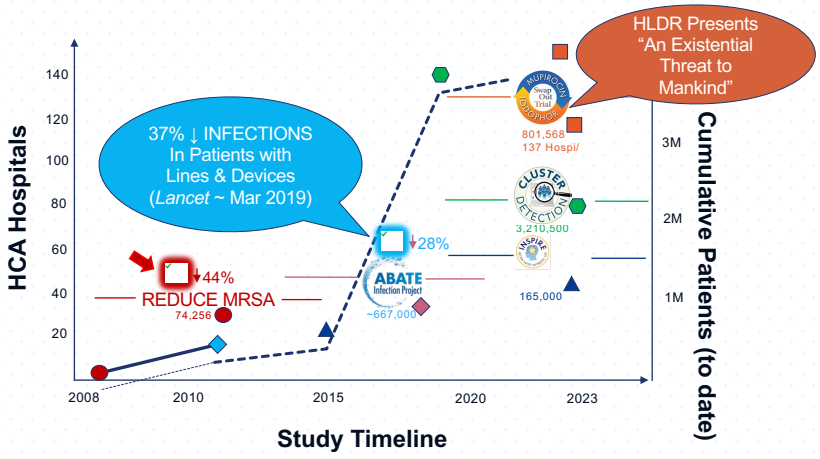
Learning in Action: Evidence-Based Healthcare

1. Discovery: Understanding Disease / Developing New Treatment
   - (Custer-Randomized) Pragmatic Research (e.g., REDUCE MRSA, COVID CHARGE)
2. Improving Healthcare Operations
   - Sensing patient flow in hospital to optimize throughput
3. Better Use of Human Resources
   - Using AI to identify cancer patients
4. Summary of Key Points
   - Responsible (Secondary) Use of Health Data
   - Analytical Hierarchy
5. Putting it all Together: Improving Diagnosis / Detecting Disease Earlier
   - SPOT Sepsis

The Joint Commission

37

Pragmatic Research to Accelerate the Speed of Learning



REDUCE: 43 hospitals 18 months, not 1 hospital 64 years!
ABATE: 53 hospitals 21 months, not one hospital 93 years!

The Joint Commission

38

What If REDUCE MRSA Didn't Require 18 Months?

What if the results of REDUCE MRSA – and all of the studies – were already present in data generated by previous care?

- *What if trials could have been performed "in silica?"*
  - *In 18 minutes, not 18 months ? (REDUCE)*

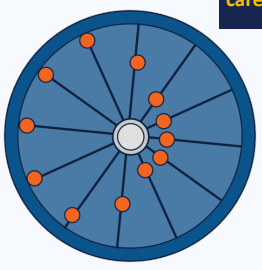
What other answers to pressing questions (cost, quality, precision medicine, policy) might exist in our "collective memory?"

How do we best harvest the "Data Dividend" of EHRS for improving clinical performance ?

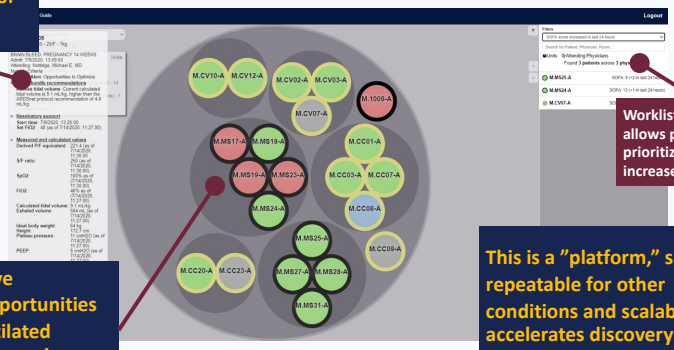
The Joint Commission

39

Applying a Learning Health System to COVID in HCA Healthcare



Evidence-based recommendations for care optimization



Worklist filtering allows patient prioritization (SOFA increase)

Lung protective ventilation opportunities across all ventilated patients (e.g., proning, low peak pressures)

This is a "platform," so it is repeatable for other conditions and scalable and accelerates discovery

The Joint Commission

40

HCA COVID CHARGE: Over 50 Studies Launched or Completed. . .

Partner Institution	Study Title (in order of project initiation)
Johns Hopkins	A. Comparative effectiveness of therapeutics for hospitalized patients with COVID-19 B. Effectiveness and safety of anticoagulation among adults hospitalized with COVID-19
Cleveland Clinic	Effect of antibiotic classes on risk of Clostridium difficile.
Brigham and Women's, UCSF	Analysis of Clinical Criteria to Determine Stability for Discharge among Patients Hospitalized with COVID-19
Duke University	Causal inference machine learning to estimate heterogeneous treatment effects for COVID-19 therapies
UMass MS - Bay State	Trends in non-invasive ventilation strategies and association with outcomes during the COVID-19 pandemic
Meharry Medical College	Developing Phenotype Adjustment Models for COVID-19 Disease Study
UCSF	Risk Stratification Scores and Prediction of Clinical Outcomes among COVID-19 Patients
Columbia University	The Effects of SARS-CoV-2 on Maternal Health Outcomes and Disparities in the U.S.
Beth Israel Deaconess MC	Understanding healthcare disparities and opportunities for equity in care delivery during the COVID-19 pandemic

The Joint Commission

41

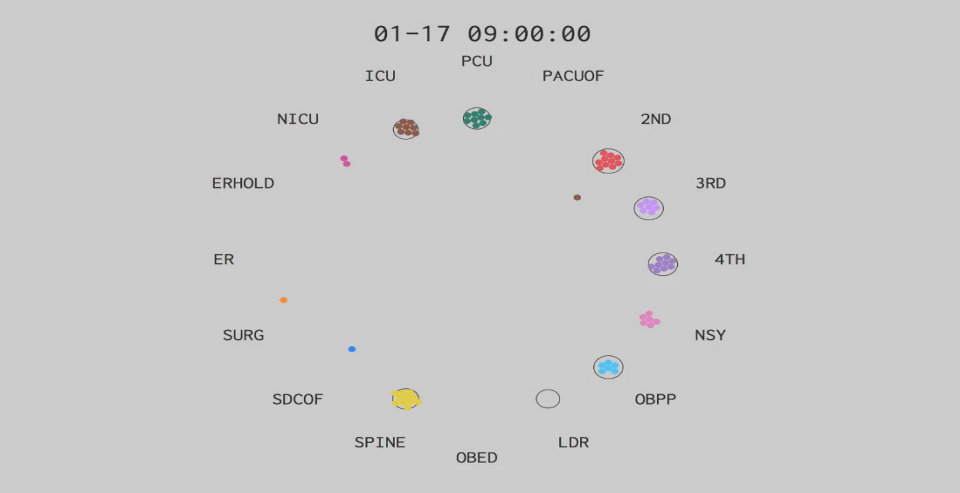
Learning in Action: Evidence-Based Healthcare

1. Discovery: Understanding Disease / Developing New Treatment
   - (Custer-Randomized) Pragmatic Research (e.g., REDUCE MRSA, COVID CHARGE)
2. Improving Healthcare Operations
   - Sensing patient flow in hospital to optimize throughput
3. Better Use of Human Resources
   - Using AI to identify cancer patients
4. Summary of Key Points
   - Responsible (Secondary) Use of Health Data
   - Analytical Hierarchy
5. Putting it all Together: Improving Diagnosis / Detecting Disease Earlier
   - SPOT Sepsis

The Joint Commission

42

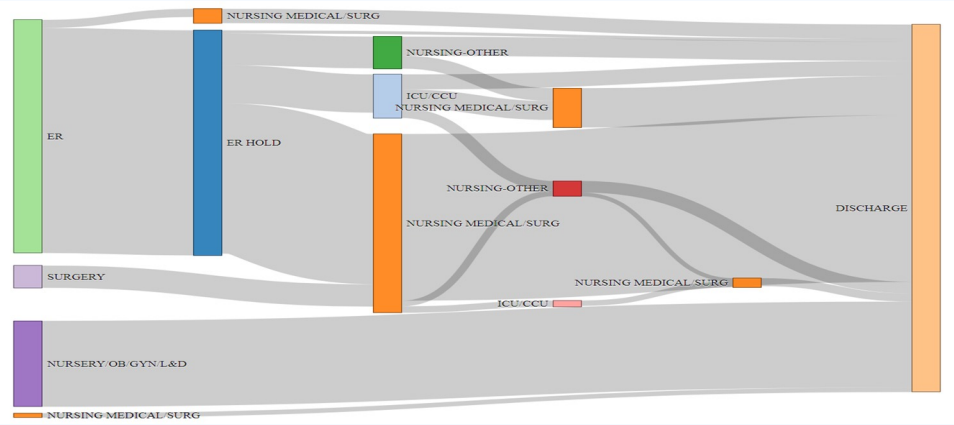
Sensing patient flow in hospital to optimize throughput



The Joint Commission

43

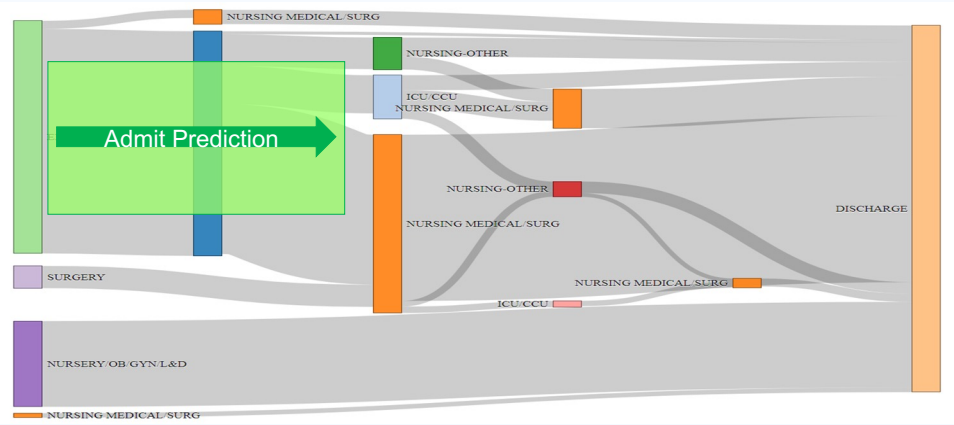
inPatient Flow



The Joint Commission

44

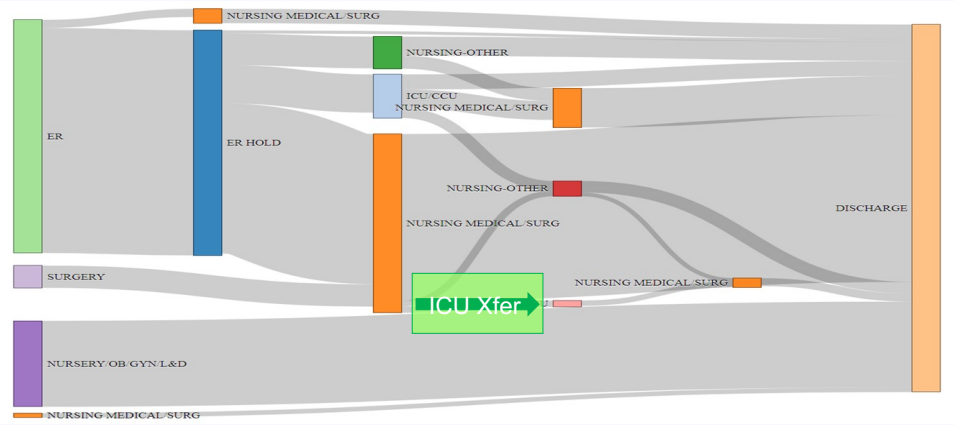
inPatient Flow



The Joint Commission

45

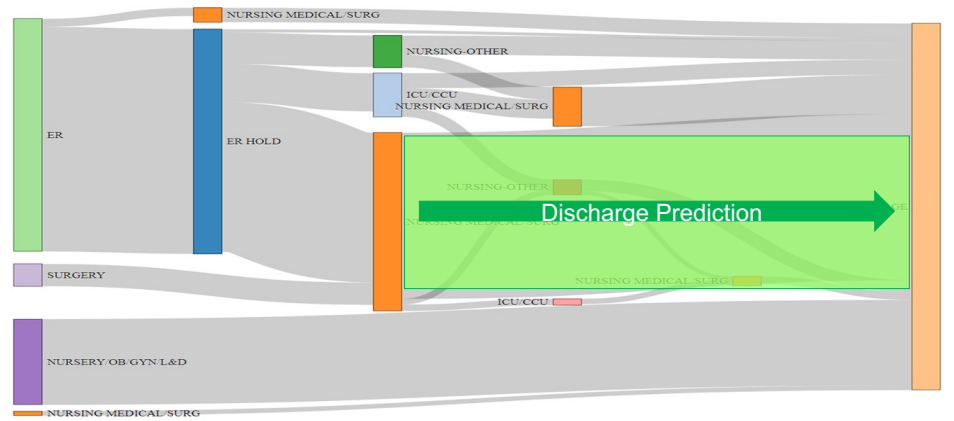
inPatient Flow



The Joint Commission

46

inPatient Flow



The Joint Commission

47

Learning in Action: Evidence-Based Healthcare

1. Discovery: Understanding Disease / Developing New Treatment
   - (Custer-Randomized) Pragmatic Research (e.g., REDUCE MRSA, COVID CHARGE)
2. Improving Healthcare Operations
   - Sensing patient flow in hospital to optimize throughput
3. Better Use of Human Resources
   - Using AI to identify cancer patients
4. Summary of Key Points
   - Responsible (Secondary) Use of Health Data
   - Analytical Hierarchy
5. Putting it all Together: Improving Diagnosis / Detecting Disease Earlier
   - SPOT Sepsis

The Joint Commission

48

Using AI to Identify Cancer Patients

Cancer (Y/N)? Which Patient?

PATIENTS

PATHOLOGY REPORTS

CANCER REPORTING

Care centers are required by federal law to report cancer patient data to the CDC

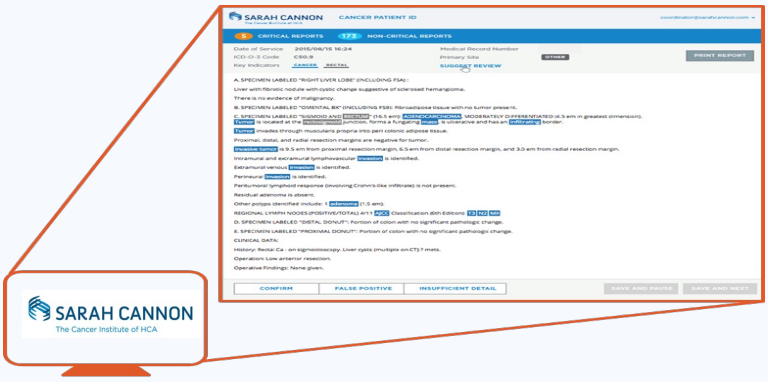
CARE COORDINATION

Assisting patients through their cancer journey, including coordinating visits, communicating, and support

The Joint Commission

49

Using AI to Identify Cancer Patients

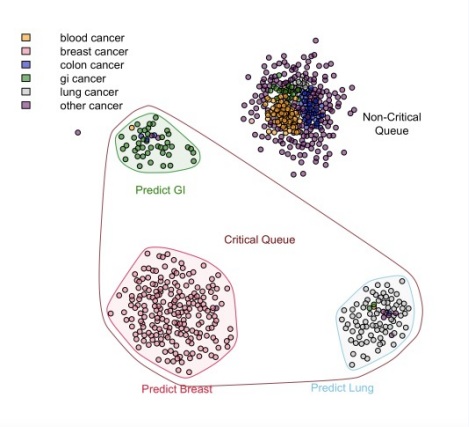


The Joint Commission

50

Using AI to Identify Cancer Patients

- Performance
  - 78k Pathology reports reviewed
  - 2.5k cancer patients rapidly identified in 3 markets
- Efficiency Gains:
  - 2,347 review-hours → 106 hours (22X improvement)
- For System:
  - Equivalent to hiring 118 Cancer Registrars or Navigators
  - Patient retention in system
- For Patient:
  - Timelier Care
  - Greater Engagement
  - Reduced Risk of Missed Positive Diagnosis
  - Better Outcomes for Time-Sensitive Cancers

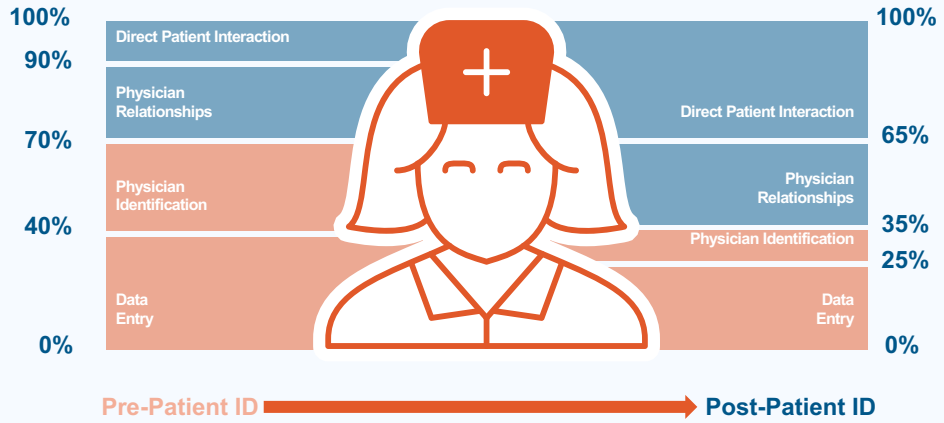


Model Performance:
- **97.52%** of positive patients.(**90.81%** of positive reports).
- **96.15%** of positive patients within 48 hours of diagnosis
- **91.53%** of cancer types in positive reports
- **100%** Positive or likely

The Joint Commission

51

Using AI to Change Care Roles



The Joint Commission

52

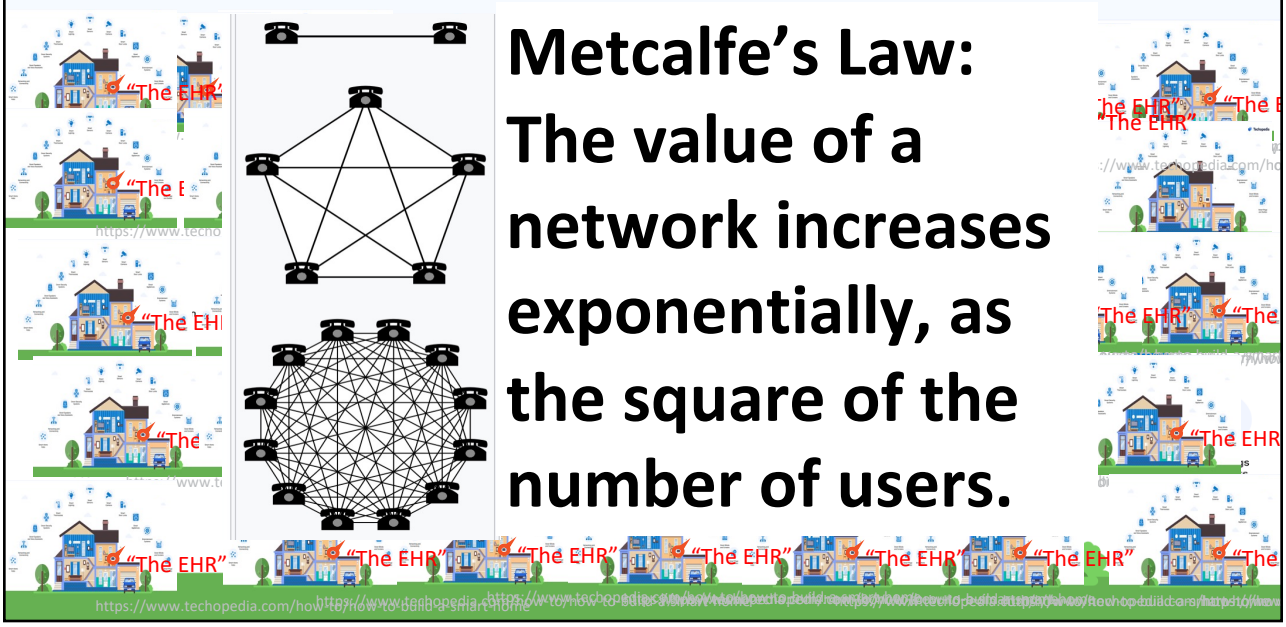
Learning in Action: Evidence-Based Healthcare

1. Discovery: Understanding Disease / Developing New Treatment
   - (Custer-Randomized) Pragmatic Research (e.g., REDUCE MRSA, COVID CHARGE)
2. Improving Healthcare Operations
   - Sensing patient flow in hospital to optimize throughput
3. Better Use of Human Resources
   - Using AI to identify cancer patients
4. Summary of Key Points
   - Responsible (Secondary) Use of Health Data
   - Analytical Hierarchy
5. Putting it all Together: Improving Diagnosis / Detecting Disease Earlier
   - SPOT Sepsis

The Joint Commission

53

The Smart House is "Smart" Because it's Part of a Network



54

A "Responsible" Learning Healthcare System . . .

Secondary Use of Data refers to use other than for clinical care, such as QI, operations improvement, discovery, or algorithm & AI development

What are Patient Rights ?

- "Agency" over use of data
  - Privacy & protection of personal health information
- Freedom from bias in algorithms
- External verification of controls on data use or financial benefit

What are the Benefits ?

- Improve personal healthcare
- Safer, higher-quality care for all

Joint Commission *Responsible Use of Health Data* Certification Program:

- De-Identification
- Data Controls
- Limitations on Use
- Algorithm Verification
- Patient Transparency
- Oversight (Governance) Structure

(Launches January 1, 2024 in U.S.)

The Joint Commission

55

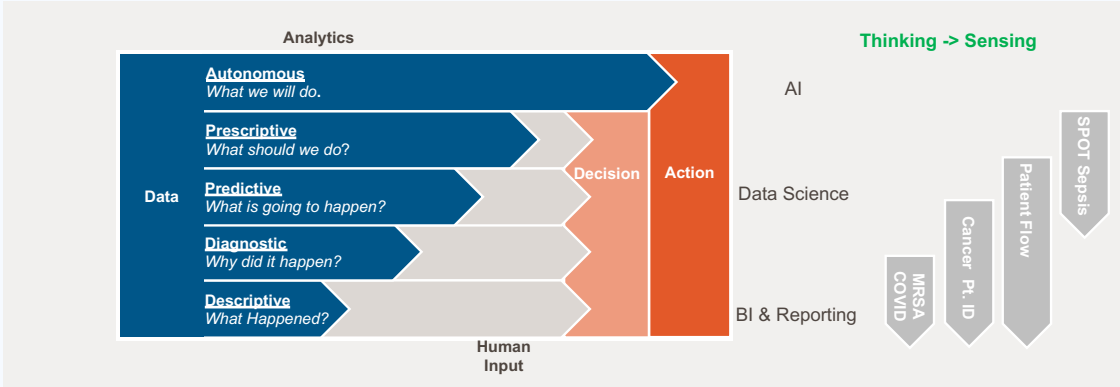
BEYOND DASHBOARDS . . .

The Joint Commission

56

57

Analytical Hierarchy Possible in Learning System



The Joint Commission

58

Learning in Action: Evidence-Based Healthcare

1. Discovery: Understanding Disease / Developing New Treatment
   - (Custer-Randomized) Pragmatic Research (e.g., REDUCE MRSA, COVID CHARGE)
2. Improving Healthcare Operations
   - Sensing patient flow in hospital to optimize throughput
3. Better Use of Human Resources
   - Using AI to identify cancer patients
4. Summary of Key Points
   - Analytical Hierarchy
   - Responsible (Secondary) Use of Health Data
5. Putting it all Together: Improving Diagnosis / Detecting Disease Earlier
   - SPOT Sepsis

The Joint Commission

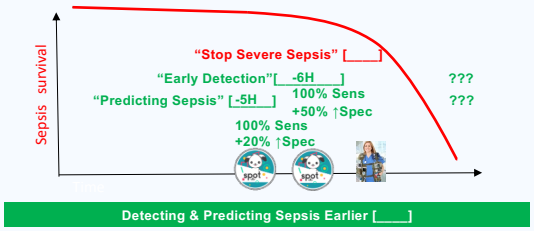
59

Decision Support & AI: Would Perfect Clinician Look Like?

60

SPOTting SEPSIS: Sepsis Prediction & Optimization of Therapy

Sepsis Mortality:
#11 in U.S.
#9 in Hospitals
#3 in ICU
#1 in non-cardiac ICU

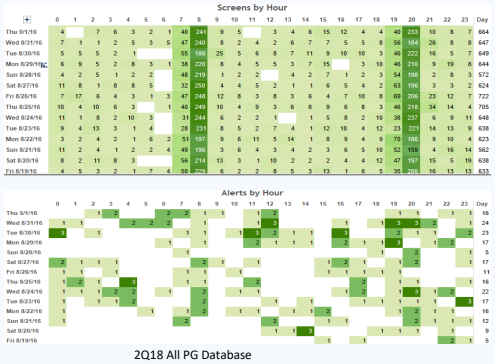


N.B.: ***Every Hour of Delayed Diagnosis & Therapy Results in Approximately 4-8% Greater Mortality***

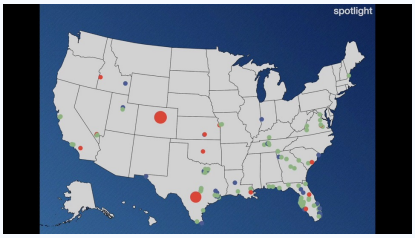
The Joint Commission

61

SPOTting SEPSIS: Sepsis Prediction & Optimization of Therapy



2Q18 All PG Database



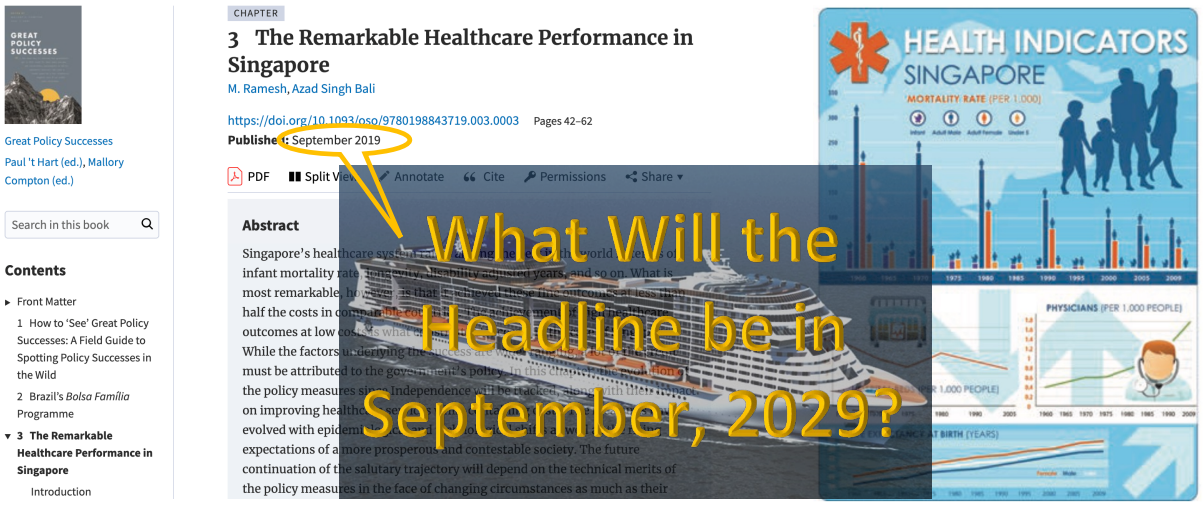
Red - Patient Movement & Demographics
Green - Pharmacy Orders and Labs
Blue Vital Signs

The Joint Commission

62

63

Singapore Healthcare: Much for the World to Admire !!!



W. Haseltine, "Affordable Excellence: The Singapore Healthcare Story" 2013: Brookings Institution Press, Washington, DC.

64

65

Agenda

1. Setting the Stage
2. JCI, NQF, and Singapore MOH Collaboration
3. From the EHR to Connected Care: Infrastructure
4. Learning Healthcare / Evidence-Based Decision-Making
5. Q & A

Joint Commission International

66

ADVANCING SAFETY, QUALITY AND LEARNING WITH ELECTRONIC HEALTH RECORDS

Jonathan B. Perlin, MD, PhD, MSHA, MACP, FACMI
President and CEO
The Joint Commission Enterprise

Joint Commission International

1 December 2023

67