



Embedding Quality Reports in Clinical Workflow and EMR

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Today's presentation learning objectives:

1. To recognize problems using administrative data for clinical reports.
2. To recognize components that negatively affect quality reports.
3. Our experience with actionable clinical reports.
4. AI

Disclosure

- Mayo Clinic and I have Financial Conflict of Interest related to this research.
- AWARE is patent pending (US 2010/0198622, 12/697861, PCT/US2010/022750) (V. Herasevich, B.W. Pickering, O. Gajic).
- Sepsis sniffer is patented - US 8,527,449 B2 (Mayo Clinic)
- AWARE and sepsis sniffer are licensed to Ambient Clinical Analytics

Reviewed by the Mayo Clinic Conflict of Interest Review Board and conducted in compliance with Mayo Clinic Conflict of Interest policies



Measures Inventory Tool

30-day All-Cause Hospital Readmission measure

NQF Endorsement Status	Not Endorsed
NQF ID	9999
Measure Type	Cost/Resource Use
Measure Content Last Updated	2019-05-31
Info As Of	Not Available

Properties

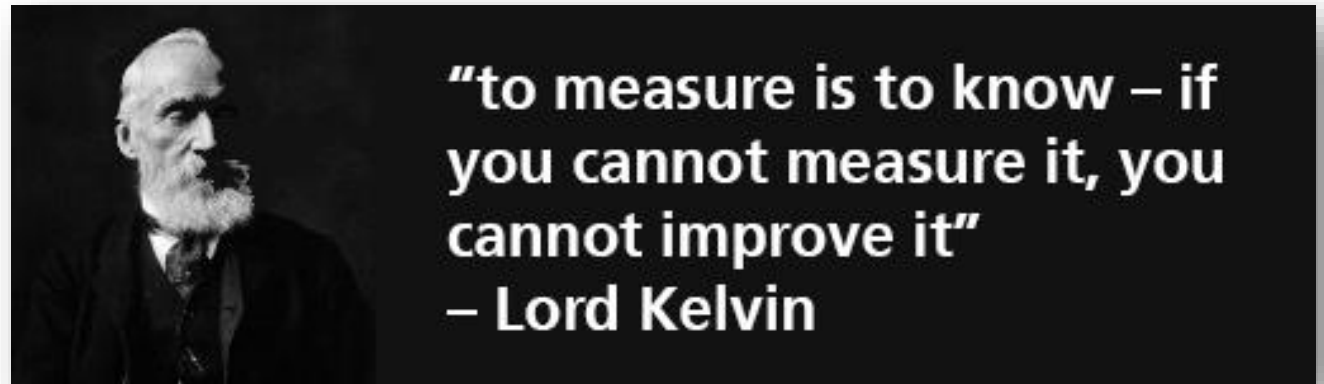
Description	The 30-day All-Cause Hospital Readmission measure is a risk-standardized readmission rate for beneficiaries age 65 or older who were hospitalized at a short-stay acute care hospital and experienced an unplanned readmission for any cause to an acute care hospital within 30 days of discharge. The measure applies to solo practitioners and groups of practitioners, as identified by their Taxpayer Identification Number (TIN).
Numerator	The outcome for this measure is any unplanned readmission to a non-federal,

https://cmit.cms.gov/CMIT_public/ListMeasures

~~Innovation~~ Motivation

Why we need reports? Practice needs.

It has been well documented that **quality measurement** has the **ability to improve** the quality of care delivered by providers.



Why we need reports?

Regulatory requirement.

Hospitals have been **facing growing demands** to participate in quality measurement for a number of purposes (e.g., **accreditation** and **licensure**).



The screenshot shows the top navigation bar of The Joint Commission website. The logo is on the left, and navigation links for 'Log In', 'Request Guest Access', and 'Contact Us' are on the right. Below the logo is a search bar. The main navigation menu is a dark blue bar with white text for 'Accreditation', 'Certification', 'Standards', 'Measurement', 'Topics', and 'About'. The 'Measurement' menu is expanded, showing a list of links under 'Measurement' and 'Quick Links'.

The Joint Commission

Log In | Request Guest Access | Contact Us |

Forgot password? | Log In Help | Search

Accreditation | Certification | Standards | **Measurement** | Topics | About

Measurement

- › Performance Measurement
- › Health Services Research
- › Accountability Measures
- › Annual Report - Improving America's Hospitals

Quick Links

- › Core Measure Sets
- › Specifications Manual for Joint Commission National Quality Core Measures
- › Specifications Manual for National Hospital Inpatient Quality Measures
- › Top Performer on Key Quality Measures
- › SIRAS - Free Courses

100 years of healthcare



1920



2020

100 years of reports



1920



2020

What to measure?

Facts about ORYX® for Hospitals (National Hospital Quality Measures)

- The Joint Commission's ORYX® initiative integrates outcomes and other performance measurement data into the accreditation process.
- **Quality Check®** www.qualitycheck.org The public availability of performance measure data permits **user comparisons of hospital performance** at the state and national levels.
- *Effective with January 1, 2014 discharges, accredited general medical/surgical hospitals are **required** to collect and transmit data to The Joint Commission on a minimum of **six core measure** sets*

2019 ORYX Performance Measure Reporting Requirements

Hospital Accreditation Program (HAP) Requirements ADC > 10

Chart-Abstracted Measures

Select and Report Data on:

AND

Electronic Clinical Quality Measures (eQMs)

Select and Report Data on:

- **Two chart-abstracted measures** applicable to the services provided and patient populations served by the hospital.

Joint Commission Chart-Abstracted Measures

ED-2
PC-01*

* **Perinatal Care measures** Reporting on PC-01 is required of all hospitals that provide OB services. In addition, Five additional perinatal care measures (PC-02, PC-03, PC-04, PC-05, and PC-06) are required for health care organizations with at least 300 live births per year.

- **Four of thirteen available eQMs** applicable to the services provided and patient populations served by the hospital.

Joint Commission eQm Measures

eAMI-8a
eCAC-3
eED-1, eED-2
ePC-01, ePC-05
eSTK-2, eSTK-3, eSTK-5, eSTK-6
eVTE-1, eVTE-2
eEHDI-1a

Joint Commission Measures Effective January 1, 2019

IMPORTANT

See [2019 ORYX Performance Measure Reporting Requirements](#) for details

Measure Topic	Retired Measure	Retained Chart Abstracted Measures	Retained Electronic Clinical Quality Measures (eCQM)
Acute Myocardial Infarction (AMI)			eAMI-8a
Children's Asthma Care (CAC)			eCAC-3
Venous Thromboembolism (VTE)		VTE-6	eVTE-1 eVTE-2
Stroke (STK)			eSTK-2 eSTK-3 eSTK-5 eSTK-6
Emergency Department (ED)		ED-1 ED-2	eED-1 eED-2
Immunization (IMM)		IMM-2	
Hospital-Based Inpatient Psychiatric Services (HBIPS)		HBIPS-1 HBIPS-2 HBIPS-3 HBIPS-5	
Tobacco Treatment (TOB)	Retired TOB-1	TOB-2 TOB-3	
Substance Use (SUB)	Retired SUB-1	SUB-2 SUB-3	
Perinatal Care (PC)		PC-01 PC-02 PC-03 PC-04 PC-05 PC-06	ePC-01 ePC-05
Hospital Outpatient (OP)		OP-18 OP-23	
Early Hearing Detection and Intervention (EHDI)			eEHDI-1a

What to measure?

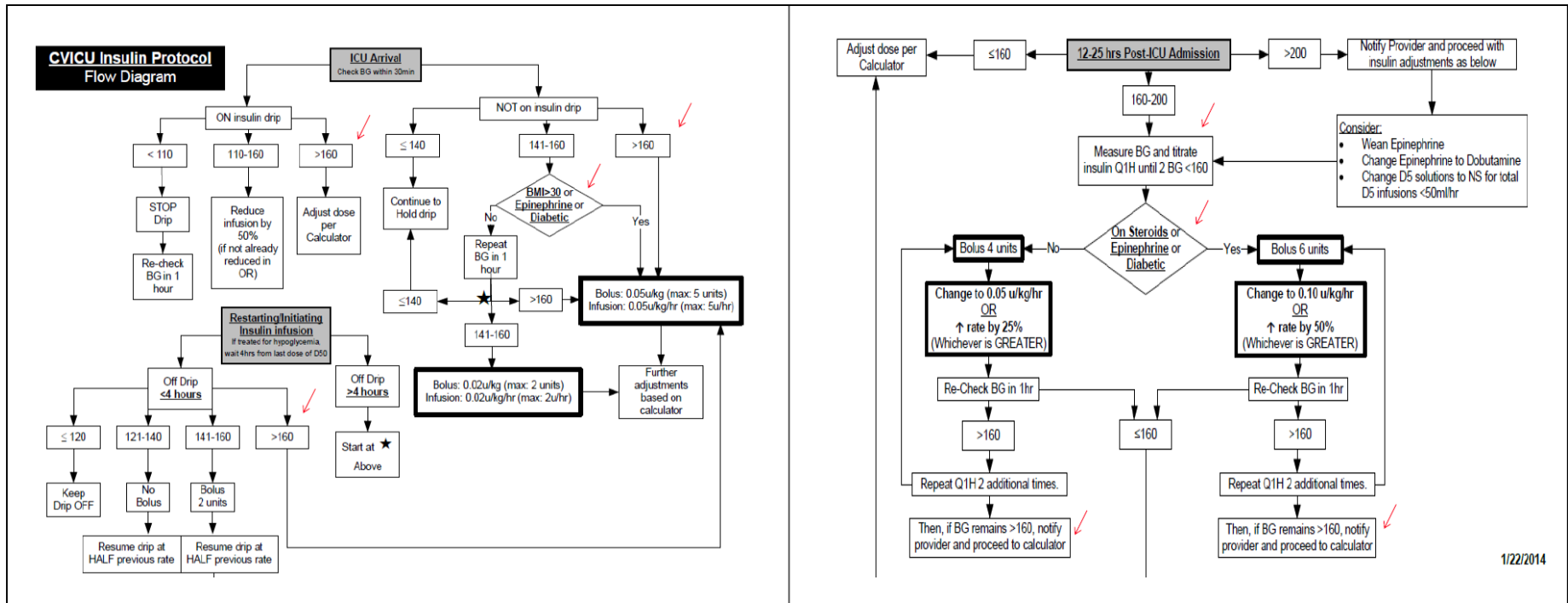


- Quality of care is usually estimated:
 - in structure,
 - process,
 - and outcome.
- **The metrics describing those domains are often poorly defined and difficult to measure**

Point #1

Complexity of metrics

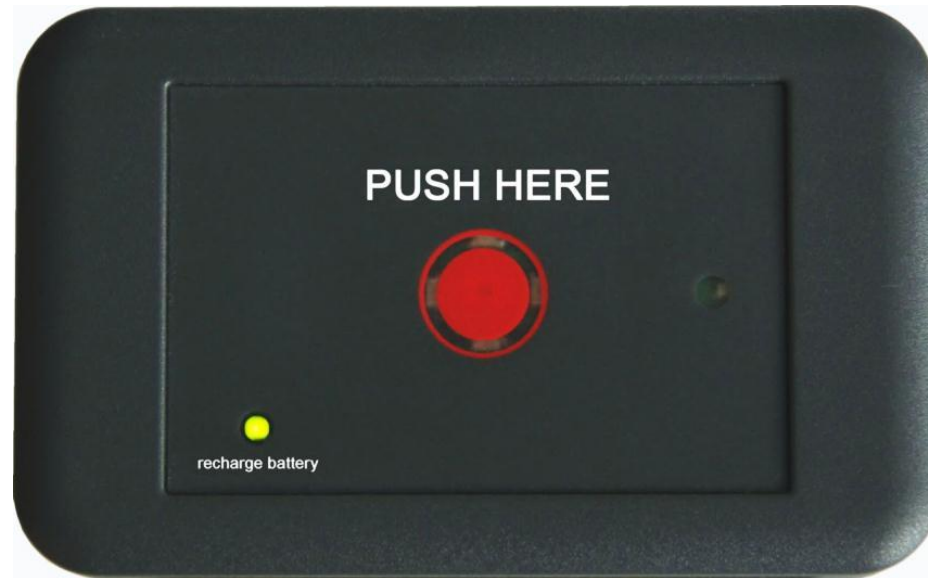
System engineering approach



<http://aats.org/annualmeeting/Program-Books/2014/presentations/72/SCIP.pdf>

Applied clinical informatics approach

Example



Electronic reminder device. The patient was considered to be adherent when pushing the button at least one hour before or after the stated drug-intake time. The TS reminded the participant about their drug intake by an audio beep signal and red LED light in the button.

Validity of administrative data

Point #2:

Administrative data...

- Definitions based on:
 - **ICD-9-CM diagnosis and procedure codes**
 - Often along with other measures (e.g., DRG, MDC, sex, age, procedure dates, admission type)
- Numerator = number of cases with the outcome of interest (e.g., cases with pneumonia)
- Denominator = population at risk (e.g., community population)
- Observed rate = numerator/denominator
- Some QIs measured as volume counts

ICD-9 for billing - not for quality

Performance Measure Name:

(PN-6) Initial Antibiotic Selection for Community-Acquired Pneumonia (CAP) in Immunocompetent Patients

Denominator Statement: Pneumonia patients (as specified under the Set Measure Identifier and description above) 18 years of age and older.

Included Populations: Discharges with:

- An ICD-9-CM Principal Diagnosis Code of pneumonia as defined in Appendix A, Table 3.1 OR ICD-9-CM Principal Diagnosis Code of septicemia or respiratory failure (acute or chronic) as defined in Appendix

Table 2

Agreement between the two external coders for the most frequently selected diagnoses

	Number	Kappa	95% CI
J960, acute respiratory failure	63	0.42	0.23–0.61
J159, bacterial pneumonia, unspecified	22	0.49	0.22–0.76
R402, coma, unspecified	21	0.82	0.63–1.00
I501, left ventricular failure	17	0.67	0.42–0.94

CI, confidence interval.

Available online <http://ccforum.com/content/12/4/R95>

Research

Open Access

Reliability of diagnostic coding in intensive care patients

Benoît Misset¹, Didier Nakache², Aurélien Vesin³, Mickael Darmon⁴, Maïté Garrouste-Orgeas⁵,

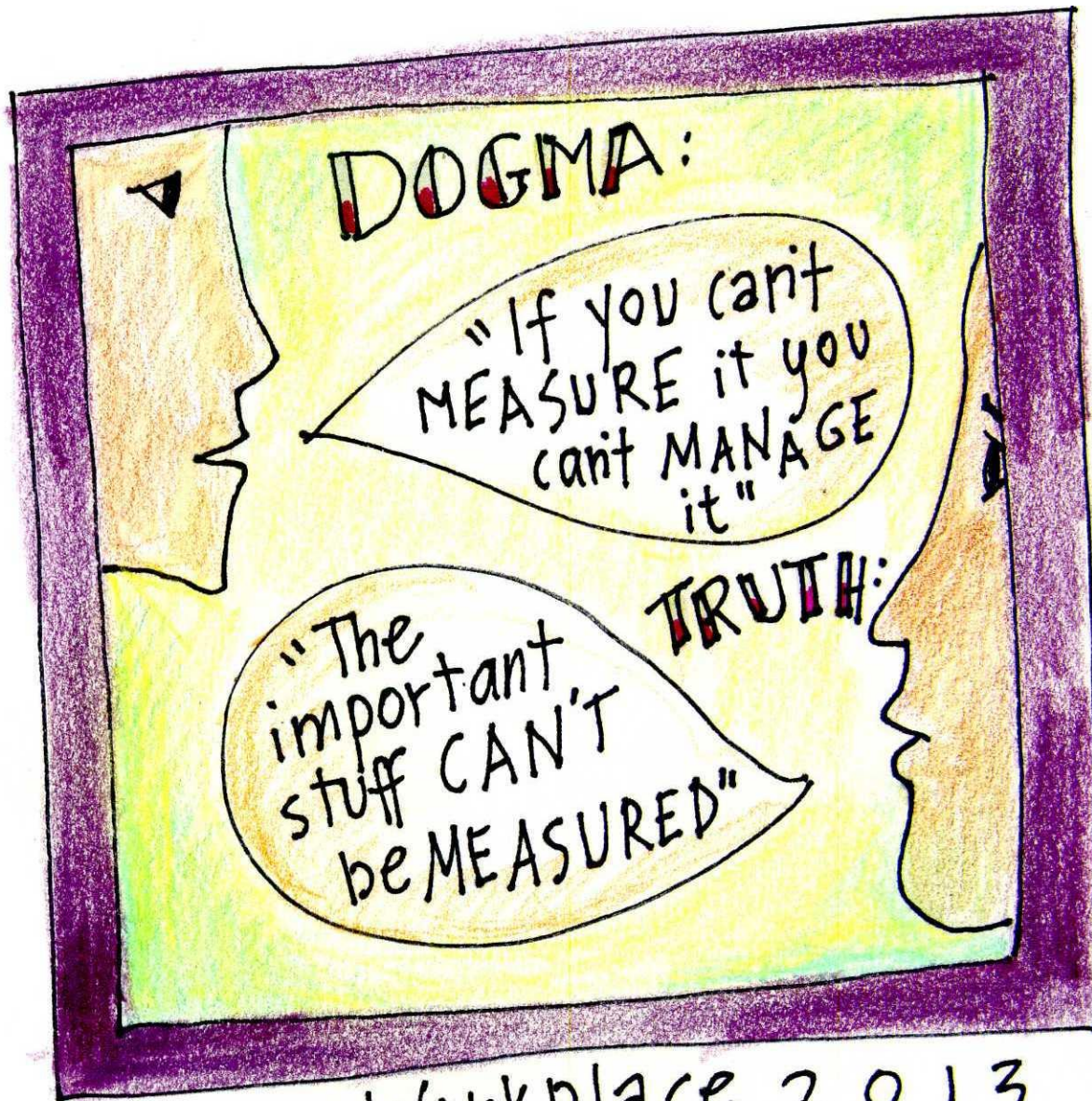
Point #2: Validity of administrative data for reports

The screenshot shows the AHRQ website header with the U.S. Department of Health & Human Services logo and the AHRQ logo. Below the header is a navigation bar with links for Home, Questions?, Contact Us, Site Map, What's New, Browse, and Información en español. The main content area features the 'Effective Health Care Program' logo and the tagline 'Helping You Make Better Treatment Choices'. A search bar is visible on the right. The main content area displays a research report titled 'Assessing the Validity of Administrative Data Using Clinical Medical Records' dated Dec. 2, 2009. A sidebar on the left contains a 'Home' link and a link to 'Research Summaries for Consumers, Clinicians, and Policymakers'.

Objective: Investigators sought to measure the positive predictive value of a specific outcome that might be employed in studies of comparative effectiveness. In particular, we validated hospitalization for the composite outcome of sudden cardiac death and ventricular arrhythmia (SCD/VA) in an administrative dataset of 1999-2000 Medicaid and Medicare data using expert medical record review as the gold standard.

Conclusion: Overall, our outpatient-occurring composite SCD/VA outcome validated poorly (PPV= 18%). This may be improved by focusing on primary claims diagnoses only or utilizing, as true cases, only those that can be validated via medical record review.

Meaningful metrics



© Human Workplace 2013

Point #3:

Is it matters?

The New York Times
nytimes.com

September 6, 2004

Clinton Surgery Puts Attention on Death Rate

By LAWRENCE K. ALTMAN

The hospital where former President Bill Clinton awaits bypass surgery operations - it is still nearly double the average for hospitals in the state.

- The hospital where former President Bill Clinton awaits bypass surgery in the next few days **has the highest death rate for the operation in New York State**, according to the state's Health Department.
- While the death rate is quite low - fewer than 4 percent of all bypass operations - **it is still nearly double** the 2.18 percent **overall death rate** for coronary bypass operations in all 35 hospitals that perform the procedure in the state.

Still no single standard...

Smart Rating 

What's this?



Organizations that have achieved The Gold Seal of Approval® from The Joint Commission®



Medicare.gov | Hospital Compare

The Official U.S. Government Site for Medicare

Ratings Hospitals

Top-scoring

Hospital name and location	Safety score
Miles Memorial Hospital Damariscotta, Maine	78

Bottom-scoring

Hospital name and location	Safety score
Bolivar Medical Center Cleveland, Miss.	11

ConsumerReports®

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Point #3: Meaningful metrics

... It is not retail

Dr. [REDACTED] MD

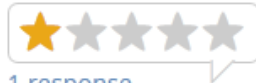
Family Medicine



Dr. [REDACTED] has:

- 36 Years of Practice
- 1 Hospital Affiliation
- 6 Office Locations
- 22 Insurance Carriers

Patient Satisfaction



1 response

[Take a survey](#)

5 of 13 people found the following review helpful

★☆☆☆☆ **Amazing Headphones, Terrible Repair Jobs**, July 22, 2011

By **Maples** - [See all my reviews](#)

Verified Purchase ([What's this?](#))

This review is from: [Beyerdynamic DT 770 PRO, 80 ohms \(Electronics\)](#)

Original review:

These headphones are by far the best headphones i have ever owned.

comfort-wise they are incredible, I can wear them for 12 or 13 hours at a time without feeling even

The bass is very responsive and prominent, but not to the point where it overpowers.

First pair I ordered were damaged and had to be exchanged for a new one, but the second was per

Updated review:

I have now sent these headphones in for repairs 5 times and they are still not working as desired.

I sent them in because of a rattling coming from the right earphone in the bass frequencies and aft

Negativity bias

Review of General Psychology
2001, Vol. 5, No. 4, 323–370

Copyright 2001 by the Educational Publishing Foundation
1089-2680/01/\$5.00 DOI: 10.1037//1089-2680.5.4.323

Bad Is Stronger Than Good

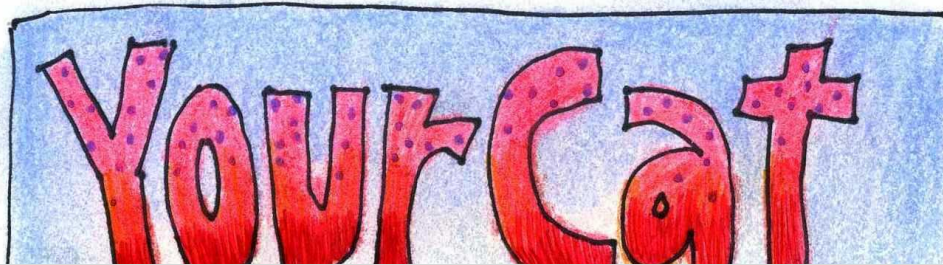
Roy F. Baumeister and Ellen Bratslavsky
Case Western Reserve University

Catrin Finkenauer
Free University of Amsterdam

Kathleen D. Vohs
Case Western Reserve University

The greater power of bad events over good ones is found in everyday events, major life events (e.g., trauma), close relationship outcomes, social network patterns, interpersonal interactions, and learning processes. Bad emotions, bad parents, and bad feedback have more impact than good ones, and bad information is processed more thoroughly than good. The self is more motivated to avoid bad self-definitions than to pursue good ones. Bad impressions and bad stereotypes are quicker to form and more resistant to disconfirmation than good ones. Various explanations such as diagnosticity and salience help explain some findings, but the greater power of bad events is still found when such variables are controlled. Hardly any exceptions (indicating greater power of good) can be found. Taken together, these findings suggest that bad is stronger than good, as a general principle across a broad range of psychological phenomena.

Point #4: Meaningful metrics



Does it change decision?



Does it actionable?



Patient centered outcomes of interest

- ***Better care:***
 - Adherence to and appropriateness of processes of care
 - Provider satisfaction
- ***Better health:***
 - Rate of ICU acquired complications,
 - Discharge home,
 - Hospital mortality,
 - ICU and hospital readmission
- ***Lower cost:***
 - Resource utilization,
 - Severity adjusted length of ICU and hospital stay
 - Cost

EMR (computers) may help

- With the current rate of growth and adoption of EHR, it present a tremendous opportunity for quality improvement projects *(which is been done by manual data collection at a very large scale. This had been proven to be dissatisfactory and consumes time and human resources.)*

- 1. Use clinical data, not administrative**
- 2. Computation...**
- 3. Feedback to providers**

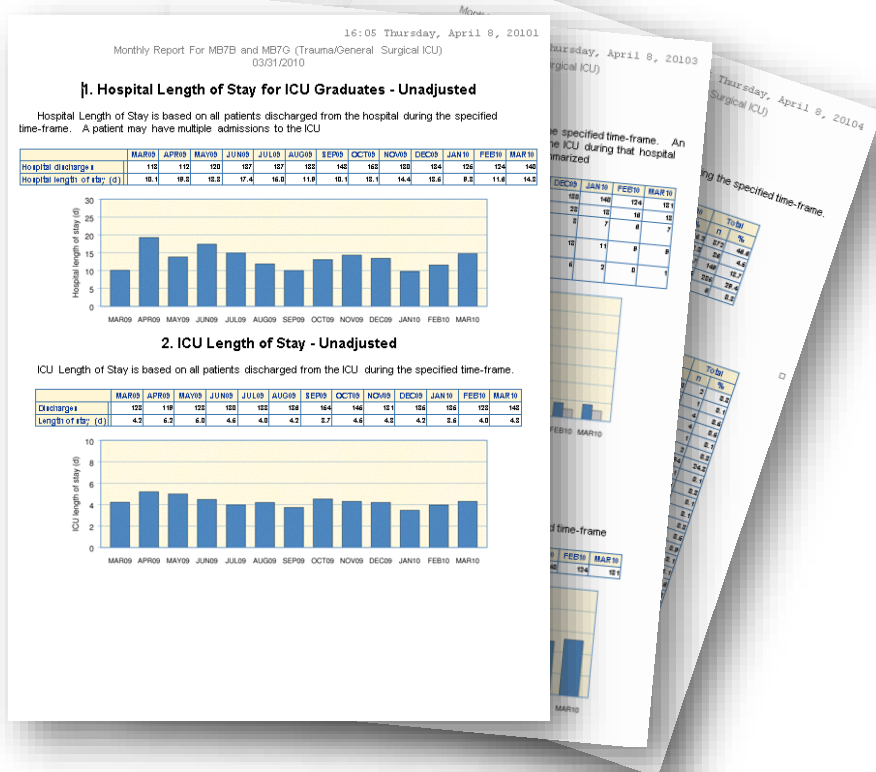
Problem

The current generation of clinical information systems do not routinely support the generation of meaningful practice management reports.

AWARE experience

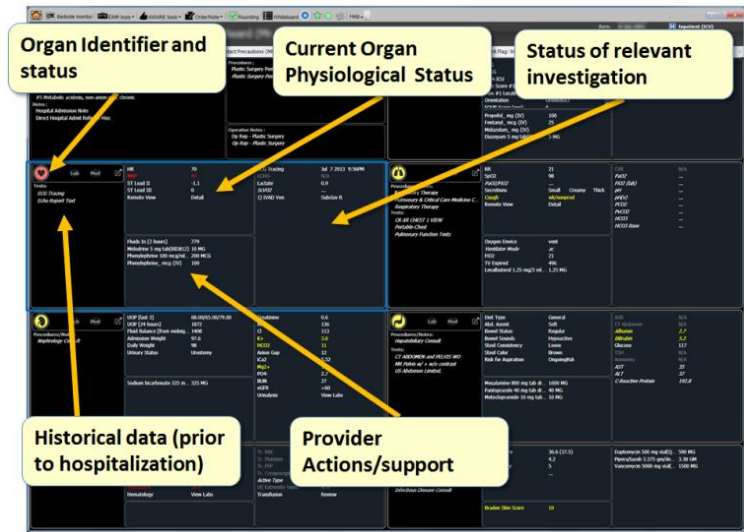
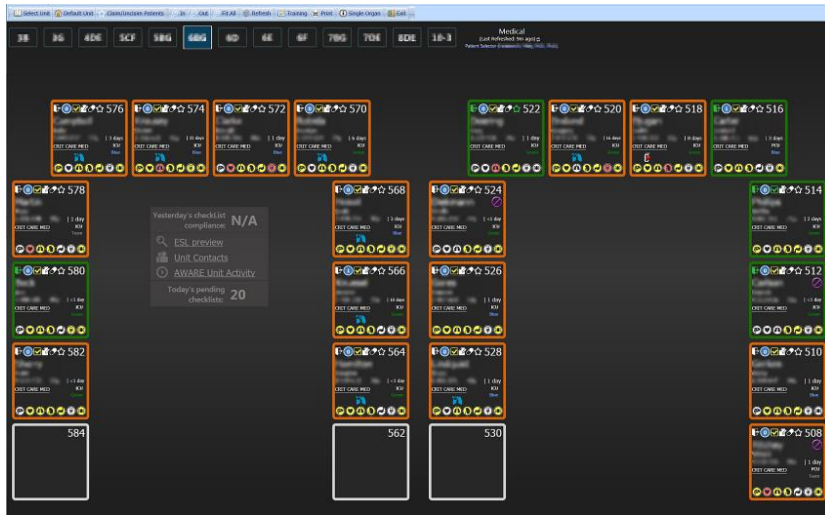
METRIC Reports (2009-2018)

1. Hospital Length of Stay for ICU Graduates – Unadjusted
2. ICU Length of Stay – Unadjusted
3. ICU Length of Stay – Adjusted
4. ICU Readmission Rate
5. ICU Admissions
6. ICU Admission Source and Service
7. Duration of Mechanical Ventilation
8. ICU Mortality Rate – Unadjusted
9. Hospital Mortality Rate – Adjusted
10. ICU Admissions for Low-Risk Monitoring
11. ICU Census - Hourly Utilization

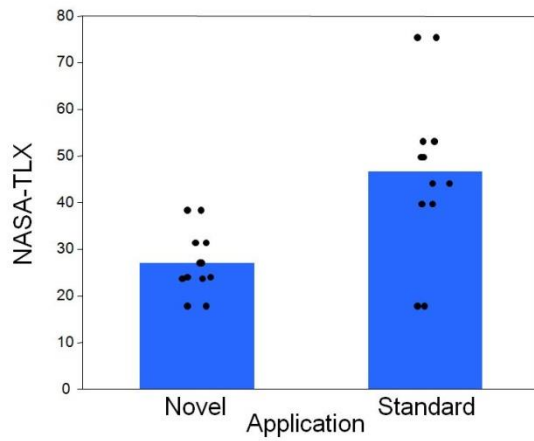


- Monthly reports
- Ad-hock reports
- Customized reports

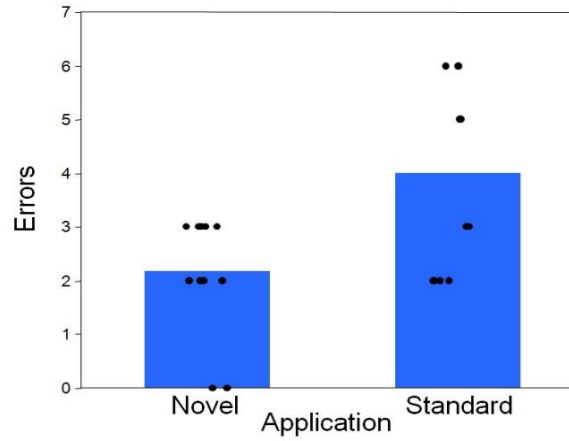
AWARE - Provider built EMR enhancement



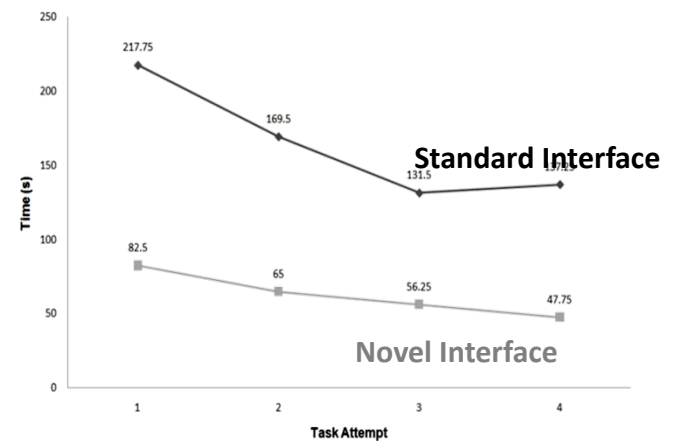
**Reduced cognitive load
(happy clinicians)**



**Reduced errors
(happy patients)**



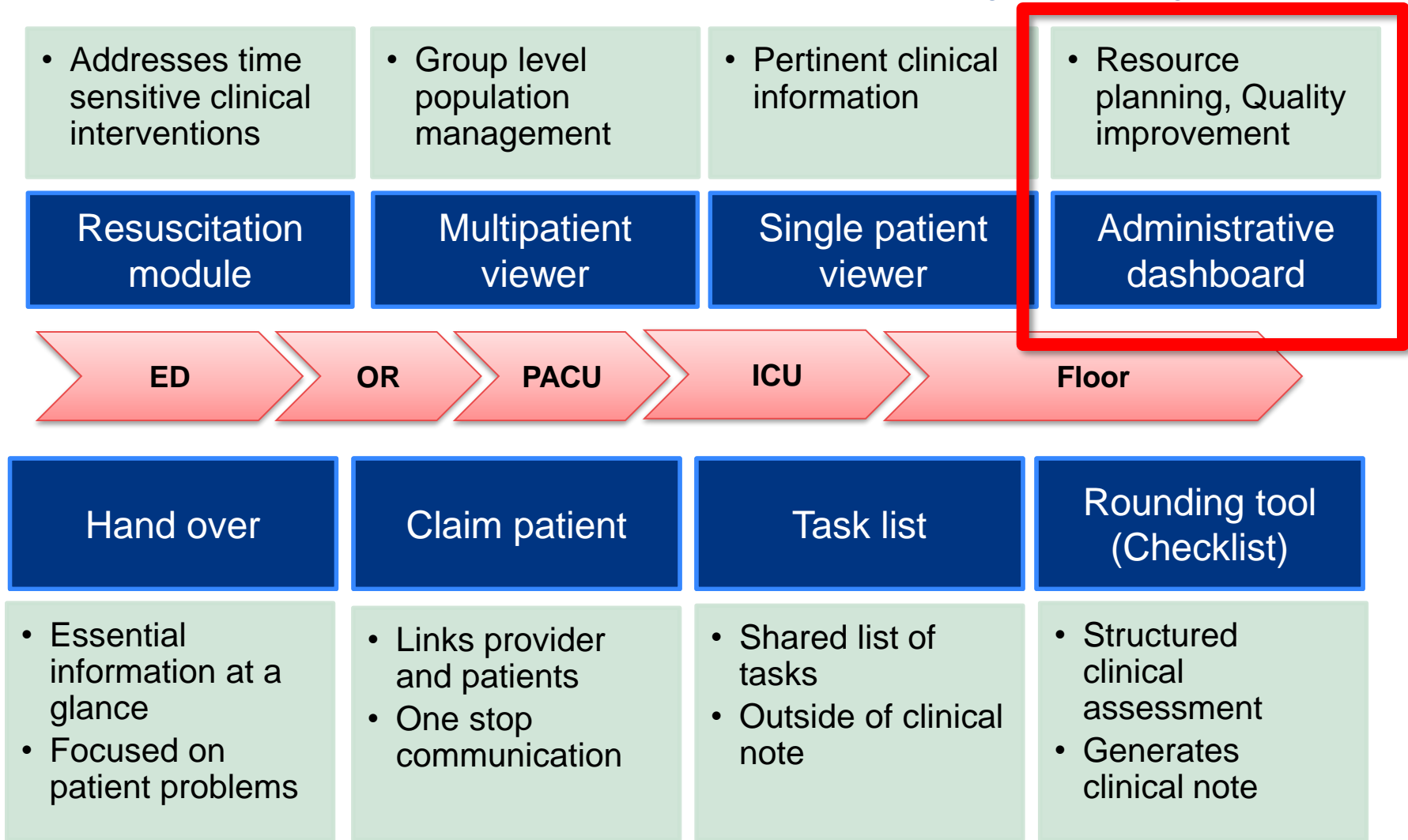
**Reduced time
(happy administrators)**



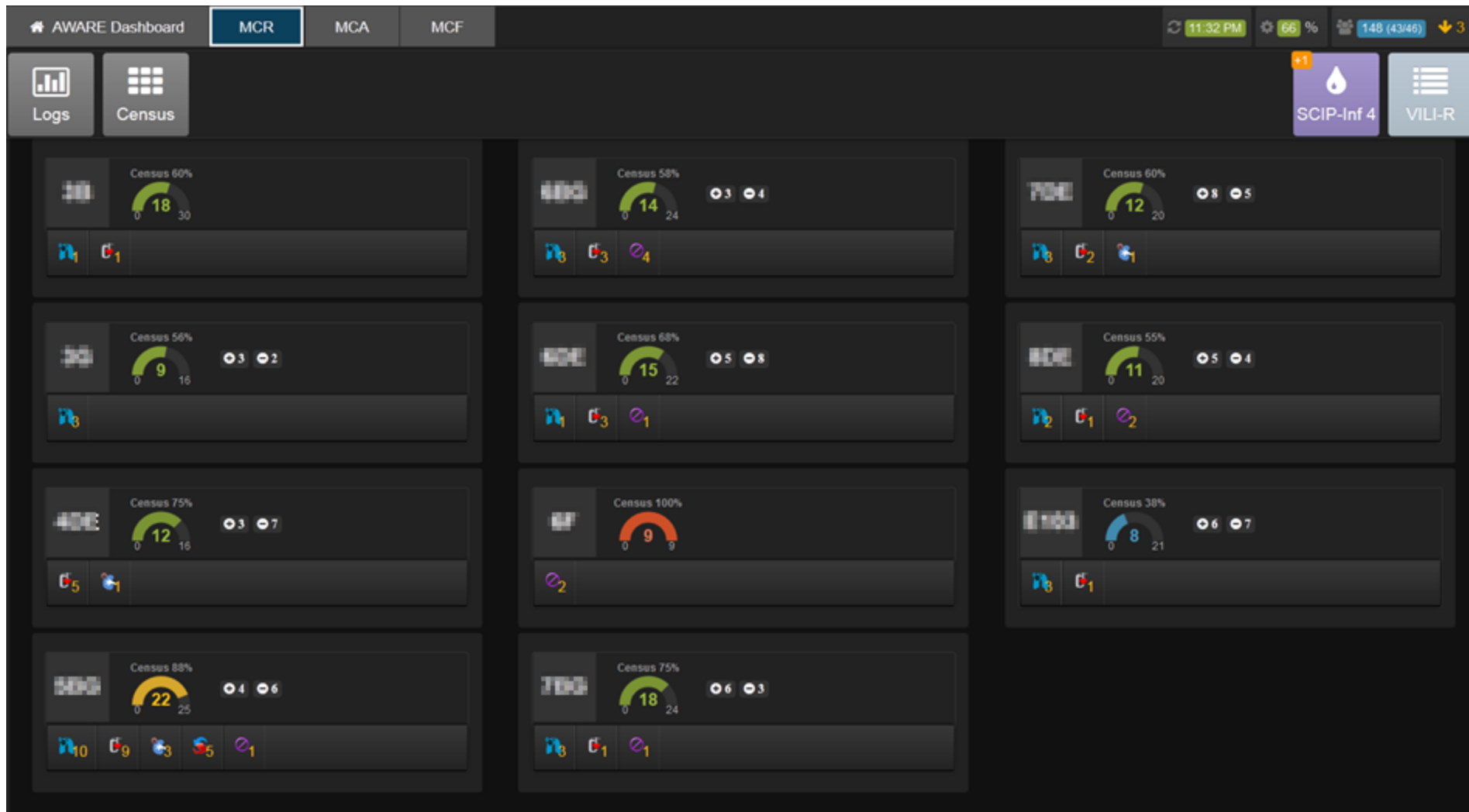
- Ahmed A, Chandra S, Herasevich V, et al. The effect of two different electronic health record user interfaces on intensive care provider task load, errors of cognition, and performance. *Critical Care Medicine* 2011;39(7):1626-1634.

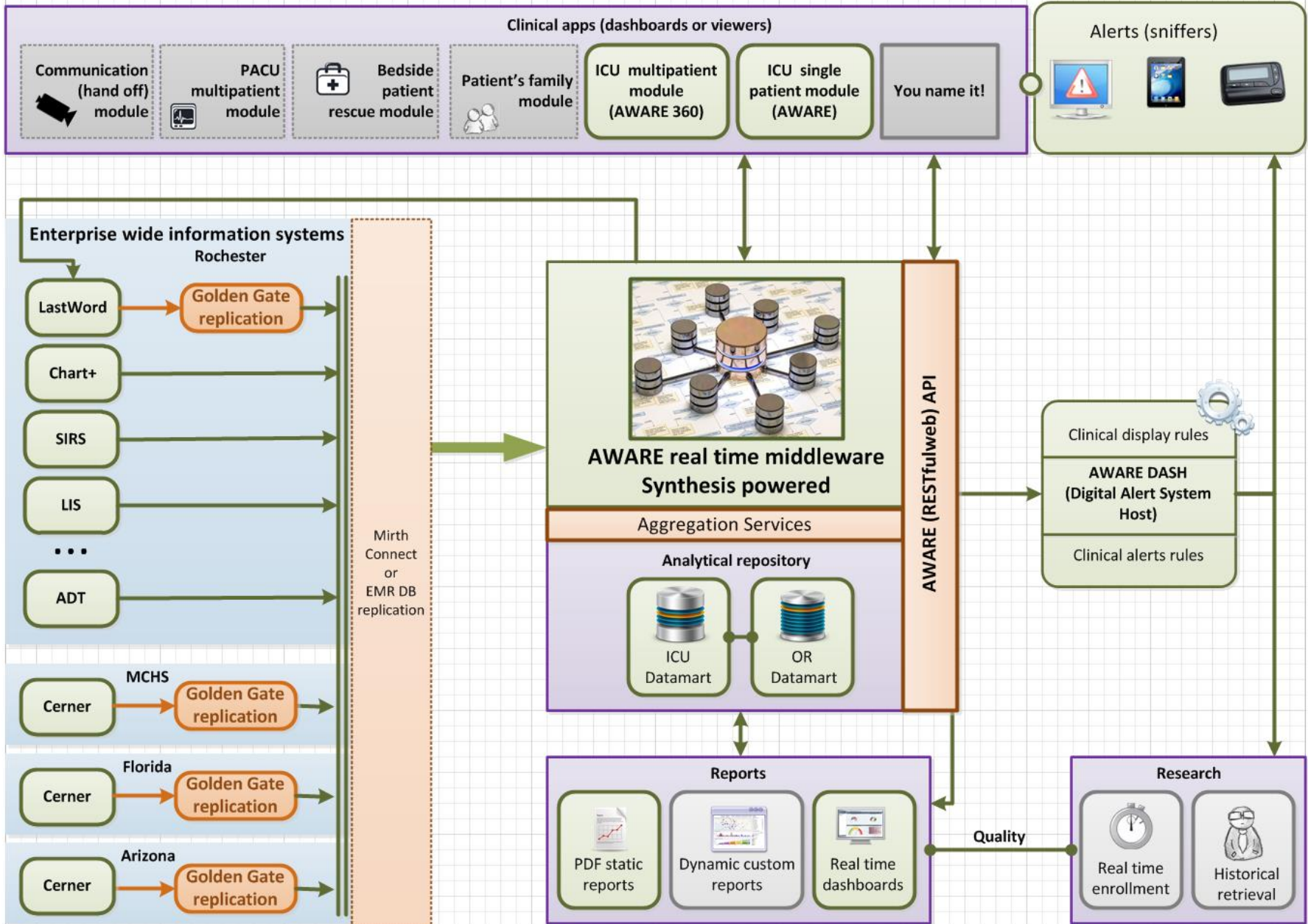
Some PROCESS AWARE components

Tools for stage 3 meaningful EMR use



AWARE real time Administrative dashboard





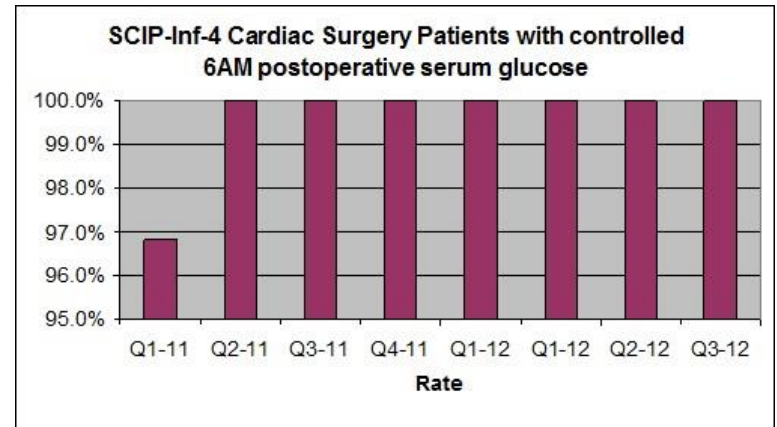
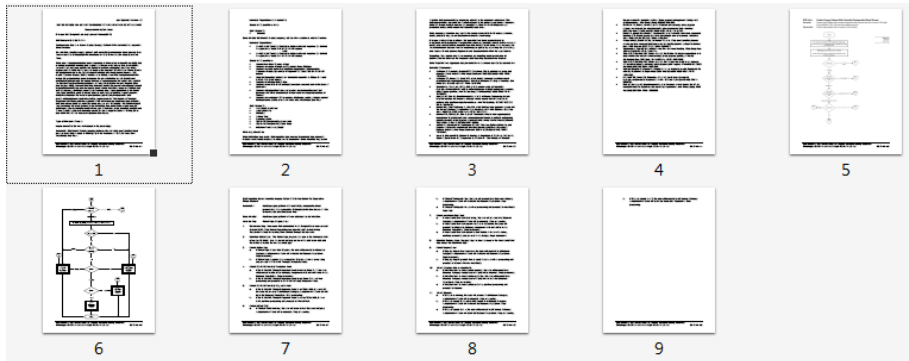
SCIP-4 glucose control metric

Measure Set: Surgical Care Improvement Project (SCIP)

Set Measure ID #: SCIP-Inf-4

Performance Measure Name: Cardiac Surgery Patients With Controlled Postoperative Blood Glucose

Description: Cardiac surgery patients with controlled postoperative blood glucose (less than or equal to 180 mg/dL) in the timeframe of 18 to 24 hours after *Anesthesia End Time*.




Data Reported As: Aggregate rate generated from count data reported as a proportion.

Questions/tasks are different

- Regulatory: have compliance report
- Administration: get 100% compliance
- Provider: EASY tool to be 100% compliant
- Patient: make sure it was done

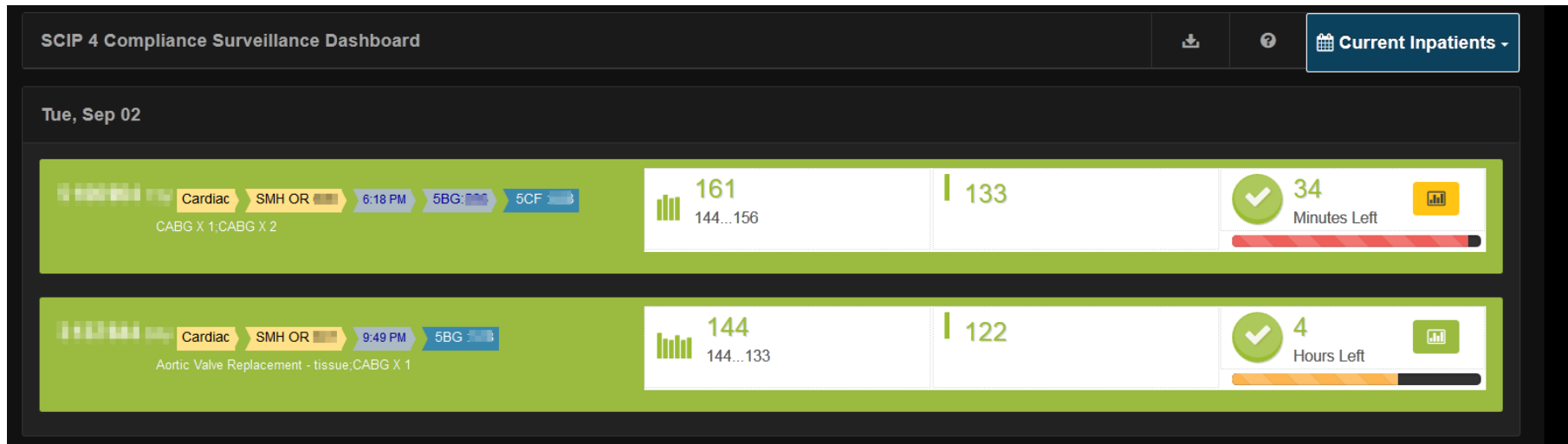
**Smart system is addressing this.
That is automatically address other 3 goals**



Real time monitoring

Task: EMR solution to help providers maintain 100% adherence with SCIP-4.

- Not disruptive.
- Zero data entry



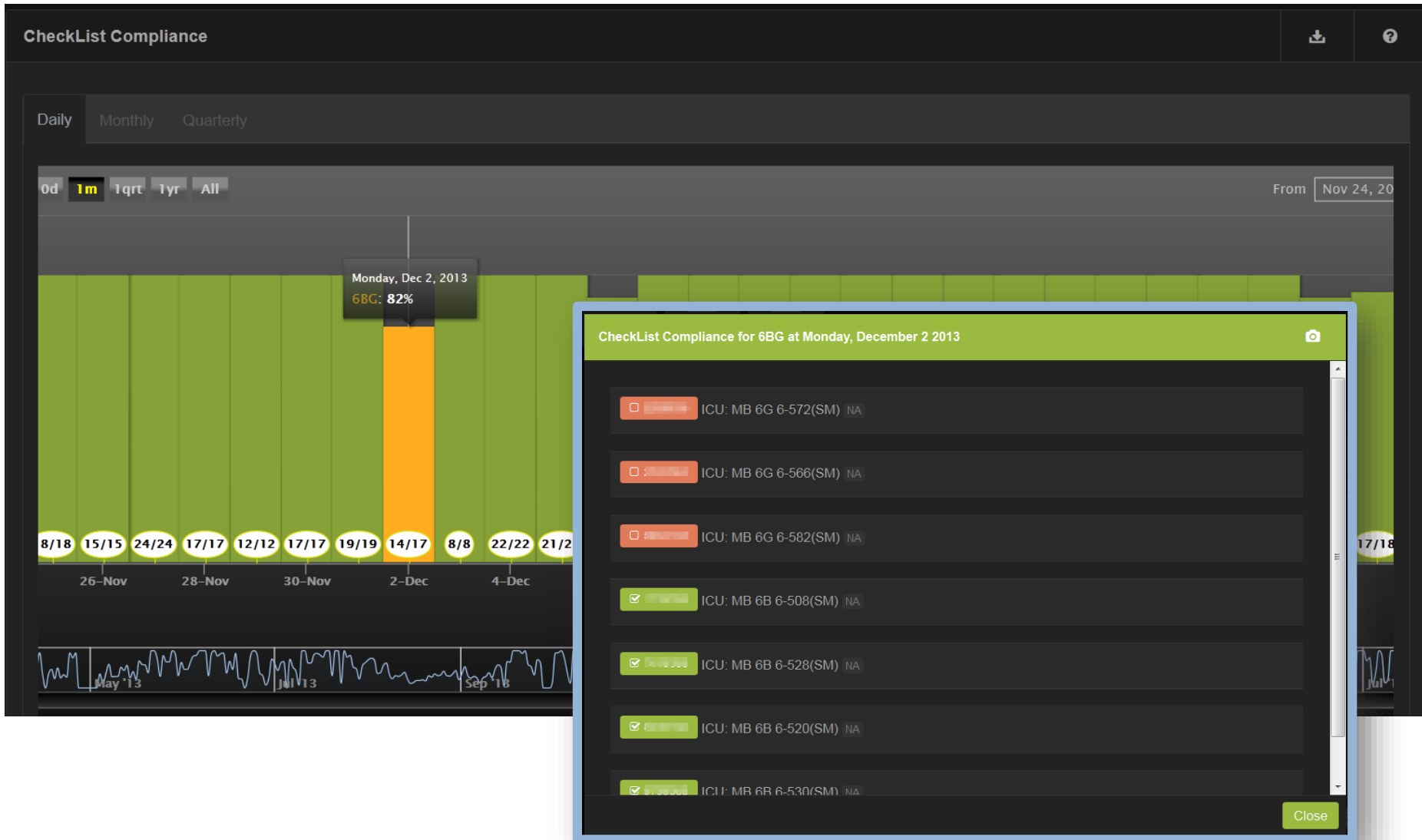
SCIP-4 glucose control metric

Information is actionable



SCIP-4 glucose control metric

Control of implementation process



Real-time providers feedback

“Are you AWARE” sign posted in ICUs

AWARE formal launch in ICU

Critical Care Fellows 2 hour AWARE training

AWARE training mandatory to all Nurse Practitioners

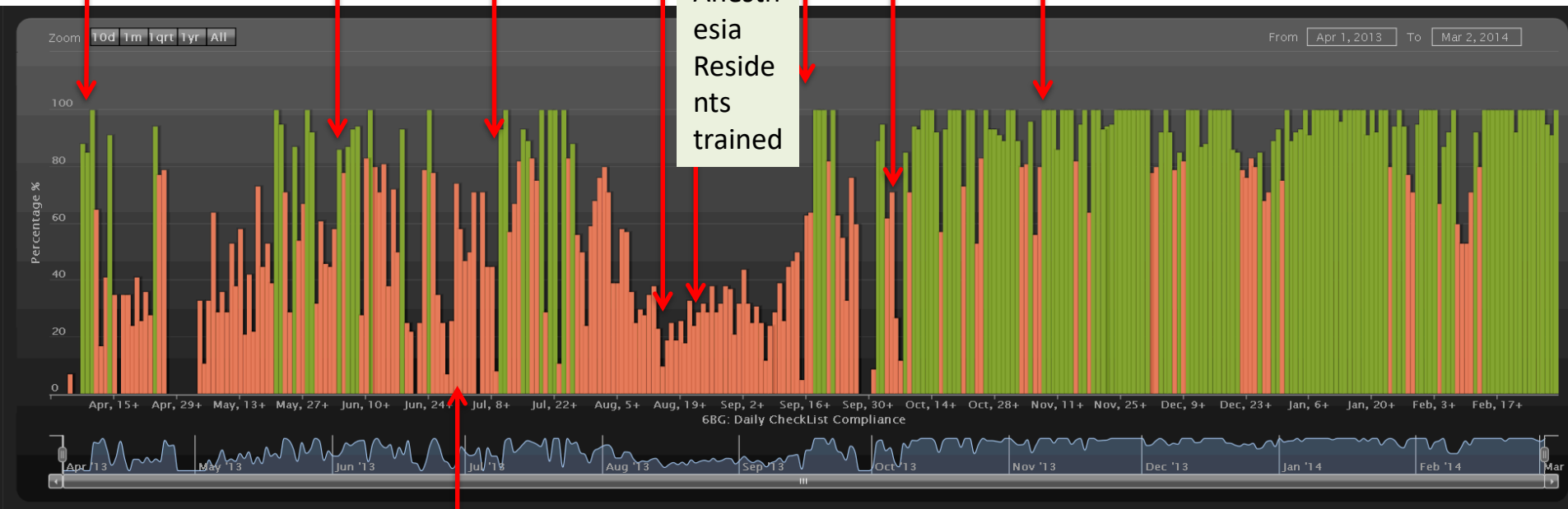
Pulmonary Fellows trained

One-on-one training for attendings

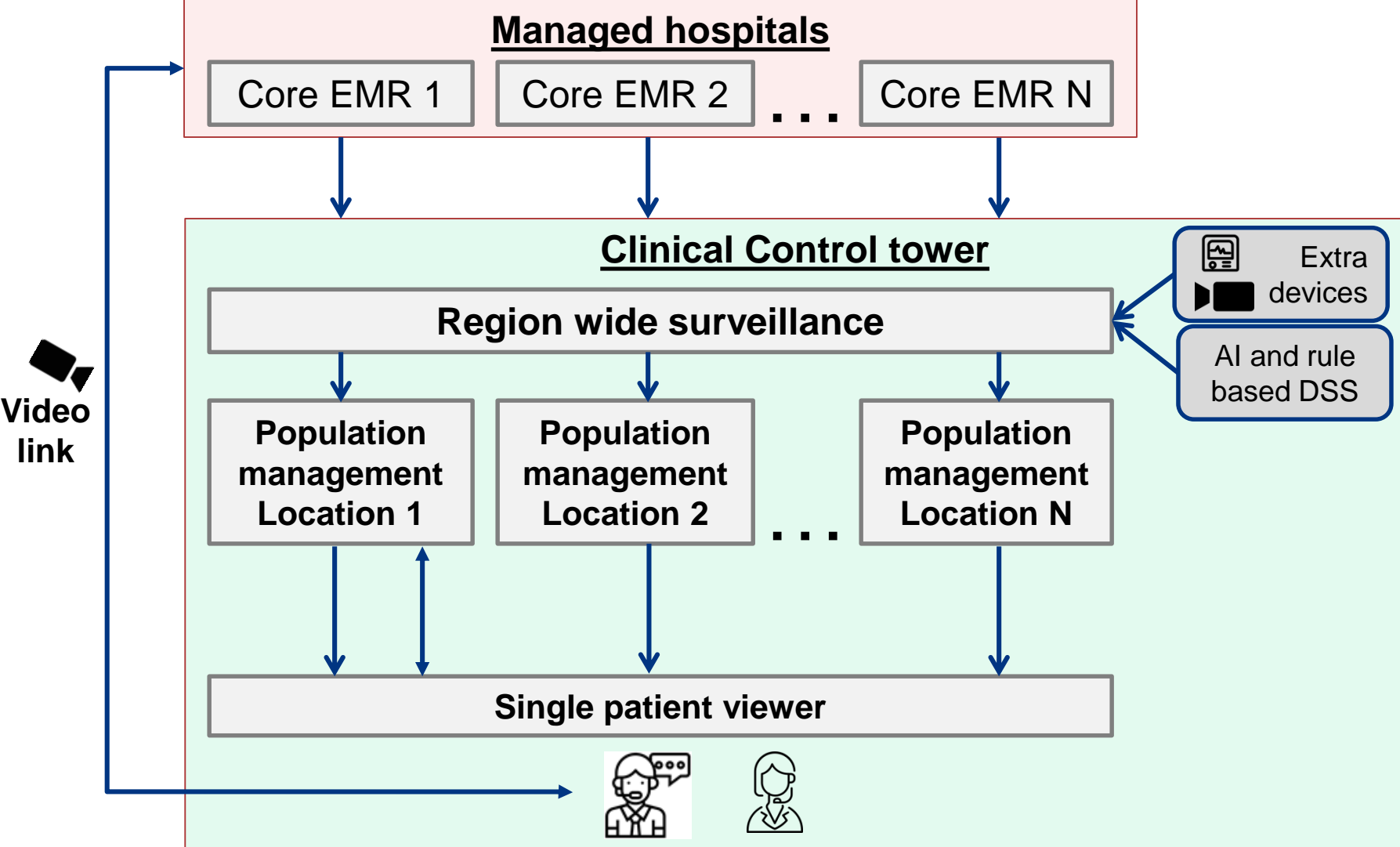
Real time compliance reports become available

Anesthesia Residents trained

New residents and fellows started



Clinical Control Tower – new generation of delivery platform



Clinical control tower- surveillance monitoring



Rochester Saint Marys Methodist Arizona Florida Mayo Health Systems



find a patient

368

Vitaly Herasevich



List View Geo View

<< first < prev 1 2 3 4 5 ... 94 next > last >>

1

10 patients per page

Advanced filter Demo Mode

<p>68 years Female 11 days in the hospital</p> <p>Facility: ROSMC Dept: [redacted] Room: [redacted]</p> <p>97 Palliative</p>	<p>Problems List 45 total</p> <ol style="list-style-type: none"> Diabetes Mellitus Type 2 With Unspecified Diabetic Retinopathy Without Macular Edema (HCC) Infection Bloodstream Catheter Related Initial Bacteremia Infection Urinary Tract 	<p>24-hour Events 3 total</p> <ol style="list-style-type: none"> Hospital Internal Medicine PROGRESS Nursing Services CARE PLAN Nursing Services CARE PLAN 	<p>New</p> <p>Open Ineligible</p>
<p>84 years Male 1 day in the hospital</p> <p>Facility: ROSMC Dept: [redacted] Room: [redacted]</p> <p>91 Palliative</p>	<p>Problems List 39 total</p> <ol style="list-style-type: none"> Delirium Palliative Care Failure Heart Biventricular (HCC) Acute And Chronic Respiratory Failure With Hypoxia (HCC) 	<p>24-hour Events 5 total</p> <ol style="list-style-type: none"> Respiratory Therapy CARE PLAN Respiratory Therapy CARE PLAN Critical Care Medicine Disch Summ Critical Care Medicine PROGRESS 	<p>New</p> <p>Open Ineligible</p>
<p>73 years Female 33 days in the hospital</p> <p>Facility: RORMC Dept: [redacted] Room: [redacted]</p> <p>77 Palliative</p>	<p>Problems List 37 total</p> <ol style="list-style-type: none"> Failure Liver (HCC) Do Not Resuscitate Status Fibrillation Atrial (HCC) Hypotension 	<p>24-hour Events 12 total</p> <ol style="list-style-type: none"> Spiritual Care PROGRESS GNS General Surgery Disch Summ Critical Care Medicine PROGRESS PTO Physical Therapy PROGRESS 	<p>New</p> <p>Open Ineligible</p>
<p>66 years Male 22 days in the hospital</p> <p>Facility: RORMC Dept: [redacted] Room: [redacted]</p> <p>67 Palliative</p>	<p>Problems List 19 total</p> <ol style="list-style-type: none"> Hemophagocytic Lymphohistiocytosis (HCC) Abnormal Coagulation Profile Respiratory Failure With Hypoxia (HCC) Sepsis (HCC) 	<p>24-hour Events 3 total</p> <ol style="list-style-type: none"> PTO Dysphagia CONSULT Nursing Services CARE PLAN Hematology PROGRESS 	<p>New</p> <p>Open Ineligible</p>
<p>81 years Male 1 day in the hospital</p> <p>Facility: RORMC Dept: [redacted] Room: [redacted]</p> <p>67 Palliative</p>	<p>Problems List 24 total</p> <ol style="list-style-type: none"> Sepsis (HCC) Cancer Colon Transverse Personal History Post Operative Nausea/Vomiting Malignant Neoplasm Of Colon (HCC) 	<p>24-hour Events 17 total</p> <ol style="list-style-type: none"> DX CHEST PORTABLE 1 VIEW DX CHEST PORTABLE 1 VIEW DX CHEST PORTABLE 1 VIEW DX ABDOMEN PORTABLE ANTERIOR POSTERIOR 1 VIEW 	<p>New</p> <p>Open Ineligible</p>

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What about AI?

April
1995

College of Healthcare Information Management Executives

April 1995
\$4.95

healthcare

I N F O R M A T I C S

USING ARTIFICIAL

Achieving high-quality, cost-efficient patient care with appropriate use of medical services for the potential cardiac patient has been debated as an inpatient resource management issue. With the application of artificial intelligence, or AI, at Florida Hospital, we no longer rely on a physician's judgment alone for the decision to admit a patient for a cardiac workup. Our system esti-

INTELLIGENCE TO PREDICT MYOCARDIAL INFARCTION



1995

Why AI has become more popular today?

Increase data volumes and storage



Improvements in computing power





REVIEW

A systematic review shows no performance benefit of machine learning over logistic regression for clinical prediction models

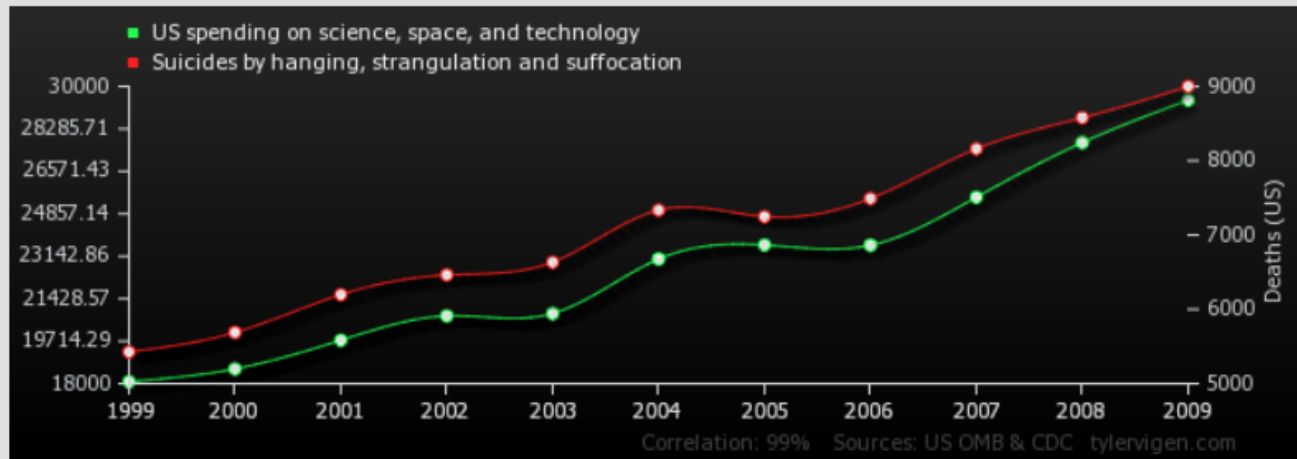
Evangelia Christodoulou^a, Jie Ma^b, Gary S. Collins^{b,c}, Ewout W. Steyerberg^d, Jan Y. Verbakel^{a,e,f}, Ben Van Calster^{a,d,*}

^aDepartment of Development & Regeneration, KU Leuven, Herestraat 49 box 805, Leuven, 3000 Belgium

^bCentre for Statistics in Medicine, Nuffield Department of Orthopaedics, Rheumatology and Musculoskeletal Sciences, Botnar Research Centre, University of Oxford, Windmill Road, Oxford, OX3 7LD UK

Association is not causation

US spending on science, space, and technology
correlates with
Suicides by hanging, strangulation and suffocation



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<i>US spending on science, space, and technology</i> Millions of todays dollars (US OMB)	18,079	18,594	19,753	20,734	20,831	23,029	23,597	23,584	25,525	27,731	29,449
<i>Suicides by hanging, strangulation and suffocation</i> Deaths (US) (CDC)	5,427	5,688	6,198	6,462	6,635	7,336	7,248	7,491	8,161	8,578	9,000

Correlation: 0.992082

AI Limitation #1

The principle limitation of AI is that it learns from the data.

- There is no other way in which knowledge can be incorporated.
- That means any inaccuracies in the data will be reflected in the results.
- And any additional layers of prediction or analysis have to be added separately.

AI Limitation #2

Today's AI systems are trained to do a clearly defined task.

- The system that plays poker cannot play solitaire or chess.
- The system that detects fraud cannot drive a car or give you legal advice.
- In fact, an AI system that detects health care fraud cannot accurately detect tax fraud or warranty claims fraud.

The imagined AI technologies that you see in movies and TV are (STILL) science fiction.

AI Limitation #3 (EMR data)

Problem: EMR data has pre-test probability

EMR data has characteristics that decrease the practicality of most predictive models.

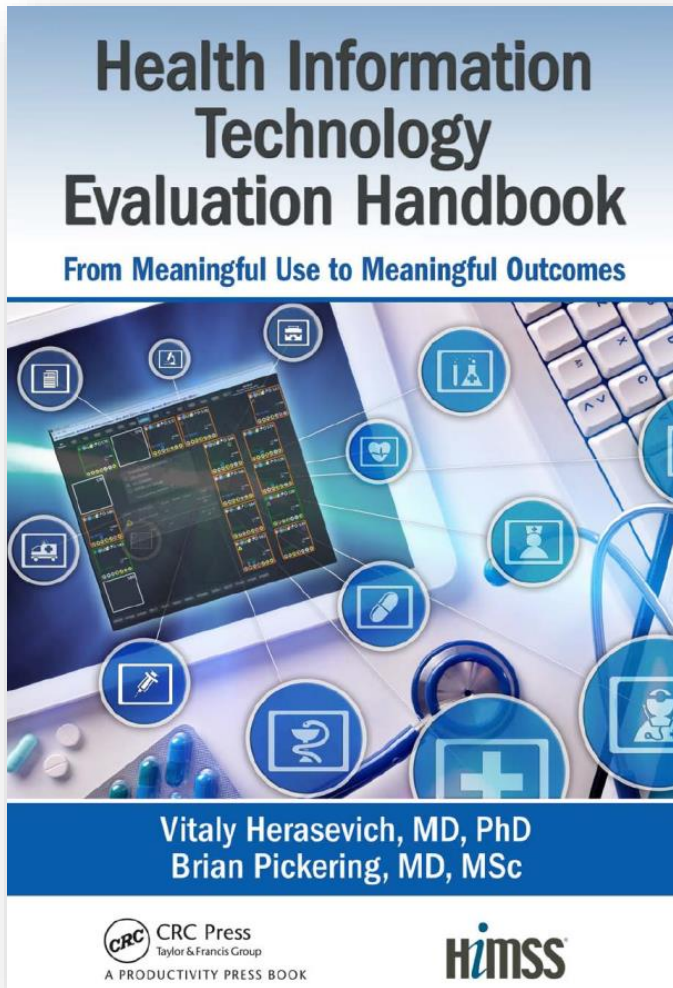
It is **Pretest Probability** which is the probability of a patient having a target disorder before a diagnostic test result is known.

Data is present in the EMR when clinicians cause it to be there as they suspect a specific health problem.

For example, a diagnostic troponin test is ordered because a physician suspects myocardial infarction.

In conclusion

- 1. Use clinical data, not administrative**
- 2. Use computers... automate**
- 3. Constant feedback to providers**



Thank You!

ISBN-10: 1498766471



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