CHCANYS DEFINING NEW DIRECTIONS
Community Health Care Association of New York State

CHCANYS-HCCN Webinar
Part 2: Optimizing the Electronic Health Record Using a Human Factors Approach

Zach Hettinger, MD, MS
Medical Director, MedStar Health National Center for Human Factors in Healthcare
July 16th, 2019

COMMUNITY HEALTH CENTER FQHC QUALITY

Agenda

- Introduction to today's presenter
- Human Factors and EHR Usability Recap
- Usability Case Studies
- Usability Resources
- Announcements and Evaluations

Introductions

MedStar Health National Center for Human Factors in Healthcare

Zach Hettinger, MD, MS

- *Emergency Physician*, MedStar Union Memorial Hospital
- *Medical Director*, MedStar Health National Center for Human Factors in Healthcare
- *Associate Professor*, Georgetown University School of Medicine

MedStar Health

Knowledge and Compassion

Focused on You

Optimizing the Electronic Health Record Using a Human Factors Approach

A. Zach Hettinger, MD MS FACEP

Medical Director

National Center for Human Factors in Healthcare

MedStar Institute for Innovation (MI2), MedStar Health Research Institute

Assistant Professor of Emergency Medicine

Georgetown University School of Medicine

Disclosures

- Office of the National Coordinator
- Agency for Healthcare Research and Quality
  - (R21 HS024755, R01 HS022542)
- National Institutes of Health
- Veterans Affairs
- Foundation Grants
  - Latham Foundation
  - American Society for Healthcare Risk Management
  - PEW Charitable Trust
  - American Medical Association

Objectives

The participants will…

- Gain an appreciation for the need for health IT safety surveillance
- Leave with concrete actions to apply in your environment
- Identify resources for future exploration

National Center for Human Factors in Healthcare

We focus on studying human capabilities and *designing technology, systems, and processes to meet these capabilities* for safety, efficiency, & quality

Multidisciplinary approach:

- Human factors
- Medicine
- Engineering
- Computer Science
- Psychology

Usability: Interface Design and Usefulness

User Interface Design

Context Independent

Font Sizes

Icons

Colors & Contrast

Layout

Cognitive Task Support

Context Dependent

“Workflow Design”

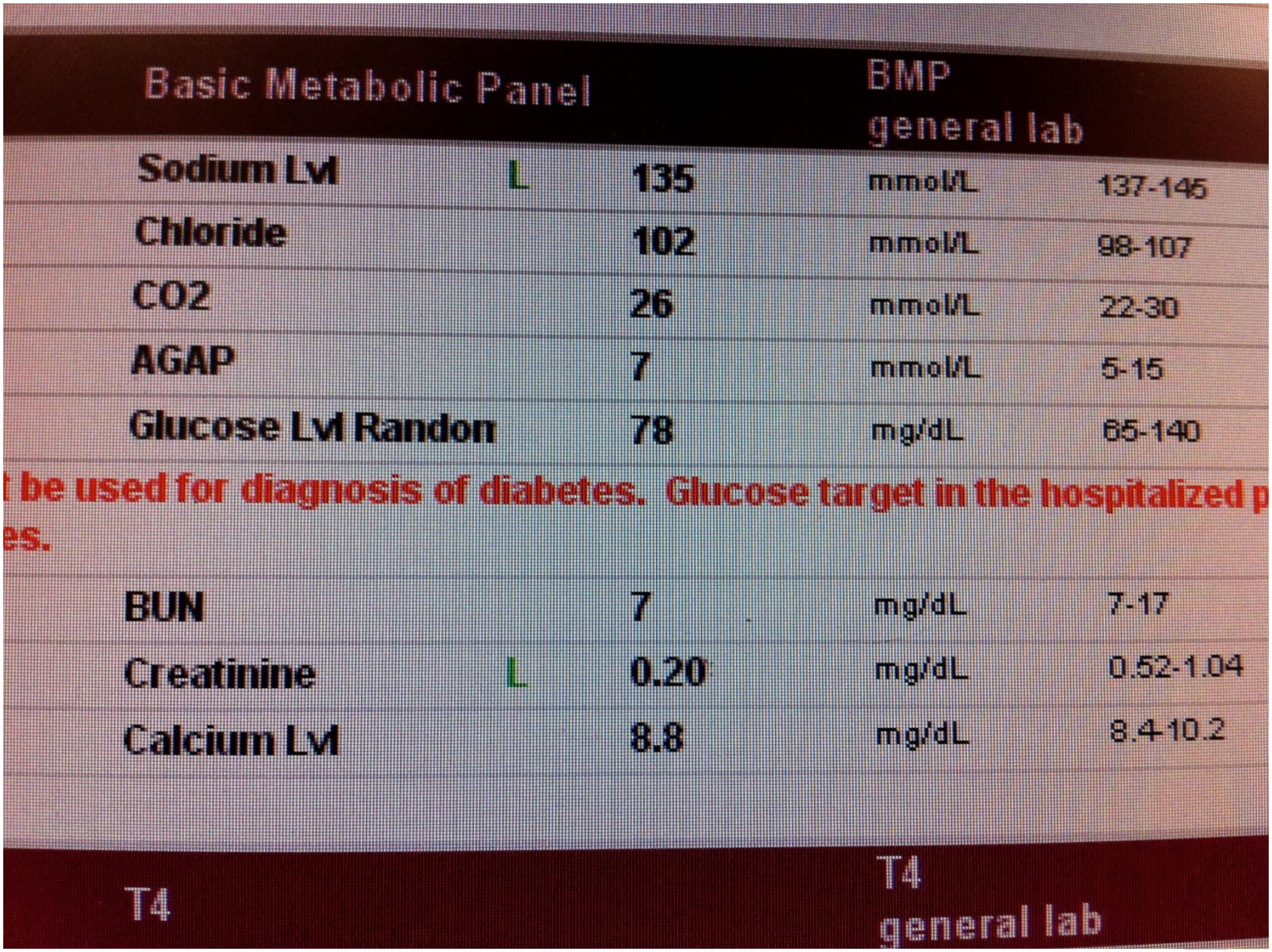
Visualization

Memory Aids

Error Anticipation

WHAT SAFETY/USABILITY ISSUES?

What's Abnormal?



Basic Metabolic Panel			BMP general lab	
Sodium Lvl	L	135	mmol/L	137-145
Chloride		102	mmol/L	98-107
CO2		26	mmol/L	22-30
AGAP		7	mmol/L	5-15
Glucose Lvl Randon		78	mg/dL	65-140

t be used for diagnosis of diabetes. Glucose target in the hospitalized p
es.

BUN		7	mg/dL	7-17
Creatinine	L	0.20	mg/dL	0.52-1.04
Calcium Lvl		8.8	mg/dL	8.4-10.2

T4			T4 general lab	

325 mg, Soln-Oral, PO, One Time, STAT, ED ONLY
120 mg, Supp, PR, One Time, STAT, ED ONLY
650 mg, Supp, PR, One Time, STAT, ED ONLY
325 mg, Tab, PO, One Time, STAT, ED ONLY
500 mg, Tab, PO, One Time, STAT, ED ONLY
650 mg, Tab, PO, One Time, STAT, ED ONLY
1,000 mg, Tab, PO, One Time, STAT, ED ONLY
1,000 mg, Inj, IVPB, One Time, Indication: Other One time dose
325 mg, Soln-Oral, PO, q6h PRN, pain/fever/headache, Indication: Other pain/fever/headache
650 mg, Soln-Oral, PO, q6h PRN, pain/fever/headache, Indication: Other pain/fever/headache
325 mg, Supp, PR, q6h PRN, pain/fever/headache, Indication: Other pain/fever/headache
650 mg, Supp, PR, q6h PRN, pain/fever/headache, Indication: Other pain/fever/headache
325 mg, Tab, PO, q4h PRN, pain/fever/headache, Indication: Other pain/fever/headache
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650 mg, Tab, PO, q4h PRN, pain/fever/headache, Indication: Other pain/fever/headache
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650 mg, Tab, PO, q6h PRN, pain/fever/headache, Indication: Other pain/fever/headache
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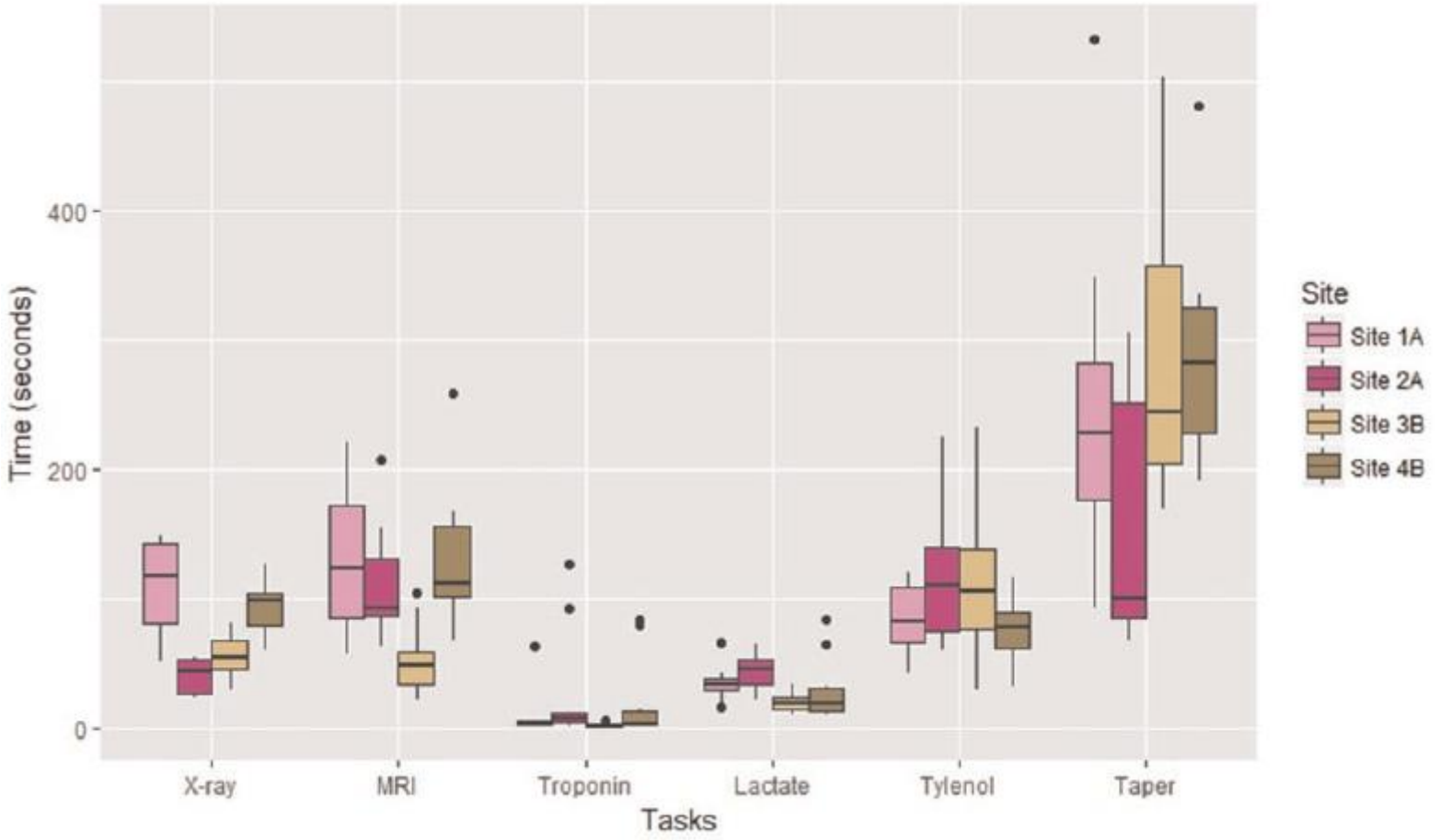
Physician Variability



EHR Usability & Safety Testing

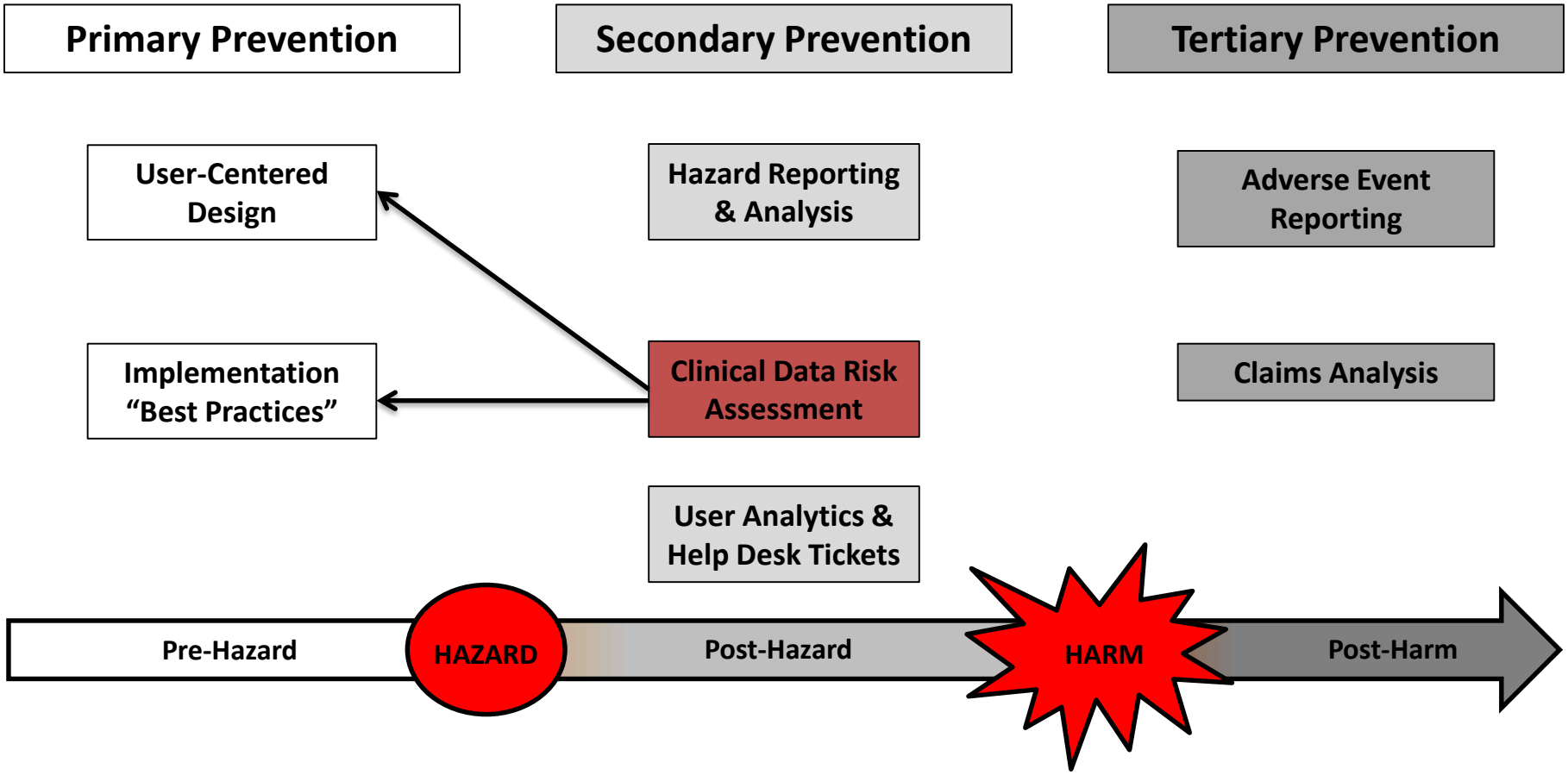
EHR Functions	Usability & Safety Metrics	Vendor A-Site 1	Vendor A-Site 2	Vendor B-Site 3	Vendor B-Site 4
X-ray (left elbow, wrist, forearm)	Time (sec)	64.1	24.3	33.3	55.5
	Clicks	31.1	7.7	8.1	15.5
	Error Rate	25%	16.7%	**35.7%**	20%
Prednisone Taper (60mg, reduce by 10mg every 2 days for 12 days)	Time (sec)	148.6	152.7	175.1	178.7
	Clicks	34.9	20	42.3	28.2
	Error Rate	16.7%	**41.7%**	**50%**	**40%**

Ratwani et al. (2018) A Usability and Safety Analysis of Electronic Health Records. Journal of the American Medical Informatics Association.

Modifying EHR Usability to Change Clinical Behavior

APPROACH

Why Health IT Safety Suvellience?



Integrated Patient Safety Transformational(PST) Model

Modifying EHR Usability to Change Clinical Behavior

HEALTH IT BLACKBOX


AlliedSignal
ENREGISTREUR
DE VOL
NE PAS OUVRIR

Flight Data Recorders

- Record in Real-time
  - Cockpit Voice
  - Instruments/Displays
  - Avionics

Air France 447

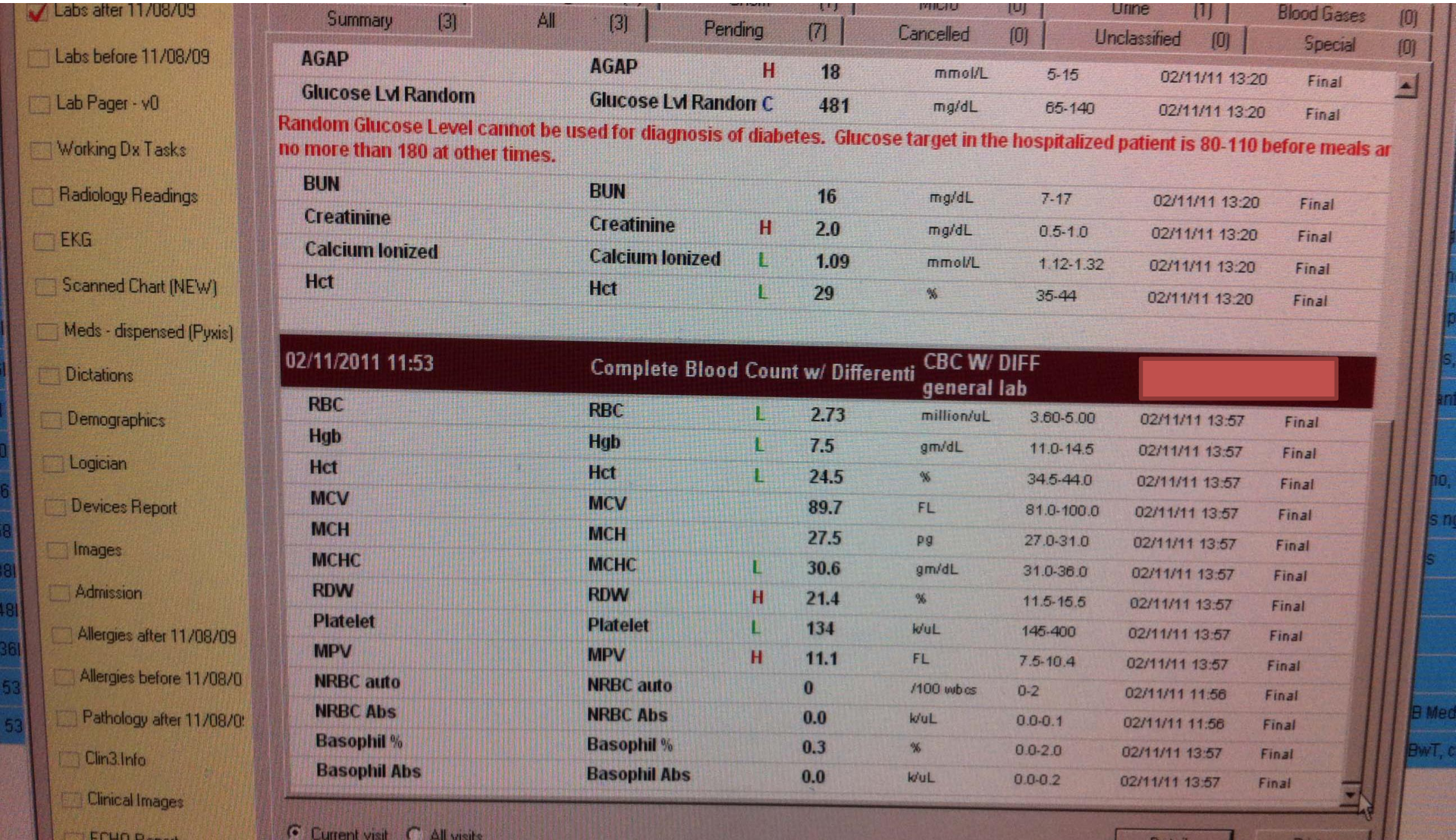
- Rio de Janeiro to Paris
- Crashed in Atlantic Ocean June 1st,2009
- Killing 228 Passengers and Crew

- “At 02:10:05 UTC the autopilot disengaged because the blocked pitot tubes were no longer providing valid airspeed information, and the aircraft transitioned from normal law to alternate law 2. The engines' auto-thrust systems disengaged three seconds later. Without the auto-pilot, the aircraft started to roll to the right due to turbulence, and the pilot reacted by deflecting his side-stick to the left.”

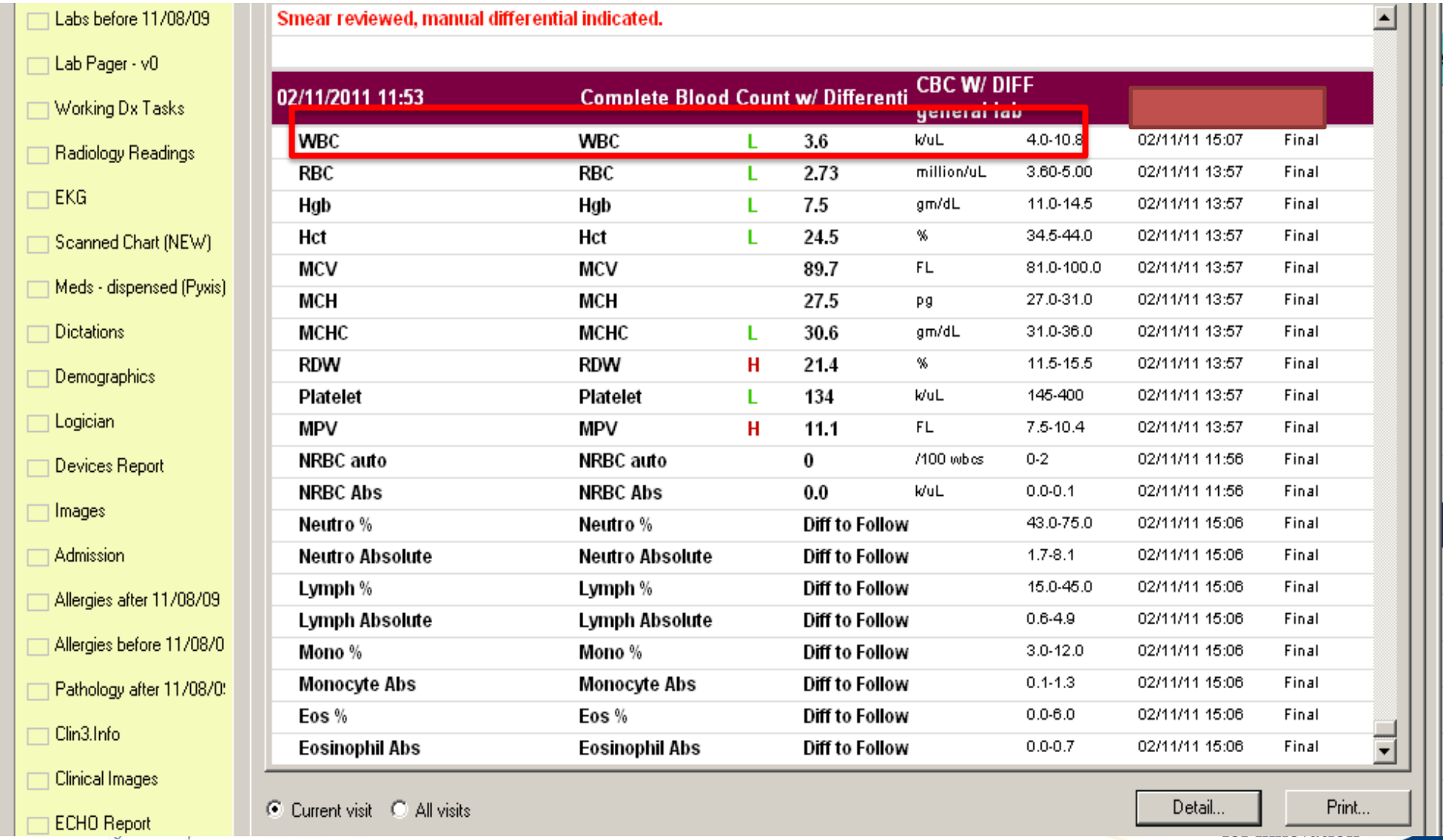
A Health IT BlackBox

- Recreate “accidents” as they unfolded

What's Abnormal



Missing White Blood Cell Count



CASE & RESOURCES

PEW

TOPICS PROJECTS FEATURES ABOUT GET INVOLVED SEARCH

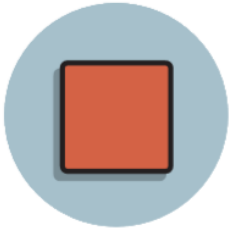
Ways to Improve Electronic Health Record Safety

Rigorous testing and establishment of voluntary criteria can protect patients

REPORT August 28, 2018 Topics: Health Care Projects: Health Information Technology Tags: Medical Devices Read time: 20 min

https://www.pewtrusts.org/en/projects/health-information-technology

Usability issue	Scenario	Definition	Setting
1. Accessibility	1-Basic	Pulmonary nodule	Ambulatory
	1-Advanced	Buried Ebola	Emergency department
2. Alerting	2-Basic	Free-text allergy	Inpatient
	2-Advanced	Food-drug alert	Ambulatory
3. System default	3-Basic	Hydromorphone overdose	Emergency department
	3-Advanced	Medication scheduling	Inpatient
4. Data entry	4-Basic	Weight-based dosing error catching	Ambulatory
	4-Advanced	Prednisone taper	Inpatient
5. Display/visual clutter	5-Basic	Missing potassium	Emergency department
	5-Advanced	Duplicate order sets	Inpatient
6. Interoperability	6-Basic	Prescription drug monitoring program data access	Emergency department
	6-Advanced	Canceling eRx	Ambulatory
7. Workflow support	7-Basic	Rapid strep test reflex testing	Ambulatory
	7-Advanced	Physician-nurse simultaneous ordering	Inpatient



Scenario 1-Basic
Pulmonary Nodule

Usability topic: Accessibility	**Estimated time:** 10 minutes
Setting: Ambulatory	**User/audience:** Physician

Scenario summary: A patient needs follow-up for a lung nodule, but the physician realizes mid-order that results from previous studies are necessary.

Particular area of risk or inefficiency: Frequently, clinicians need to access details of prior tests while ordering new diagnostic tests. If this clinical workflow need is not accounted for in the design of the EHR, the clinician may start placing a new diagnostic test order, have to cancel that order, navigate to the prior test results, review those results, and then return to placing the original diagnostic order. These extra steps introduce an unnecessary interruption in the clinician's workflow that may lead to errors in recall, with the clinician potentially forgetting the primary task and delaying care.

Realism/generalizability: This scenario may be easy to complete in an EHR that allows the user to review diagnostic testing and/or automatically pulls up previous results to similar tests that are being ordered. This scenario will present significant challenges to users of systems that require them to cancel an order that is currently being placed to review previous diagnostic results in other parts of the EHR. This case may be adapted for use with laboratory tests (e.g., cardiac troponin test) to make the case less challenging.

Begin scenario

A 71-year-old male patient presents for a follow-up visit for a lung nodule last evaluated six months ago. The patient has a history of smoking (a pack a day for 30 years), chronic obstructive pulmonary disease (COPD), and hypertension. The patient takes hydrochlorothiazide 25 mg. daily and tiotropium 18 mcg. daily with no allergies to any medications.

Task

1. *Begin an order for a CT scan of the chest with contrast to evaluate a pulmonary nodule, but do not sign the order.*

2. *While ordering the CT scan, you decide to review the last two CT scans and to document in the order the previous size of the nodule.* [On review of the prior chest CT scans, the participant will see a CT scan from six months prior with an 8-mm. right-upper-lobe nodule and 12 months prior with a 6-mm. nodule in the same position.]

3. *Now sign the order after including the findings from the previous CT scan reports.*

Measures

The scenario fails if the participant is unable to:

- Add requested information to the order.
- Place the CT scan as specified.
- Review previous results without losing the new CT scan order.

Note

Not recommending close follow-up for a pulmonary nodule can result in significant delays in care for patients with lung cancer. This can prove to be the difference between successful treatment and death for patients. One EHR review found 37.8 percent of 587 patients with lung cancer had delays in care.*

* Hardeep Singh et al., "Characteristics and Predictors of Missed Opportunities in Lung Cancer Diagnosis: An Electronic Health Record-Based Study," *Journal of Clinical Oncology* 28, no. 20 (2010): 3307–15, http://ascopubs.org/doi/10.1200/JCO.2009.25.6636.

Scenario 4-Basic

Weight-Based Dosing Error Catching

Usability topic: Data entry	**Estimated time:** 10 minutes
Setting: Ambulatory	**User/audience:** Technician/nurse

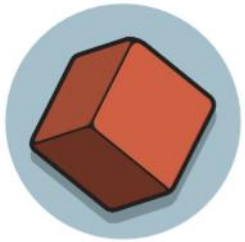
Scenario summary: The participant entering the patient's information accidentally records the weight in pounds in the EHR.

Particular area of risk or inefficiency: To reduce this error, EHRs may be implemented to allow only metric measurements. However, some EHRs and health care organizations still allow for multiple units of measure (kilogram or pounds) and may display information in a confusing manner that increases the risk of errors in dangerous weight-based medication orders. Even if only kilograms can be entered, staff may use estimated weights from the patient that are typically communicated in pounds or scales that may display pounds.

Realism/generalizability: Test sites may choose to use measurements that are closer together, making it harder to catch the discrepancy that is being tested. While this scenario tests the user's ability to convert measurements and to avoid accidentally entering measured kilograms into a field for pounds, sites should evaluate the scenario where the user enters pounds into a kilogram field [e.g., in this scenario, the 3-year-old patient receives a weight of 31 kg. (68 lbs.) instead of the actual weight of 31 lbs. (14 kg.)].

Begin scenario

The patient is a 3-year-old girl presenting with urinary tract infection symptoms. On arrival at the office, the patient's height and weight are recorded and documented in the EHR. [The patient should have a weight of 12 kg. (approximately 26.5 lbs.) and length of 85 cm. (33.5 in.) from approximately one year before the usability test date.]



Scenario 6-Advanced

Canceling eRx

Usability topic: Interoperability	**Estimated time:** 20 minutes
Setting: Ambulatory	**User/audience:** Physician

Scenario summary: A pediatric patient presents with a urinary tract infection (UTI) and requires appropriate antibiotics to be sent electronically to the pharmacy. A urinalysis in the office is positive for an infection. The patient appears well and does not require transfer to a higher level of care.

Particular area of risk or inefficiency: With the adoption of electronic prescriptions, there are safety concerns with canceled prescriptions. Although the Surescripts network is capable of transmitting a cancellation request, not all pharmacies are capable of processing the cancellation and not all EHRs will provide feedback to the user that the cancellation was successful.

Realism/generalizability: This scenario requires testing of the electronic prescription system and may require testing and coordination with pharmacies in addition to the health care organization's EHR. This system should also be tested with electronic transmission of controlled substance prescriptions where applicable. Performing this scenario with an already implemented EHR may expose risks in the system that were previously unknown if they were not explicitly tested. Other evaluations not focused on usability could also uncover these risks. This test case represents a different modality to identify EHR usability issues that ideally would have been addressed before implementation.

Begin scenario

A parent brings her 3-year-old daughter to the pediatrician with a fever and history of UTIs. She otherwise appears well and nontoxic. She weighs 14 kg. with no known drug allergies.

https://www.healthit.gov/playbook/electronic-health-records/
https://www.healthit.gov/sites/default/files/playbook/pdf/usability-change-plan.pdf

Quick Start Guide: Take a Dive into EHR Usability

Just getting started with EHR usability?

Introduction

Review the purpose and structure of this resource, and get some basic usability information.

Examples

Review a list of common usability challenges and see how you are doing.

Comfortable with basic EHR usability?

Preparing for Change

Learn about EHR usability from basic design to information support, and understand the types of usability challenges and the role of training and customization.

Problem Finding

Review the basics of identifying usability challenges and understanding the impact of interdisciplinary team communication, and look over some case studies.

Experienced with EHR usability and looking for resources?

Implementing a Solution

Understand the critical considerations you should be aware of when planning an implementation, and become familiar with possible unintended consequences.

Locating a Tool

- Brief overviews for each usability resource
- One-page descriptions with the estimated level of effort required to use the resource
- List of strengths and weaknesses
  - most accessible, easy-to-use tools at the beginning
  - more complicated resources near the end

Additional Resources

- Additional references
- Resources that may contain background information
- Advanced usability resources
- Resources beyond the scope of the primary goal of this document

EHR Usability Problem Examples

Examples of EHR Usability Issues *(See also: Basic Usability Resources)*

This page provides examples of EHR usability issues to show the range of problems that may affect usability. Not every EHR will contain these examples—**they are shown for illustration only**. Other usability challenges are found in the Locating a Tool and Additional Resources sections.

Usability–Basic Design Principles

Nurses are worried about patient safety because the abnormal results on lab tests aren't clearly visible (they are the same font style and color as normal results).

See Case Study Patient Harm Event

☐ YES — Are abnormal and critical results easy to identify and read (e.g., no yellow text on a white background)?

Users have noted that they can't always record the complete medication list details on patients.

See Case Study Help Desk Ticket

☐ YES — If a nurse records non-adherence with an antihypertensive, is that reliably reflected in the medication reconciliation when the physician admits the patient?

Clinicians are noticing that their free text fields for clinical notes are too small for them to make complete remarks.

See Case Study Vendor Support

☐ YES — Are notes made by physicians during the ordering process clearly visible when transmitted to nurses, pharmacists, technicians, and others?

Usability–Information Support Issues

Since a new update to their EHR rolled out, users are having trouble locating lab results as they did in the past.

See Case Study EHR Updates

☐ YES — Do the common search terms and language used in the clinical setting allow users to get to the correct result?

When staff first began using their new EHR, they noticed that the way they were generating reports had changed.

See Case Study Implementing a New EHR

☐ YES — Is the team able to run reports on critical information?

Prescription drug monitoring program data on controlled substances is not available during the initial patient encounter and the prescription writing period.

See Case Study Process Improvement

☐ YES — Is information displayed in a meaningful way at the most appropriate time?

Locating a Tool

Health Information Technology Evaluation Toolkit

Phase of Impact			Estimated Effort		
Design and Implementation	Hazard Analysis	Harm Reduction	Low	Moderate	High
	■				■

Description

This PDF document from AHRQ guides users through the steps of planning an evaluation of the impact of their health IT projects. The document is broken down into three sections: Section I helps the user create measurable and realistic goals and figure out how to measure them, Section II provides a list of measures that could be used, and Section III contains examples of implementation projects. Measurement areas covered in the document include clinical outcomes, clinical process, provider adoption and attitude, patient adoption, workflow impact, and financial impact.

Tools

- Health IT Evaluation Toolkit

Strengths

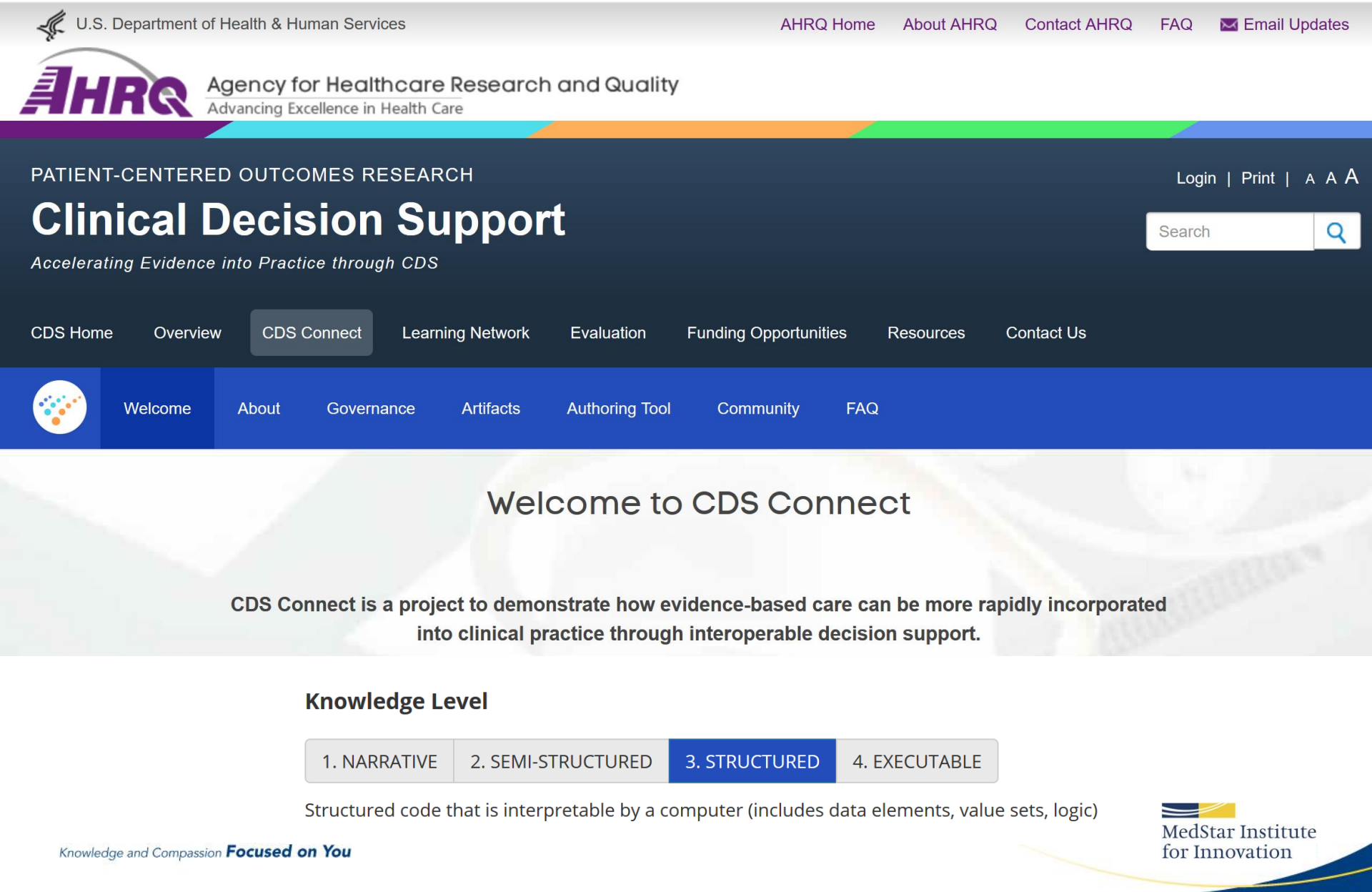
- Provides many examples of potential measures users might consider when evaluating their system
- Could be used in all parts of the EHR lifecycle, such as evaluating a new intervention in a current system or a new system evaluation

Areas for Improvement

- Older document, some links are outdated
- Some of the evaluation techniques would be resource-intensive

https://cds.ahrq.gov/cdsconnect

CDS Connect



Primary Health Care

Mar 07 2018

Primary Care: Family Health History Documentation Template

SMART DOCUMENTATION FORM

Publisher: Veterans Health Administration

Primary Health Care | Internal Medicine | Medical History Taking

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Mar 27 2018

Mental Health: Homelessness Documentation Template

SMART DOCUMENTATION FORM

Publisher: Veterans Health Administration

Primary Health Care | Internal Medicine | Mental Health | Homeless Persons

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Mar 26 2018

Primary Care: General Clinical Note - History and Physical Exam Documentation Template

SMART DOCUMENTATION FORM

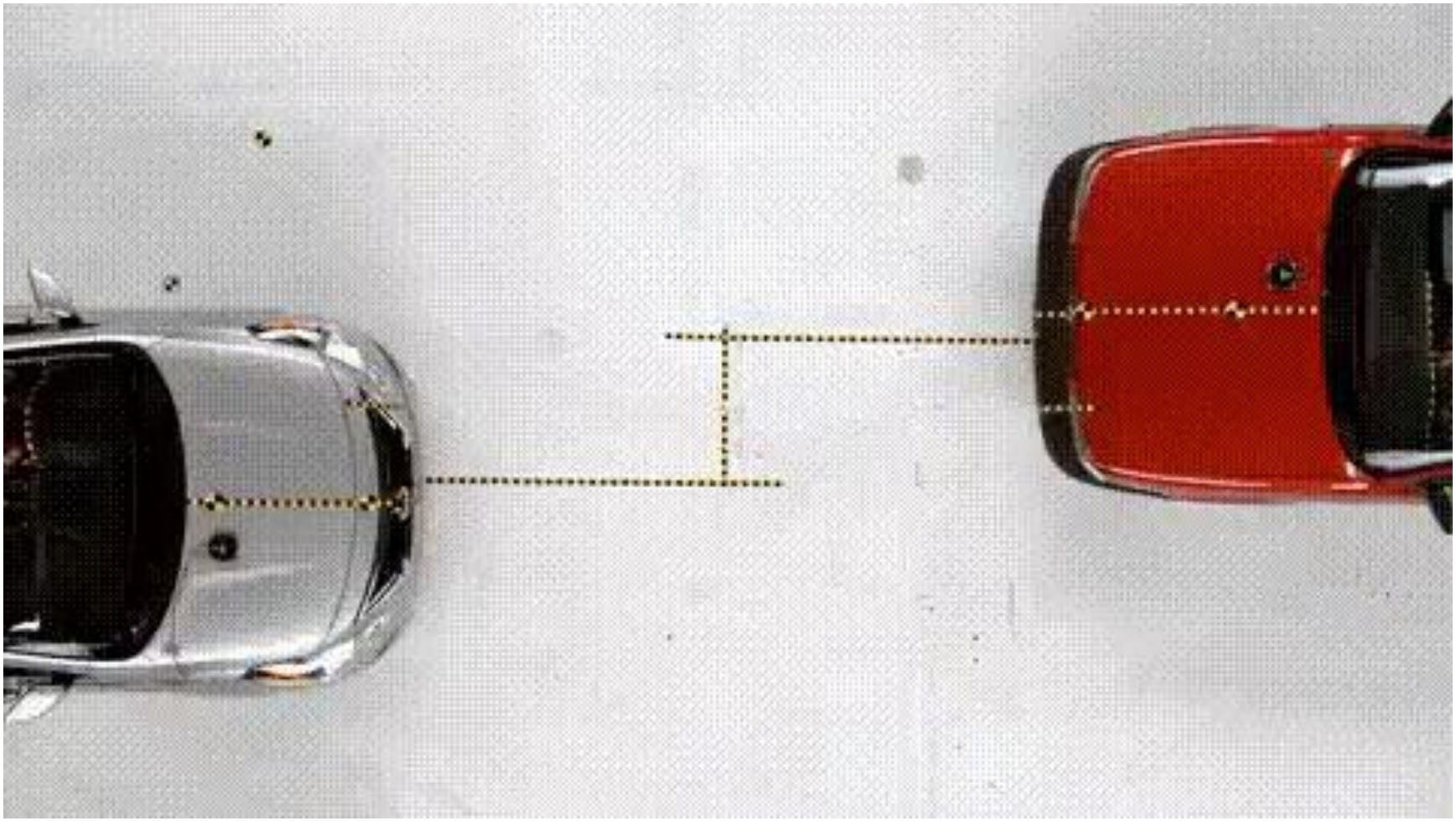
Publisher: Veterans Health Administration

Primary Health Care | Internal Medicine | Medical History Taking | Physical Examination

Be Optimistic

http://www.youtube.com/user/iihs
http://www.iihs.org

Always room to improve



Summary, Takeaways, & Next Steps

Summary

- PST Model
- Health IT BlackBox

Takeaways

- PEW Safety/Usability Cases
- ONC Usability Change Package
- CDS Connect

Thank You

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MedStar Health

Knowledge and Compassion **Focused on You**

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National Center for
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MedStar Institute
for Innovation

Announcements

- HCCN Upcoming Workshop – **Leveraging Data from External Sources to Optimize Practice & EHR Workflows**
  - July 30th, 2019 from 9:30am-4:30pm
  - Metropolitan College, 60 West Street, New York, NY 10006

SURVEY LINK

https://www.surveymonkey.com/r/XTL8VQK

Questions?

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