CONCEPTUAL FRAMEWORKS TO MEASURE THE INTERSECTION OF HEALTH IT AND PATIENT SAFETY

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Safety Begins with Measurement

We cannot improve what we cannot measure!

We cannot measure what we cannot define!

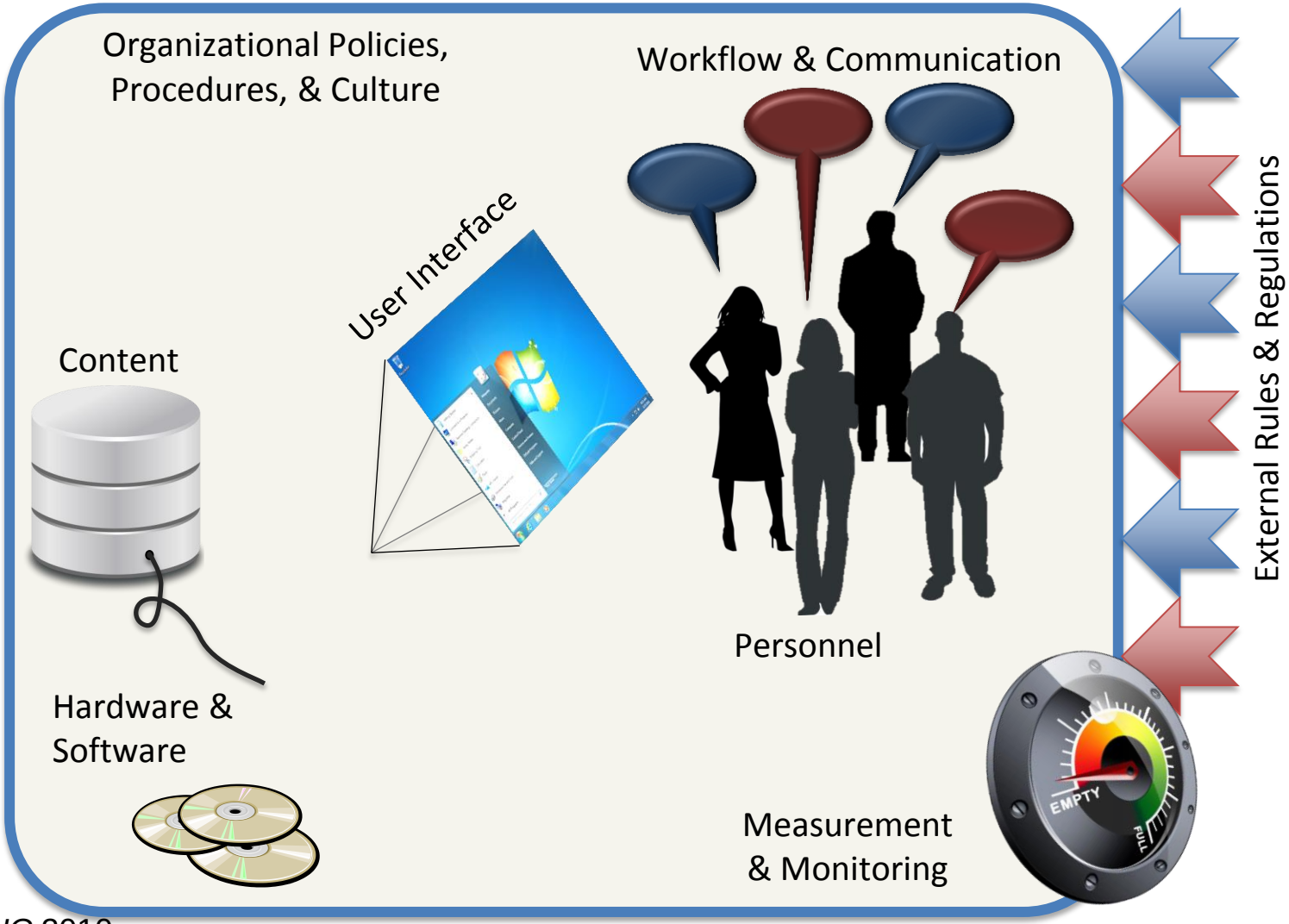
Why New Measurement Approaches?

- Implementation & use of health IT inherently complex, prone to failure and leads to unintended consequences
  - Measurement essential in our journey to ensure safety

Emerging Evidence

- Sentinel event reports received by The Joint Commission (1/2010-6/2013)
- 120 health IT-related sentinel events
- 3 most frequent types of events
  - medication errors (29%)
  - wrong-site/procedure/patient (19%)
  - delays in treatment (12%)

8-dimensional Socio-Technical Model of Safe & Effective Health IT Use



Sittig Singh *QSHC* 2010

Emerging Evidence

- Web-based survey American Society for Healthcare Risk Management & American Health Lawyers Association members
- Frequency and types of EHR-related serious safety events
- Of 369 respondents, 53% admitted to at least one safety event in previous 5 years
- 10% experienced > 20 events

Menon et al. J Healthc Risk Manag. 2014;34(1):14-26.

SACRAMENTO
BUSINESS JOURNAL

Sutter electronic records system crashed Monday

Aug 27, 2013, 2:57pm PDT | **UPDATED:** Aug 27, 2013, 6:13pm PDT

Kathy Robertson | Senior Staff Writer – *Sacramento Business Journal*

At about 8 a.m. Monday, the electronic health record system at seven East Bay hospitals, medical offices and clinics went dark. The meltdown continued through late afternoon or early evening, according to early reports from the California Nurses Association.

The incident left doctors and nurses without access to patient information — including medications and patient histories — at Alta Bates Summit Medical Center facilities in Berkeley and Oakland, Eden Medical Center in Castro Valley, Mills Peninsula Health Services in Burlingame and San Mateo, Sutter Delta in Antioch, Sutter Tracy, Sutter

The electronic health record system at seven East Bay hospitals, medical offices and clinics went dark on Monday in an unplanned outage. The information technology system had been down for a planned upgrade Friday.

Downtimes anywhere anytime…

- **Survey of Scottsdale Institute Membership**
  - 95% had at least 1 unplanned downtime in past 3 years
  - 79% organizations had at least one unplanned downtime of at least 8 hours
    - 13% had 24+ hours of downtime

Sittig et al. Int J Med Inform. 2014 Nov;83(11):797-804

VA EHR Safety Concerns

- 100 unique investigations (Aug 09 – May 13)
- 344 reported incidents
- 55 VA facilities
- Most safety concerns related to:
  - **unmet data-display** needs in the EHR,
  - **software upgrades or modifications,**
  - **data transmission between EHR components**

Meeks et al J Am Med Inform Assoc. 2014 Nov-Dec;21(6):1053-9

Lessons from the VA Study

- Despite highly sophisticated technology and close monitoring, EHR-related safety concerns are still seen long after "go-live”

- Need constant organizational attention!

Health IT Safety Hierarchy – 3 Phases

- Phase 1: Safe health IT:
  - Events unique/specific to health IT

Sittig & Singh N Engl J Med. 2012 Nov 8;367(19):1854-60

Smokers prescribed Viagra to quit

Smokers trying to quit the habit were mistakenly prescribed anti-impotence drug Viagra by doctors.

The health board said no-one received Viagra

NHS Greater Glasgow and Clyde said the error was due to a computer glitch at two city GP practices.

When GPs selected anti-smoking pill **Zyban**, computers selected **sildenafil**, the generic name for **Viagra**.

A health board spokeswoman said: "At no time was patient care affected by this as all prescriptions are subject to stringent double checking."

The e-Formulary computer system used by GPs automatically selects a list of the most popular drugs when doctors fill out prescriptions.

Some patients went to the pharmacy with a prescription for the anti-impotence drug instead of tablets to help them stop smoking.

Health IT Safety Hierarchy– 3 Phases

- Phase 1: Safe health IT:
  - Events unique/specific to health IT
- Phase 2: Using health IT safely:
  - Unsafe or inappropriate use of technology
  - Unsafe changes in the workflows that emerge from technology use

Sittig & Singh N Engl J Med. 2012 Nov 8;367(19):1854-60

Opinion Paper Open Access

Divvy K. Upadhyay, Dean F. Sittig and Hardeep Singh*

Ebola US Patient Zero: lessons on misdiagnosis and effective use of electronic health records

Abstract: On September 30th, 2014, the Centers for Disease Control and Prevention (CDC) confirmed the first travel-associated case of US Ebola in Dallas, TX. This case exposed two of the greatest concerns in patient safety in the US outpatient health care system: misdiagnosis and ineffective use of electronic health records (EHRs). The case received widespread media attention highlighting failures in disaster management, infectious disease control, national security, and emergency department (ED) care. In addition, an error in making a correct and timely Ebola diagnosis on initial ED presentation brought diagnostic decision-making vulnerabilities in the EHR era into non-technical factors will be needed. Ebola US Patient Zero reminds us that in certain cases, a single misdiagnosis can have widespread and costly implications for public health.

Keywords: cognition; decision-making; diagnostic error; Ebola; electronic medical records; health information technology; human factors; misdiagnosis; patient safety.

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Using EHRs Safely

- Potential for current EHRs to interfere with physician cognition/decision-making
- Use of templates and documentation issues
- Reduced physician efficiency
- Data display issues leading to ambiguity
- "iPatient" and effect on critical thinking skills?
- E-Communication breakdowns persist

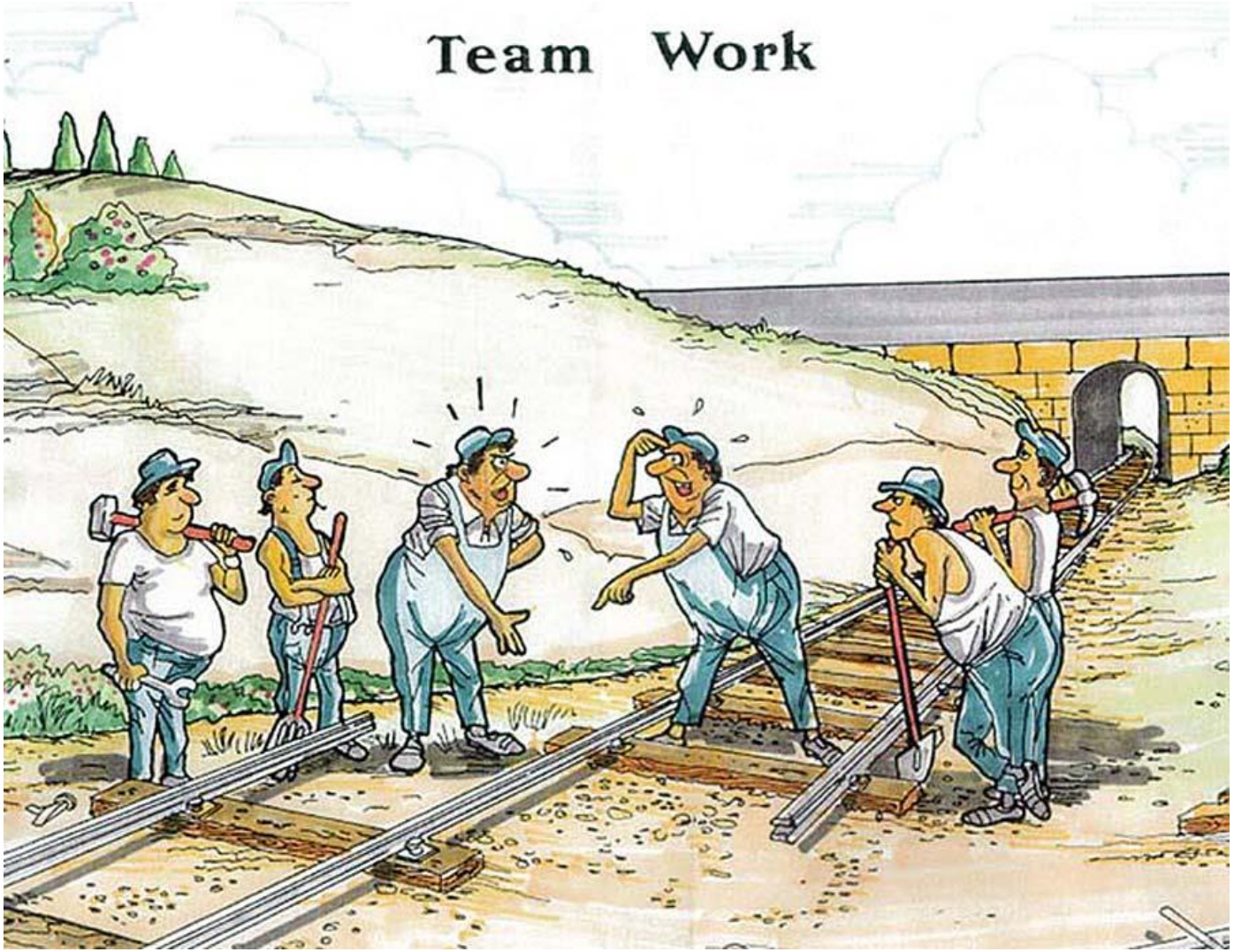
Upadhyaya Sitting Singh *Diagnosis* 2014; Sittig et al JAMIA in Press

Measuring Follow-up of Test Results

- Evaluation of 1,163 outpatient abnormal lab & 1,196 abnormal imaging test result alerts
  - 7% abnormal labs lacked timely follow-up
  - 8% abnormal imaging lacked timely follow-up
- Follow-up in acknowledged vs. unacknowledged alerts?

Singh et al *Am J Med 2010* & Singh et al *Archives of Int Med 2009*

Ambiguous Responsibility



By MICHELLE CASTILLO / CBS NEWS / March 5, 2013, 1:16 PM

Too many electronic health record alerts may be leading doctors to skip them

Your doctor may be more likely to ignore your test results if they come electronically.

A new study published in the JAMA Internal Medicine on Mar. 4 revealed that doctors receive about 63 electronic health record (EHR)-based alerts each day, which are supposed to let them know about abnormal patient results. And, almost one-third of the doctors surveyed -- about 30 percent -- admitted that they had missed some results because of too many alerts.

"If you're getting 100 emails a day, you are bound to miss a few. I study this area and I still sometimes miss emails. We have good intentions, but sometimes getting too many can be a problem," Dr. Hardeep Singh, chief of health policy, quality, and informatics at the Michael E. DeBakey Veterans Affairs Medical Center, in Houston, told TIME.

Health IT Safety Hierarchy – 3 Phases

- Phase 1: Safe health IT :
  - Events unique/specific to EHRs
- Phase 2: Using health IT safely:
  - Unsafe or inappropriate use of technology
  - Unsafe changes in the workflows that emerge from technology use
- Phase 3: Using health IT to improve safety
  - Leveraging health IT to identify unsafe care processes and potential patient safety concerns before harm

Sittig & Singh N Engl J Med. 2012 Nov 8;367(19):1854-60

Using Health IT to Improve Safety

- EHRs can be programmed to help detect easily overlooked /underreported errors
- On a daily basis, thousands of patients have abnormal test results
- Can we electronically identify those likely to be experiencing diagnostic delays and intervene?

Murphy et al BMJQS 2013

BMJ Quality & Safety

The international journal of healthcare improvement

ORIGINAL RESEARCH

Electronic health record-based triggers to detect potential delays in cancer diagnosis

Daniel R Murphy,[1,2] Archana Laxmisan,[1,2] Brian A Reis,[1,2] Eric J Thomas,[3] Adol Esquivel,[4] Samuel N Forjuoh,[5] Rohan Parikh,[6] Myrna M Khan,[1,2] Hardeep Singh[1,2]

ABSTRACT

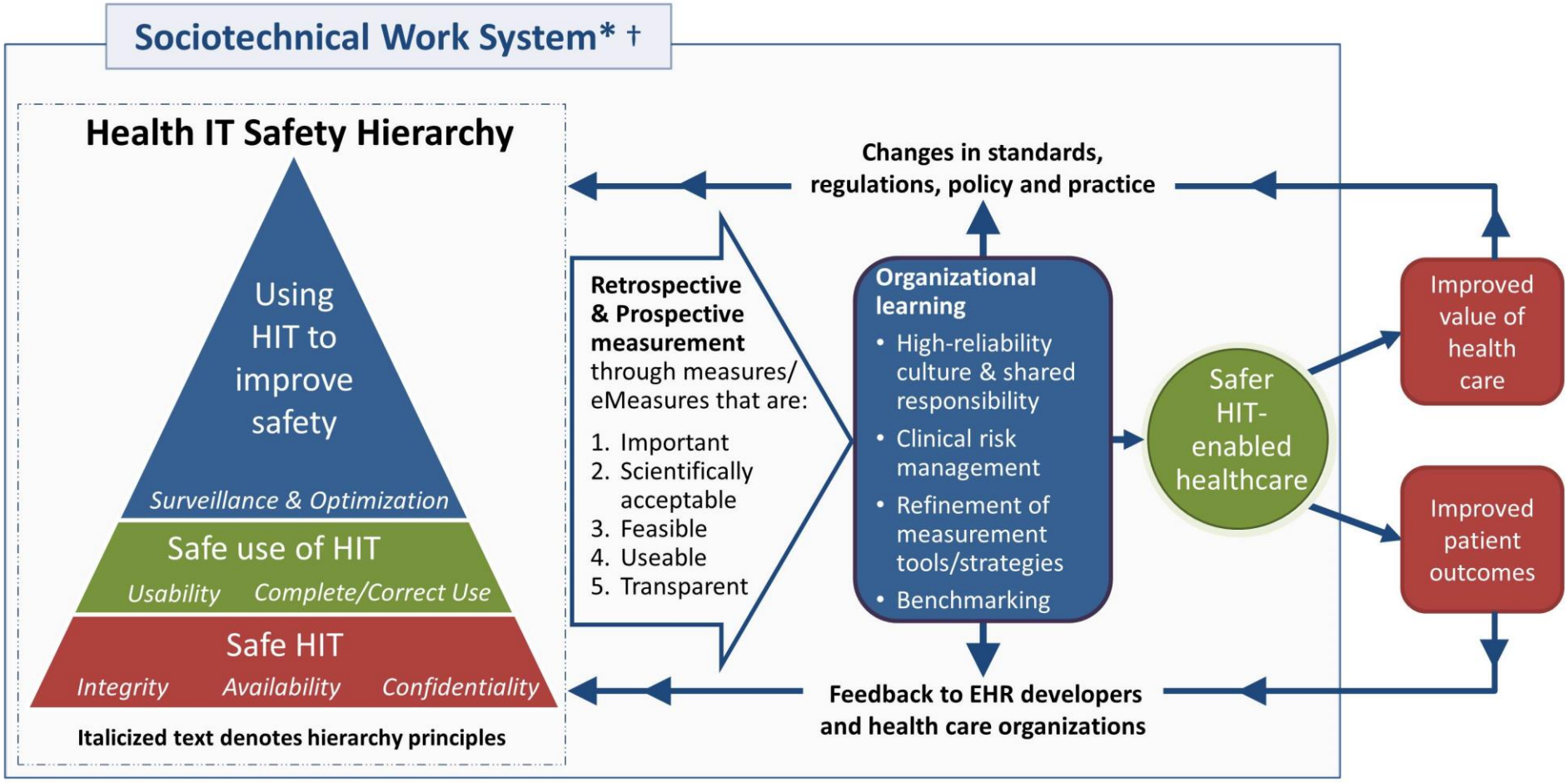
Background Delayed diagnosis of cancer can lead to patient harm, and strategies are needed to proactively and efficiently detect such delays in care. We aimed to develop and evaluate 'trigger' algorithms to electronically flag medical records of patients with potential delays in prostate and colorectal cancer (CRC) diagnosis.

Methods We mined retrospective data from two large integrated health systems with comprehensive electronic health records (EHR) to iteratively develop triggers. Data mining algorithms identified all patient records with specific demographics and a lack of appropriate follow-up of abnormal clinical findings suspicious for cancer.

BACKGROUND

Identifying and preventing delays in cancer diagnosis have proved elusive and challenging to overcome.[1 2] For certain cancers, delays are common and lead to poor outcomes and increased malpractice litigation.[3–8] While root causes of such delays are multifactorial,[2 9–11] many delays arise when abnormal cancer screening results or other 'red flags' are missed by providers.[3 5 12–21] These

Health Information Technology Safety Measurement Framework (HITS Framework)



* Includes 8 technological and non-technological dimensions.

† Includes external factors affecting measurement such as payment systems, legal factors, national quality measurement initiatives, accreditation, and other policy and regulatory requirements.

Defining Major types of HIT-related Safety Concerns

Type of HIT-related safety concern	Examples
1. Instances in which **HIT fails during use or is otherwise not working** as designed.	Broken hardware or software "bugs"
2. Instances in which HIT is working as designed, but the design **does not meet the user's needs or expectations.**	Usability issues
3. Instances in which HIT is well-designed and working correctly, but was **not configured, implemented, or used in a way anticipated or planned** for by system designers and developers	Duplicate order alerts that fire on alternative PRN pain medications

Sittig Classen Singh J Am Med Inform Assoc. 2014 Oct 20

5 Major types of HIT-related Safety Concerns

Type of HIT-related safety concern	Examples
4. Instances in which HIT is working as designed, and was configured and used correctly, but **interacts with external systems (e.g., via hardware or software interfaces) so that data is lost or incorrectly transmitted or displayed.**	Medication order for extended release morphine inadvertently changed to immediate release morphine by error in interface translation table
5. Instances in which specific safety **features or functions were not implemented or not available** (i.e., HIT could have prevented a safety concern).	Hospitalized patient inadvertently receives 5 grams of acetaminophen in 24 hours because maximum daily dose alerting was not available

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Examples of What Can We Measure-1

- Unexpected EHR-related downtimes lasting more than 8 hours
- Mean EHR response time as measured from the end-users viewpoint
- Erroneous displays of laboratory test results or medications
- Software bugs reported to the EHR vendor

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Examples of What Can We Measure-2

- Interruptive alerts with ~100% override rate
- % of EHR users trained and passing a competency test before getting a login
- Rate of Computer-based provider order entry use
- % of "order-retract-reorder" events recorded
- % of potential duplicate patients in the live clinical database (i.e., same First name, Last name, and date of birth)

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Examples of What Can We Measure-3

- % of patients with abnormal laboratory test results without appropriate follow-up
- % of patients with positive sepsis alert transferred to ICU within 1 hour of identification
- Automated measures of Hospital Acquired Conditions (HACs) or early warning signs

Proactive Measurement

- ONC-sponsored "Safety Assurance Factors for EHR Resilience (SAFER) project"
- Proactive risk assessment and guidance
- "1st draft" of best practices and knowledge
- Self-assessment; not meant to be regulatory
  - Focused on high-risk areas
  - Nine guides

Singh et al *BMC Med Inf* 2013

http://www.healthit.gov/safer

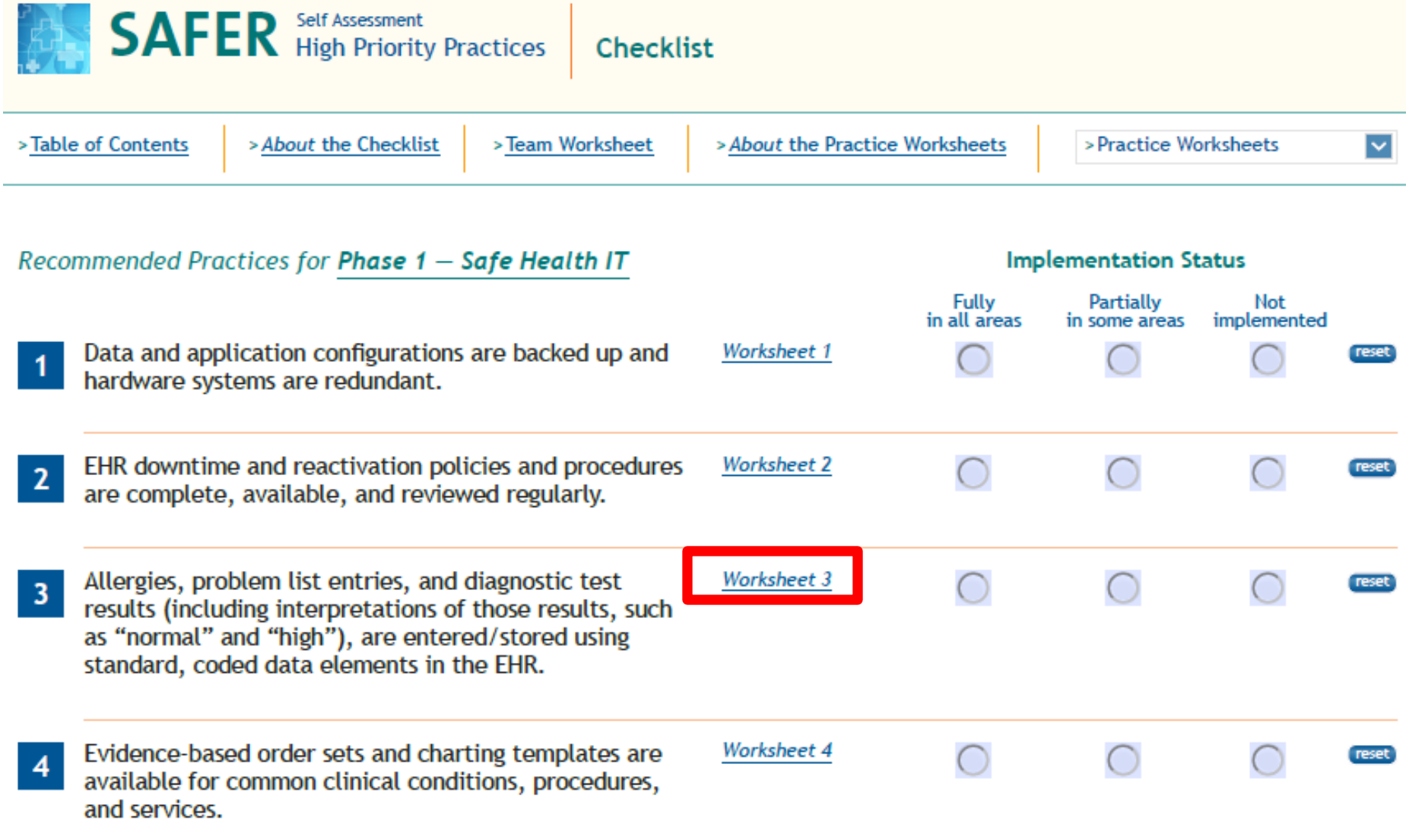
SAFER: Safety Assurance Factors for EHR Resilience

http://www.healthit.gov/safer

- **Foundational Guides**
  - High Priority Practices
  - Organizational Responsibilities
- **Infrastructure Guides**
  - System Configuration
  - System Interfaces
  - Contingency Planning
- **Clinical Process Guides**
  - Patient Identification
  - Computerized Provider Order Entry with CDS
  - Test Results Reporting and Follow-up
  - Clinician Communication

Sittig, Singh, Ash. Am J Manag Care. 2014;20(5):418-423

SAFER Recommended Practices



SAFER Worksheet – Practice 3

SAFER Self Assessment High Priority Practices | Recommended Practice 3 Worksheet | *Phase 1 – Safe Health IT*

> Table of Contents | > *About* the Checklist | > Team Worksheet | > *About* the Practice Worksheets | > Practice Worksheets

Recommended Practice

3 Allergies, problem list entries, and diagnostic test results (including interpretations of those results, such as "normal" and "high"), are entered/stored using standard, coded data elements in the EHR.[7,12-21] Meaningful Use *Checklist*

Implementation Status

Rationale for Practice or Risk Assessment

Free text data cannot be used by clinical decision support logic[22] to check for data entry errors or notify clinicians about important new information.

Suggested Sources of Input

Clinicians, support staff, and/or clinical administration

EHR developer

Examples of Potentially Useful Practices/Scenarios

- RxNorm is used for coding medications and NDF-RT for medication classes.
- SNOMED-CT is used for coding allergens, reactions, and severity

Assessment Notes

Take Home

- Essential to have robust definitions & shared mental models
- Certain risk areas are now well defined and amenable to local measurement for QI/safety purposes
- Measuring health IT-related safety needs to become an essential component of overall patient safety strategy

Thank you…

Funding Agencies

- Department of Veterans Affairs
- Agency for Health Care Research & Quality
- National Institute of Health
- Office of National Coordinator (SAFER Guides)
- Multidisciplinary team at Houston-based VA Health Services Research Center of Innovation

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