U.S. Department of Health and Human Services

Agency for Healthcare Research and Quality
Advancing Excellence in Health Care • www.ahrq.gov

# A National Web Conference on Assessing Safety Risks Associated With EHRs


**Presented by:**
David Classen, M.D., M.S.
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**Moderated By:**
Edwin Lomotan, M.D.
Agency for Healthcare Research and Quality


August 29, 2016

# Agenda

- Welcome and Introductions
- Presentations
- Q&A Session With Presenters
- Instructions for Obtaining CME Credits

**Note:** After today's Webinar, a copy of the slides will be emailed to all participants.

# AHRQ's Mission

To produce evidence to make health care safer, higher quality, more accessible, equitable, and affordable, and work within the U.S. Department of Health and Human Services and with other partners to make sure that the evidence is understood and used.

# How AHRQ Makes a Difference

- AHRQ **invests in research and evidence** to understand how to make health care safer and improve quality.
- AHRQ creates materials to **teach and train** health care systems and professionals to **catalyze** improvements in care.
- AHRQ **generates measures and data** used to track and improve performance and evaluate progress of the U.S. health system.

# AHRQ Health IT Funding

Apply now for **Research Demonstration and Dissemination Projects** in clinical decision support:

- Scale and spread of existing clinical decision support for patient-centered outcomes research http://grants.nih.gov/grants/guide/pa-files/PA-16-283.html
- Develop new clinical decision support for patient-centered outcomes research http://grants.nih.gov/grants/guide/pa-files/PA-16-282.html

The Division of Health IT is **actively seeking R03, R21, R18, and R01 applications** to study:

- Design, implementation, usability, and safe use of health IT http://grants.nih.gov/grants/guide/notice-files/NOT-HS-16-009.html
- Use of health IT for patient-reported outcomes to improve quality http://grants.nih.gov/grants/guide/notice-files/NOT-HS-16-015.html

# Presenters and Moderator Disclosures

The following presenters and moderator have no financial interests to disclose:

- Jason Adelman, M.D., M.S.
- Edwin Lomotan, M.D.

Dr. Classen would like to disclose that he is an employee/stockholder of Pascalmetrics, and he is a consultant to Mentice, Phillips, and Health Catalyst.

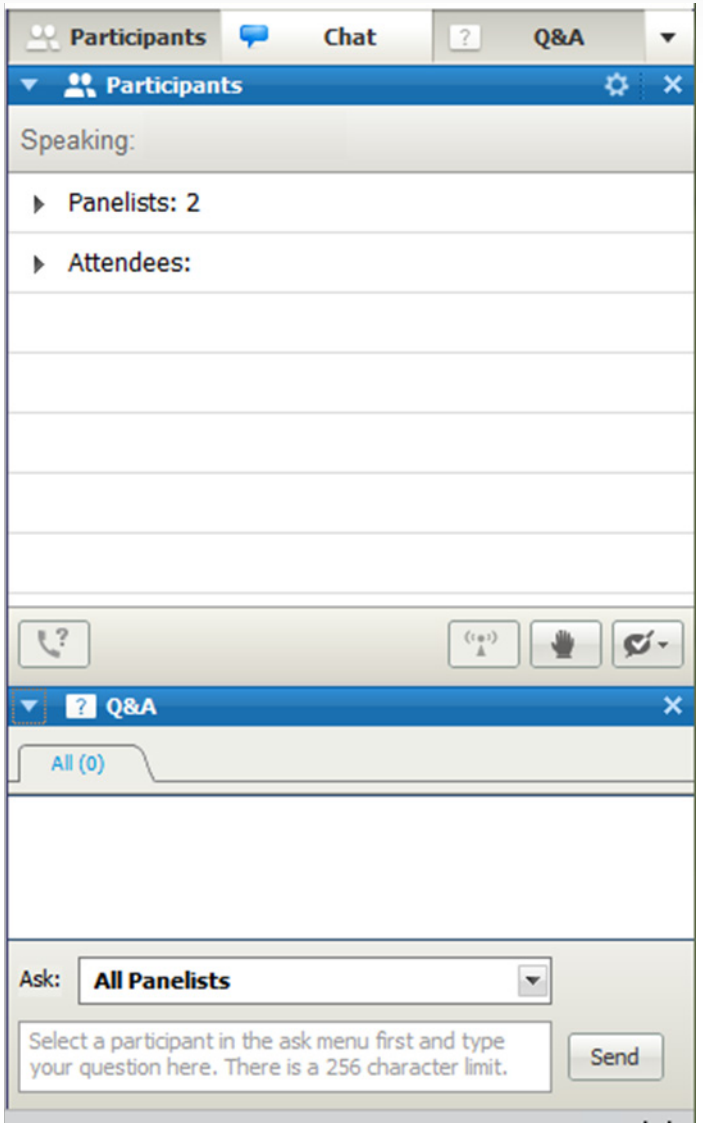
This continuing education activity is managed and accredited by the Professional Education Services Group (PESG), in cooperation with AHRQ, AFYA, and RTI.

PESG, AHRQ, AFYA, and RTI staff have no financial interests to disclose.

Commercial support was not received for this activity.

# How To Submit a Question

- At any time during the presentation, type your question into the “Q&A” section of your WebEx Q&A panel.
- Please address your questions to “All Panelists” in the drop-down menu.
- Select “Send” to submit your question to the moderator.
- Questions will be read aloud by the moderator.



# Learning Objectives

At the conclusion of this activity, the participant will be able to do the following:

1. Discuss the use of a computerized provider order entry (CPOE) evaluation tool to self-assess an inpatient electronic health record (EHR) system for safety performance and planned refinements that aim to improve the tool.
2. Describe the potential risk of providers placing orders in the wrong patient's record when multiple patient records are open at once in an EHR system.

# Using a CPOE/EHR Evaluation Tool to Evaluate Your Clinical System

**David Classen, M.D., M.S.**

Associate Professor of Medicine,

University of Utah

CMIO, PascalMetrics

# Overview

- Safety and EHRs, in general
  - Examples of problems
- Using a CPOE/EHR tool to assess the safety of your system
- Overarching points
  - Lessons learned
  - Successes
  - Challenges
  - Recommendations
- Conclusions

# Backdrop

- Literature suggests that health IT clearly appears to improve safety overall.
  - Many studies strongly support the benefits.[1,2]
  - However, literature provides multiple anecdotes of new health IT safety risks.
- The magnitude of harm and impact of health IT on patient safety is uncertain:
  - Heterogeneous nature of health IT
  - Diverse clinical environments, workflow
  - Limited evidence in the literature
- FDA has had authority to regulate health IT but has not done so except in limited ways—authority limited to health IT that meets the definition of a “medical device.”

1) Bates and Gawande, NEJM 2003
2) Health IT and Patient Safety: Building Safer Systems for Better Care

# Examples of Problems Associated With Health IT

- Mortality rate increased from 2.8% to 6.3% (OR=3.3) in children transferred in for special care after introduction of a commercial CPOE application.[1]
- "Flight simulator" of CPOE across 63 hospital EHRs detected only 53% of medication orders which would have been fatal.[2]
- Clear problem of providers writing electronic orders on the wrong patient because they don't realize what record they are in.[3]
- A sensor attached to an asthma rescue inhaler records the location where the rescue medication is used but not the time. When the information is uploaded to a computer the time of the upload, not the time of the medication use, is recorded.
- When even serious safety-related issues with software occur, no central place to report them to, and they do not generally get aggregated at a national level.[4]

1) Han, Pediatrics 2005; 2) Metzger, Health Affairs 2010; 3) Adelman et al., JAMIA 2013 ; 4) Institute of Medicine, Health IT and Patient Safety: Building Safer Systems for Better Care, 2011

# University of Pennsylvania: Unintended Consequences

- Koppel, et al. (2005) evaluated on a commercial CPOE application at U Penn, asking users about their impressions about the system.[1]
  - Found many situations in which “a leading CPOE system facilitated medication error risks.”
  - Often took many screens to do things.
  - Needed views were not available.
- Others, including Joan Ash and Dean Sittig, have also reported on this.

1. Koppel, JAMA, 2005

# Issues With the Koppel Study

- Didn't count errors or adverse events.
- Inaccurately states that other studies focused only on advantages.
- CPOE application studied was an old one.
- Nonetheless, paper stimulated valuable debate and identified key points:
  - Need change systems after implementation.
  - Software alone is insufficient.

Bates DW, J Biomed Inform 2005

# FDASIA Recommendations

- Substantial additional regulation of health IT beyond what is currently in place is not needed and would not be helpful (should be Class 0), except for:
  - Medical device data systems (MDDS)
  - Medical device accessories
  - Certain forms of high-risk clinical decision support
  - Higher risk software use cases
    - For the regulated software, it will be important for the FDA to improve the regulatory system to accommodate the characteristics that make software development, distribution, and use different from physical devices.
- New risk framework(s) should support re-evaluation of what is currently regulated as well as new health IT.

# Ensuring the Safe Performance of Electronic Health Records

BRIGHAM AND WOMEN'S HOSPITAL

THE UNIVERSITY OF UTAH

# History of the Assessment Tool

- 2003–2007
  - Initial development funded by Robert Wood Johnson Foundation, the California HealthCare Foundation, and the Agency for Healthcare Research and Quality (AHRQ)
  - Original development team included Jane Metzger, Emily Welebob, Peter Kilbridge, David Bates, David Classen
  - Multiple testing at more than 25 hospitals
- 2008
  - Released with some development/changes implemented
  - Incorporated into the Leapfrog Annual Safe Practices Survey
- 2011
  - Updated platform and content
- 2016
  - Used by over 1,400 hospitals in the United States

# Relationship between medication event rates and the Leapfrog computerized physician order entry evaluation tool

Alexander A Leung,[1] Carol Keohane,[1] Stuart Lipsitz,[1] Eyal Zimlichman,[1] Mary Amato,[1,2] Steven R Simon,[1] Michael Coffey,[3] Nathan Kaufman,[3] Bismarck Cadet,[4] Gordon Schiff,[1] Diane L Seger,[1] David W Bates[1]

- 43% relative reduction for every 5% increase in Leapfrog score (p=0.01)
- Four fewer preventable adverse drug events (ADEs)/100 admissions for every 5% increase in score

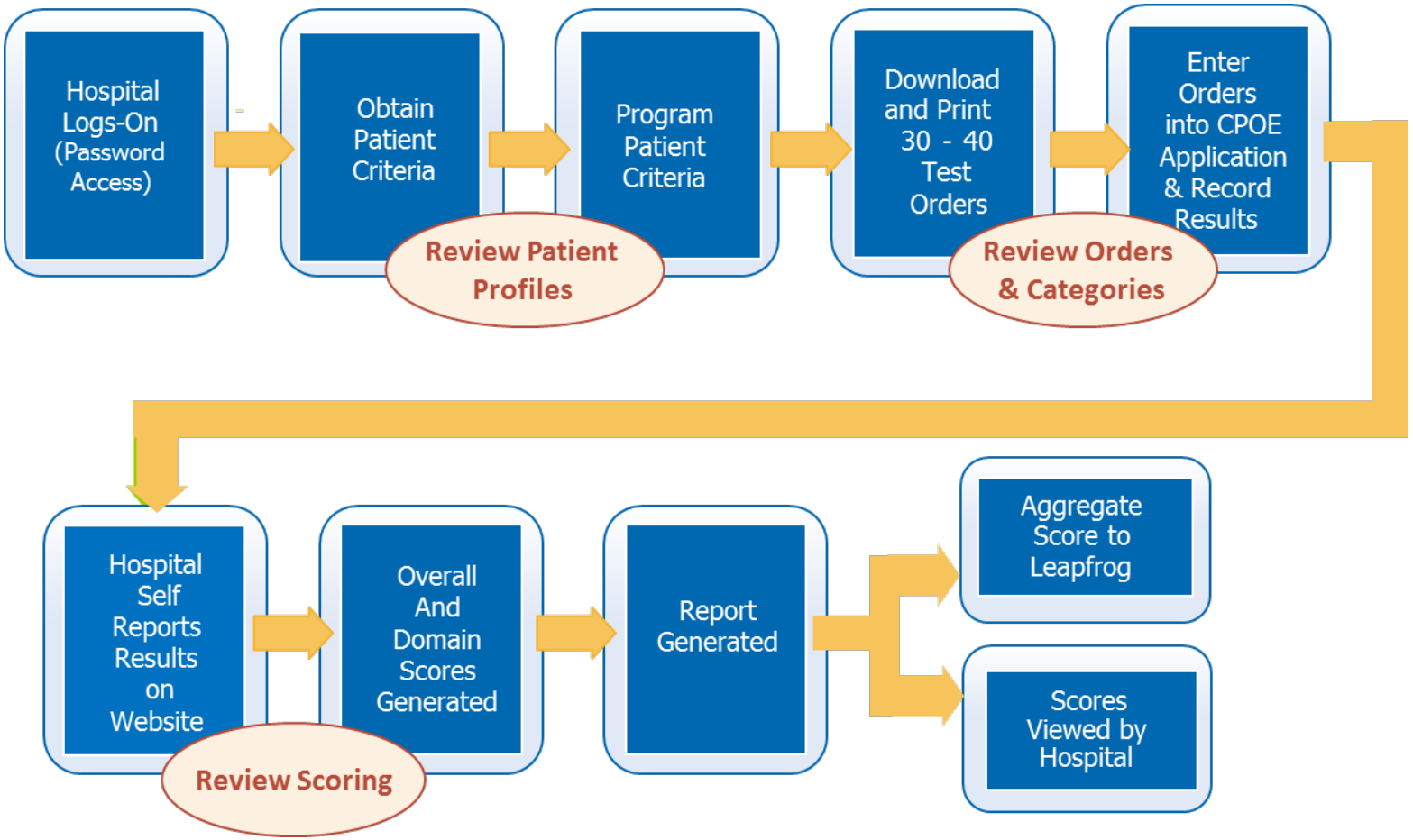


Leung et al., JAMIA 2013

# Assessment Tool

- Web-based, self-assessment tool completed in 4-6 hours
  - Download instructions, test patient profiles, orders, and observation sheets
  - Enter orders into CPOE/EHR system and record decision support
  - Post results into the assessment tool
- Immediate feedback
  - Overall summary score
  - Individual domain scores

The primary purpose of the evaluation is to **evaluate CPOE/EHR clinical decision support as implemented,** testing specifically the ability of the system to assist in avoiding medication-related adverse events originating in orders for hospitalized patients.



# Simulations of EHR Use With CPOE

The assessment pairs medication orders that would cause a serious adverse drug event with a fictitious patient.

**A physician enters the order …**

**Patient AB**

Female
52 years old
Weighs 60 kg
Allergy to morphine
Normal creatinine

**and observes and records the type of CDS-generated advice that is given (if any).**

Coumadin (Warfarin) 5 mg po three times a day.

# Assessment Tool Screen

Print patient descriptions

Print Patient Descriptions

**Note:** Change the page orientation to Landscape prior to printing

**Adult Inpatient Description**

| Patient Id | Age | Sex | Weight | Allergies | Diagnosis/Problems | Lab Values | Specifics |
|---|---|---|---|---|---|---|---|
| 1 | 51 year old | Female | Wgt = 48 kg; Hgt = 155 cm | Pencillin Egg | Seizure Disorder | Potassium = 2.4 mEq/L; Serum Creatinine = 0.9 mg/dL | None |
| 2 | 43 year old | Male | Wgt = 75 kg; Hgt = 175 cm | No Known Drug Allergies | None | Serum Creatinine = 0.9 mg/dL; Theophylline level = 15 mg/l; Potassium = 4.0 mEq/L | None |
| 3 | 43 year old | Male | Wgt = 70 kg; Hgt = 155 cm | Aspirin Shellfish | None | Vancomycin trough = 17 mcg/ml; Clostridium Difficile Toxin Assay = Negative; Serum Creatinine = 0.9 mg/dL | None |
| 4 | 40 year old | Female | Wgt = 60 kg; Hgt = 165 cm | Codeine | Low Back Pain | Dilantin level = 50 mcg/mL; Serum Creatinine = 0.9 mg/dL | None |
| | 65 year | | Wgt = 75 kgs; | | | | |

Internet

# Assessment Tool Screen

Print order descriptions, enter order, and note result

Please print the orders shown below and enter the orders into your CPOE application for the appropriate patients. Record the results of each order including the alert message then return to this site to submit the results.

Print Orders

| Number | Order | Patient | Result (Check One) |
|---|---|---|---|
| 1 | Levothroid 200 mcg po twice daily | 1 | ☐ Alert or Information Received or Order Blocked.DisPlayed Message:_____ ☐ Order Accepted, No Alert or Information Received ☐ Medication Not on Formulary |
| 2 | Cephalexin 250 mg po four times a day | 1 | ☐ Alert or Information Received or Order Blocked.DisPlayed Message:_____ ☐ Order Accepted, No Alert or Information Received ☐ Medication Not on Formulary |
| 3 | Lovenox 80 mg subcutaneous every 12 hours | 1 | ☐ Alert or Information Received or Order Blocked.DisPlayed Message:_____ ☐ Order Accepted, No Alert or Information Received ☐ Medication Not on Formulary |
| 4 | Demerol 50 mg po every 4 to 6 hours as needed | 1 | ☐ Alert or Information Received or Order Blocked.DisPlayed Message:_____ ☐ Order Accepted, No Alert or Information Received ☐ Medication Not on Formulary |
| 5 | 1) Metoprolol 50 mg po twice daily,2) Toprol XL 100 mg po daily | 2 | ☐ Alert or Information Received or Order Blocked.DisPlayed Message:_____ ☐ Order Accepted, No Alert or Information Received ☐ Medication Not on Formulary |
| 6 | 1) Lotrel 5 mg/10 mg po daily,2) Enalapril 5 mg po daily | 2 | ☐ Alert or Information Received or Order Blocked.DisPlayed Message:_____ ☐ Order Accepted, No Alert or Information Received ☐ Medication Not on Formulary |
| 7 | Hydrocodone/Acetaminophen 5 mg/500 mg (Vicodin) 2 tablets po every four hours | 2 | ☐ Alert or Information Received or Order Blocked.DisPlayed Message:_____ ☐ Order Accepted, No Alert or Information Received ☐ Medication Not on Formulary |
| 8 | Vicodin ES one tablet every 6 hoursTylenol 500mg po every 4 hours prn | 2 | ☐ Alert or Information Received or Order Blocked.DisPlayed Message:_____ |

# Assessment Tool Screen

## Print results and sign out

**Adult inpatient**

| Category | Score(in percent) |
|---|---|
| Therapeutic duplication | 100.00 |
| Drug-allergy | 100.00 |
| Drug-route | 100.00 |
| Drug:drug | 100.00 |
| Drug:diagnosis | 100.00 |
| Drug-labs | 100.00 |
| Monitoring | 100.00 |
| Deception | 100.00 |
| Nuisance | 100.00 |
| Drug-renal | 100.00 |
| Drug-age | 100.00 |
| Drug-dose (single) | 100.00 |
| Drug-dose (daily) | 100.00 |

| Your TOTAL Medication Checking score reflects: | |
|---|---|
|  | Fully implemented recommended safety practice |

**Note:** Medication checking Total score does not include Nuisance and Deception Analysis categories

| Legend | Description |
|---|---|
|  | Did not meet criteria for a good early stage effort |
|  | Good early stage effort in implementing recommended safety practice |
|  | Good progress in implementing recommended safety practice |
|  | Fully implemented recommended safety practice |
|  | Did not complete the evaluation or did not report results |

# Test Order Domains

| Order Category | Description |
|---|---|
| **Therapeutic duplication** | Medication with therapeutic overlap with new or current medication |
| **Drug-dose (single)** | Specified dose that exceeds recommended dose ranges for single dose |
| **Drug-dose (daily)** | Specified dose that exceeds recommended dose ranges for single dose |
| **Drug-allergy** | Medication for which a patient allergy has been documented |
| **Drug-route** | Specified route is not appropriate |
| **Drug-drug** | Medication that results in potentially dangerous interaction when administered in combination with another new or current medication |
| **Drug-diagnosis** | Medication contraindicated based on electronically documented diagnosis |
| **Drug-age** | Medication contraindicated based on electronically documented patient age |
| **Drug-renal** | Medication contraindicated or requires dose adjustment based on patient renal status as indicated in laboratory test results |
| **Drug-lab** | Medication contraindicated or requires dose adjustment based on patient metabolic status (other than renal) as indicated in laboratory test results |
| **Monitoring** | Medication requires an associated order for monitoring to meet the standard of care |
| **Nuisance** | Medication order triggers advice or information that physicians consider invalid or clinically insignificant |
| **Deception** | Used to detect testing irregularities |

By Jane Metzger, Emily Welebob, David W. Bates, Stuart Lipsitz, and David C. Classen

# Mixed Results In The Safety Performance Of Computerized Physician Order Entry

DOI: 10.1377/hlthaff.2010.0160
HEALTH AFFAIRS 29,
NO. 4 (2010): 655–663


ABSTRACT **Computerized physician order entry is a required feature for hospitals seeking to demonstrate meaningful use of electronic medical record systems and qualify for federal financial incentives. A national sample of sixty-two hospitals voluntarily used a simulation tool designed to assess how well safety decision support worked when applied to medication orders in computerized order entry. The simulation detected only 53 percent of the medication orders that would have resulted in fatalities and 10–82 percent of the test orders that would have caused serious adverse drug events. It is important to ascertain whether actual implementations of computerized physician order entry are achieving goals such as improved patient safety.**

**Jane Metzger** (jmetzger2@csc.com) is a principal researcher at CSC Healthcare in Waltham, Massachusetts.

**Emily Welebob** is an independent consultant in Indianapolis, Indiana.

**David W. Bates** is division chief for general internal medicine at Brigham and Women's Hospital in Boston, Massachusetts.

**Stuart Lipsitz** is a researcher at Brigham and Women's Hospital.

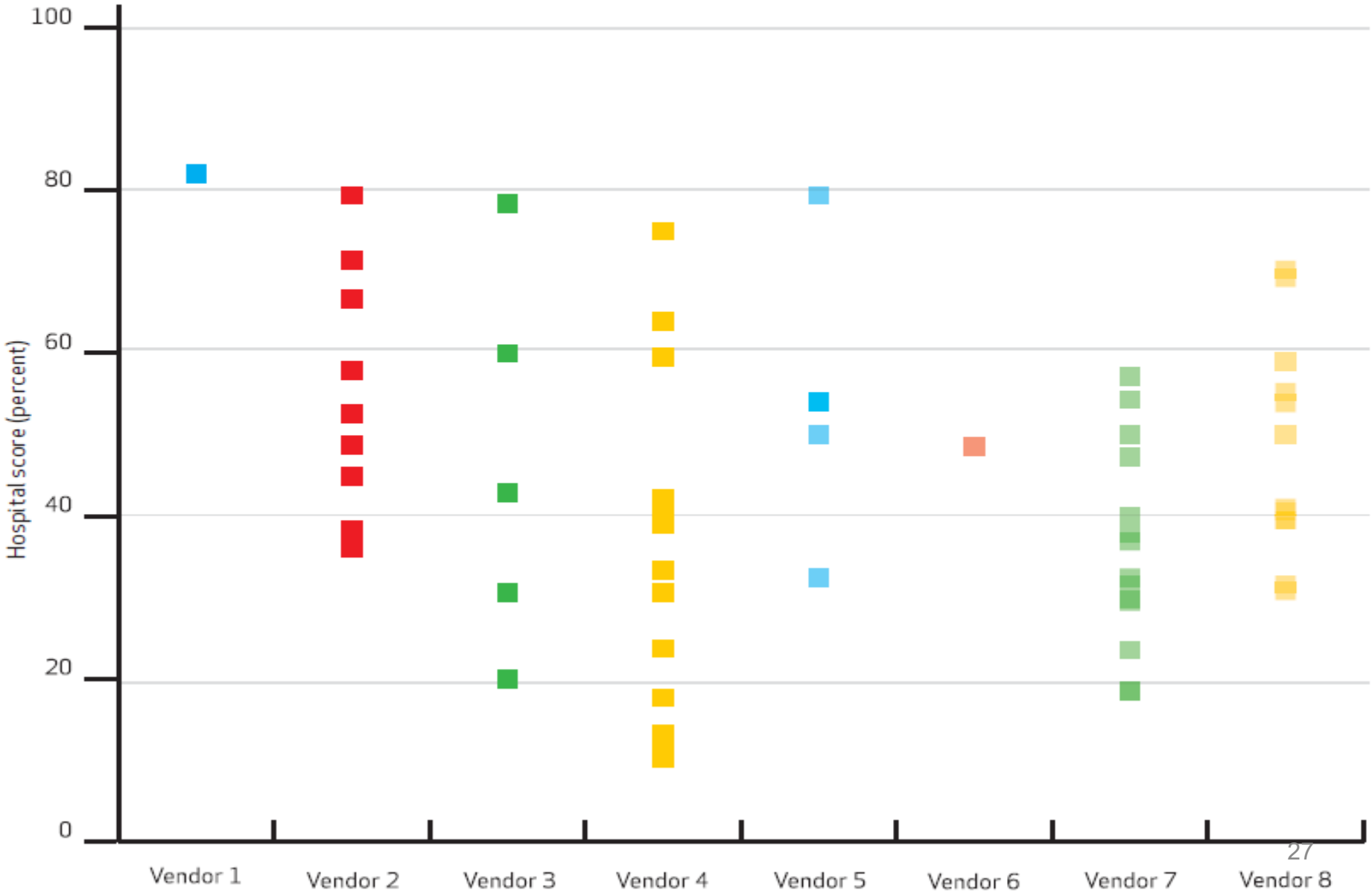
**David C. Classen** is an associate professor of medicine at the University of Utah in Salt Lake City, and is also with CSC Healthcare.

Many people have suggested that electronic health records represent essential infrastructure for the provision of safe health care in the United States. For several years, the Institute of Medicine, the Leapfrog Group, the National Quality

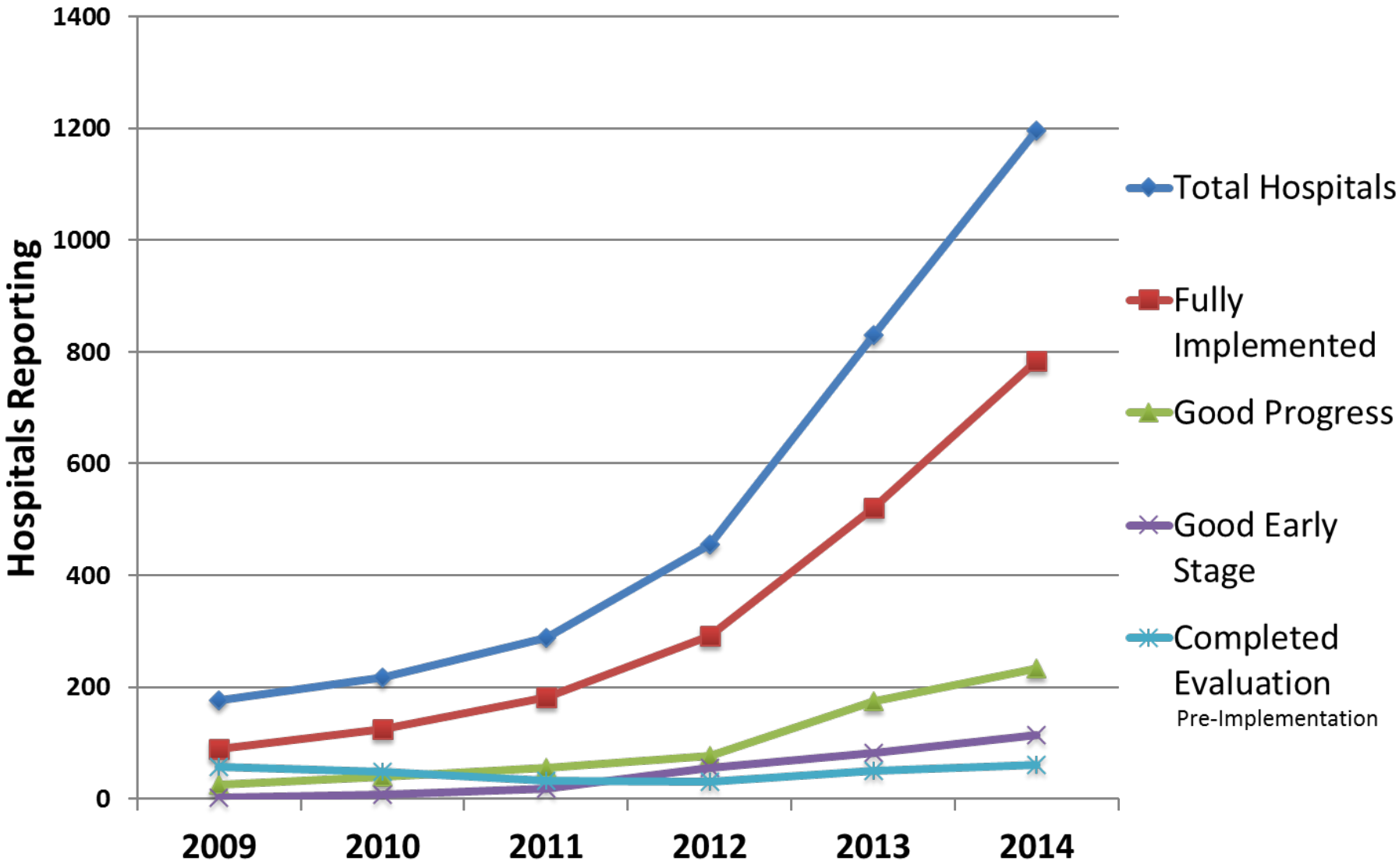
In this application of clinical decision support, physicians are made aware of potential safety issues that can result—for example, when ampicillin is given to a patient with a known allergy to penicillin, or the dose being ordered for a pediatric patient is much higher than the therapeutic range for a child of this age and weight. Prescrib-

**EXHIBIT 2**

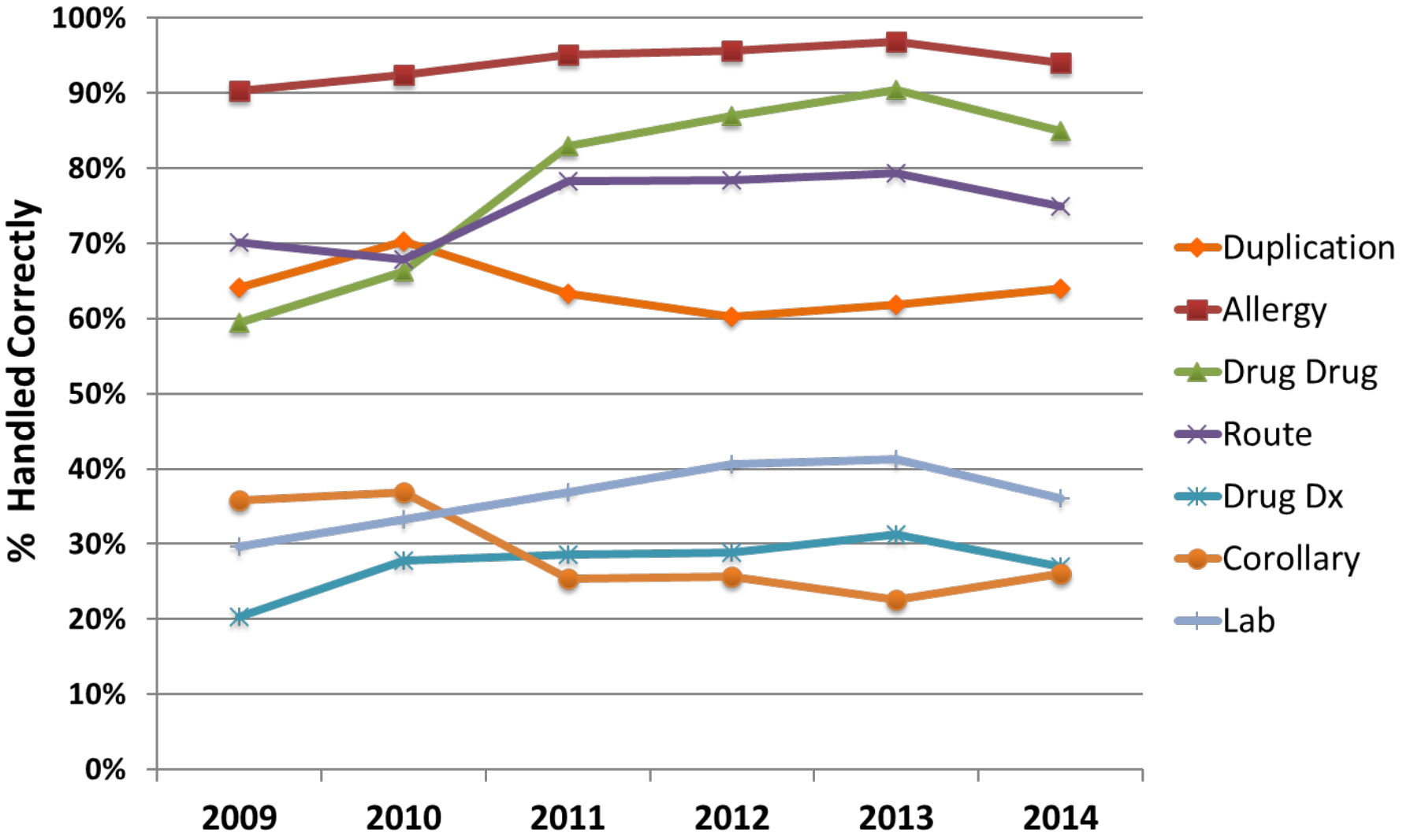
**Hospital Scores For Detection Of Test Orders That Would Cause An Adverse Drug Event In An Adult Patient According To The Software Product (Vendor) Implemented**



# Growth in Participation and Performance



# Orders Handled Correctly by Checking Category



# Safe EHRs Project

- Funded by AHRQ
  - Five years: 9/1/14 – 8/31/19
  - Investigators: David Bates and David Classen

- Project  Aims
  - Aim 1: Evaluate national experience
  - Aim 2: Update the test
  - Aim 3: Develop new capabilities and domains

# Aim 1: Evaluate National Experience

- Retrospective analysis of existing tool in years 1-3
  - Overall scores of over 800 hospitals
  - Individual scores for each domain
  - Detailed analysis on cohort of 176 hospitals taking test at least once a year 2009–2016
- Findings will inform Aim 2 and 3
- Evaluation of enhanced tool in years 4-5

# Aim 2: Update the Existing Test

- Technical evaluation of platform
- Enhancements
  - Update based on current EHR versions of leading vendors
  - Latest formularies, labs, procedures
  - Update platform to share info on test results with vendors and Patient Safety Organizations (PSOs)
- Usability of assessment tool

# Aim 3: Enhanced Test

- New Domains
  - Central line infection prevention
  - Deep vein thrombosis (DVT) prevention
  - Reduce overuse of meds, labs, diagnostic test
- New Capabilities
  - Usability testing (i-MeDeSA) of clinical decision support
  - Novel testing for health IT-related errors—Jason Adelman Tool

# NEW CATEGORIES

| Order Category | Description | Example |
|---|---|---|
| **CHOOSING WISELY** | INAPPROPRIATE ORDERING OF MEDICATIONS, LABORATORY TESTS, RADIOLOGIC TESTS | ORDERING OF VIT D LEVELS IN LOW-RISK PATIENTS |
| **PREVENTION OF COMMON HOSPITAL COMPLICATIONS** | APPROPRIATE ORDERING OF INTERVENTIONS TO PREVENT HOSPITAL COMPLICATIONS -- CLABSI OR DVT | ORDERING OF APPROPRIATE INTERVENTIONS FOR PATIENTS WITH CENTRAL LINES IN PLACE |
| **USABILITY OF CLINICAL DECISION SUPPORT** | EVALUATION OF USABILITY OF COMMON DECISION SUPPORT CAPABILITY | USE OF THE IMEDESA TOOL |
| **EHR ERROR DETECTION** | EVALUATION OF COMMON EHR ERRORS | USE OF THE ORDER REORDER RETRACT TOOL (Jason Adelman) |

# Lessons Learned

- Hard to keep up with what therapies are current.
- Many ways to deliver decision support.
- Many hospitals didn't have a good sense of where they were.

# Successes

- Hospitals that have taken the test have improved a lot!
- Test has improved greatly with feedback from the broader community.
- New test is a complete rewrite; will eventually cover new areas.
- More hospitals take the test every year.

# Challenges

- Many vendors don't make it easy to set up test patients with real lab data.
- Because there are many ways to deliver decision support, hard to give people credit for everything.
- Takes time to take the test.

# Recommendations

- Sign up to take the test!
- Provide feedback about how to make it better.
- When finding things that are broken, fix them.
  - Especially potentially fatal errors
- Take the test regularly, because even if scoring well, things can break.

# Conclusions

- When buying an EHR, it typically comes with little or no decision support.
- There is huge variation among hospitals as to what is actually operationally implemented.
- It's good to spot check, because things can break and often do with upgrades!
- Hospitals that perform better on the test have lower ADE rates.

# Contact Information

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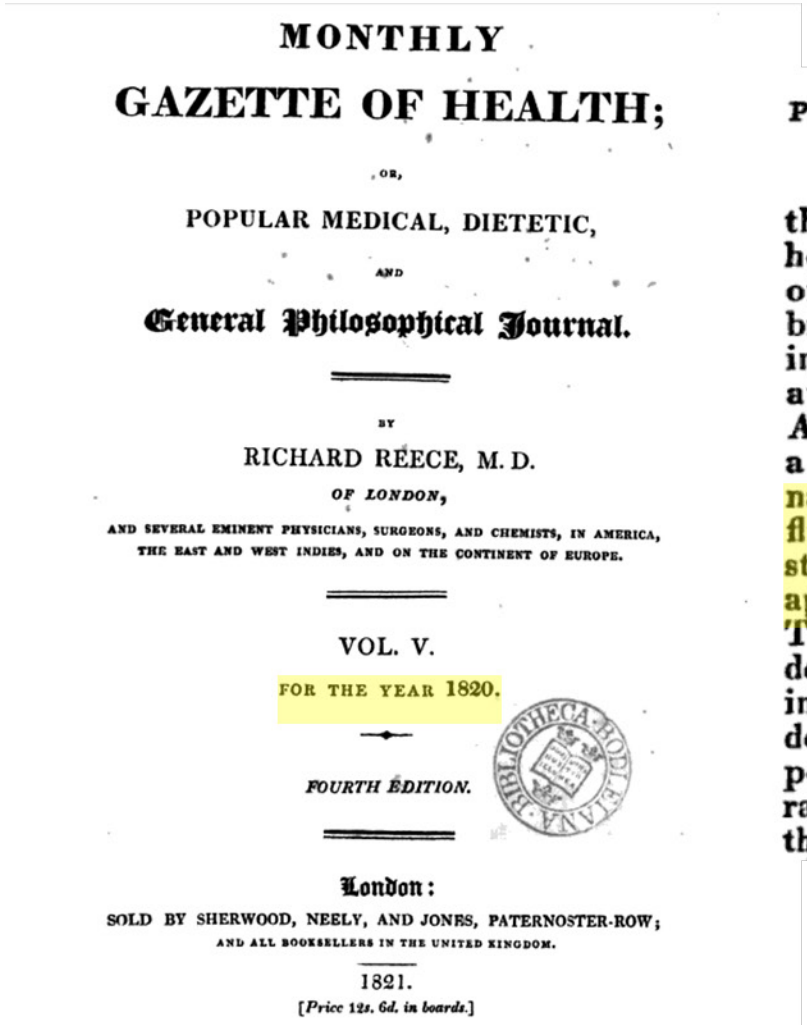
# Wrong Patient Errors

**Jason Adelman, M.D., M.S.**
Chief Patient Safety Officer
Associate Chief Quality Officer
Columbia University Medical Center

# Wrong Patient Errors: An Old Problem



MONTHLY

GAZETTE OF HEALTH;

OR,

POPULAR MEDICAL, DIETETIC,

AND

General Philosophical Journal.

BY

RICHARD REECE, M. D.

OF LONDON,

AND SEVERAL EMINENT PHYSICIANS, SURGEONS, AND CHEMISTS, IN AMERICA, THE EAST AND WEST INDIES, AND ON THE CONTINENT OF EUROPE.

VOL. V.

FOR THE YEAR 1820.

FOURTH EDITION.



London:

SOLD BY SHERWOOD, NEELY, AND JONES, PATERNOSTER-ROW;
AND ALL BOOKSELLERS IN THE UNITED KINGDOM.

1821.

[*Price 12s. 6d. in boards.*]



PRUSSIC ACID.—A Dr. Elliotson has published the results of the numerous trials he has made with this powerful remedy in his hospital and private practice. The favourable reports of the effects of the prussic acid in complaints of the chest, published by the celebrated Magendie and some medical practitioners of the metropolis, induced Dr. Elliotson to commence his experiments with it in those affections. He accordingly prescribed it for a patient of the name of Ann Lee, who was admitted a patient of St. Thomas's Hospital, for a "disorder of the lungs." Having another patient of the same name in the hospital, whose complaint was "violent spasms and flatulence of the stomach," the prussic acid was by mistake administered to the wrong patient—a circumstance highly creditable to the apothecary, and by no means uncommon in the London hospitals. To this mistake the learned doctor acknowledges himself to be indebted for the discovery of "the extraordinary efficacy of this remedy in derangements of the stomach." From the numerous cases the doctor has taken from his "note books to establish the decisive important fact which has established the power of the acid over derangement of the stomach," we select the two following, as affording the strongest evidence in its favour:

# Case Report

## Mrs. X

- Mrs. X, an 87-year-old female with a history of hypertension, COPD, CAD, and hypothyroidism was admitted to a telemetry unit with the diagnoses of rapid atrial fibrillation and bronchitis.
- The day after admission, a Medicine resident (PGY I) accidentally placed an order for Methadone 70mg for Mrs. X, which he meant to order for another patient.
- Both patients were on the resident's hotlist in the EHR.

# Case Report

## Mrs. X

- A pharmacist signed off on the Methadone order, and later that day a nurse-in-training, who was working under the supervision of an experienced nurse, administered the medication.
- Several hours later, Mrs. X was observed to be restless and complaining of being hot and nauseated.
- Shortly thereafter, Mrs. X was found unresponsive, pulseless, and with blue extremities. A code was called. She was intubated and transferred to the MICU.

# Outline Slide

- What we know about wrong patient errors
- Voluntary reporting of errors
- Automated detection of errors
- Research on detecting wrong patient errors
- Research on preventing wrong patient errors
- Future Health IT Safety Measures
- Summary

# Outline Slide

- What we know about wrong patient errors
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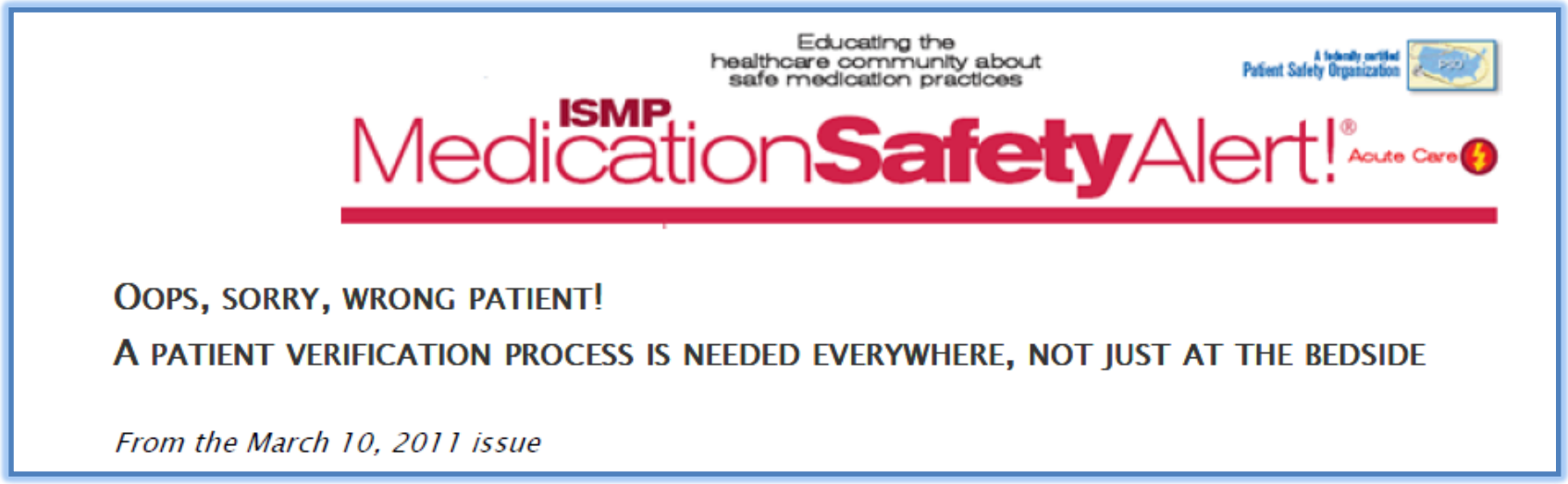
# What We Knew Prior to Our Research

- Case reports
- Expert opinion
- Voluntary reporting
- Chart review

# What We Knew Prior to Our Research

*(Case Report)*



Educating the healthcare community about safe medication practices

A federally certified Patient Safety Organization

ISMP Medication Safety Alert!® Acute Care

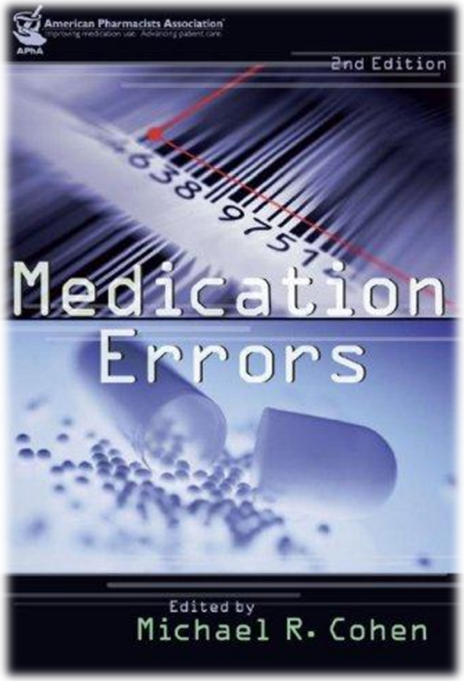
OOPS, SORRY, WRONG PATIENT!

A PATIENT VERIFICATION PROCESS IS NEEDED EVERYWHERE, NOT JUST AT THE BEDSIDE

*From the March 10, 2011 issue*

# What We Knew
# Prior to Our Research

*(Expert Opinion)*



# What We Knew Prior to Our Research

## (Chart Review)

Medication Errors and Near Misses in Pediatric Inpatients

*Charts reviewed of 1120 patients.*
*JAMA 2001;285:2114-2120*

**Table 2.** Types of Medication Errors and Potential Prevention Strategies*

| Variable | Medication Errors (n = 616) | Potential Adverse Drug Events (n = 115) |
|---|---|---|
| Error type | | |
| Dose | 175 (28) | 44 (34) |
| Frequency | 58 (9.4) | 23 (20) |
| Route | 109 (18) | 16 (14) |
| Medication administration record transcription or documentation | 85 (14) | 9 (7.8) |
| Wrong drug | 8 (1.3) | 6 (5.2) |
| Wrong patient | 1 (0.16) | 1 (0.86) |
| Known allergy | 8 (1.3) | 5 (4.3) |
| Illegible order | 14 (2.3) | 2 (1.7) |
| Missing or wrong weight | 23 (3.7) | 1 (0.86) |
| No or wrong date | 74 (12) | 0 (0) |
| Other | 61 (9.9) | 8 (7) |

# What We Knew Prior to Our Research

## (Voluntary Reporting)

### MEDMARX

*120 Facilities Voluntary Reported*

| Type of Error | Average Number of Errors | | Errors per 100,000 doses Dispensed | |
|---|---|---|---|---|
| | CPOE Mean (SD) | No CPOE Mean (SD) | CPOE Mean (SD) | No CPOE Mean (SD) |
| Prescribing error | 68 (222) | 38 (199) | 14 (47) | 5 (20) |
| Improper dose/quantity | 59 (132) | 55 (74) | 10 (23) | 10 (12) |
| Wrong dosage form | 8 (23) | 4 (8) | 1 (3) | 0.8 (1) |
| Extra dose | 14 (24) | 19 (27) | 2 (4) | 3 (5) |
| Omission | 48 (84) | 107 (174) | 11 (29) | 19 (30) |
| Unauthorized drug | [illegible] | 36 (72) | 4 (8) | 6 (10) |
| Wrong patient | 9 (17) | 13 (18) | 2 (3) | 2 (3) |
| Wrong time | [illegible] | 23 (34) | 4 (9) | 4 (7) |
| Wrong drug preparation | 6 (9) | 13 (22) | 1 (3) | 2 (4) |
| Wrong route | 6 (16) | 5 (7) | 0.8 (2) | 0.9 (2) |

# Cause of Wrong-Patient Errors

*Viewpoint Paper* ■

Some Unintended Consequences of Information Technology in Health Care: The Nature of Patient Care Information System-related Errors

Joan S. Ash, PhD, MLS, Marc Berg, MD, PhD, Enrico Coiera, MBBS, PhD

This mismatch between interface and use context often results in a *juxtaposition* error, the kind of error that can result when something is close to something else on the screen and the wrong option is too easily clicked in error. The following are typical quotations from physicians; note the allusions to the "interruptive" use context: "I have ordered the test that was right next to the one I thought I ordered, you know, right below it that my little thingie had come down and I clicked and I'm lookin' at this one but I in fact clicked on the thing before. By that time I turned my head and I'm hitting return and typing my signature and not seeing it" [physician, U.S. hospital]. "I was ordering Cortisporin, and Cortisporin solution and suspension comes up. The patient was talking to me, I accidentally put down solution, realized that's not what I wanted . . . . I would not have made that mistake, or potential mistake, if I had been writing it out because I would have put down what I wanted" [physician, U.S. outpatient setting].

# Outline Slide

- What we know about wrong patient errors
- Voluntary reporting of errors
- Automated detection of errors
- Research on detecting wrong patient errors
- Research on preventing wrong patient errors
- Future Health IT Safety Measures
- Summary

# Wrong Patient Errors: An Old Problem

A MANUAL FOR ATTENDANTS

IN

INSANE ASYLUMS

BY

WILLIAM D. GRANGER, M.D.

FIRST ASSISTANT PHYSICIAN BUFFALO STATE ASYLUM FOR THE INSANE, BUFFALO, N. Y.

NEW YORK & LONDON

G. P. PUTNAM'S SONS

The Knickerbocker Press

1886



hat it is medicine, that the doctor ordered it for them, hat it is for their good to take it, that it is given to help hem get well.

The giving of medicine and food is among the most nportant and frequent duty that an attendant is called pon to perform, or assist others in doing. Attendants ıust remember that many medicines are injurious or even oisonous, if not properly given, or if mixed with other ıedicines, or if given to the wrong patient; they should herefore, never make a mistake, or, if by carelessness hey commit one, should immediately report it.

*Opium and Some of its Preparations.*—Opium is a medi- ine that is very frequently given to patients in an asylum. The ordinary dose is one grain. *Tincture of opium, or udanum*, is opium dissolved in alcohol. Ten minims qual one grain of opium. *Camphorated tincture of opium, r Paregoric*, is a weaker alcoholic solution, with some amphor, and flavored with a pleasant aromatic. One alf a fluid ounce equals a grain of opium. *Morphine* is white powder extracted from opium. An eighth of a rain about equals a grain of opium.

Opium, in some of its forms, is a common household emedy. To an adult, not more than one grain should e given; it should not be repeated more than once, nor ess than six hours after the first dose. It would be bet- er if never given, except by a physician's order. Under o circumstances should any one but a physician give it o a weak or old person, or to a young child.

Opium, is given in ordinary doses to relieve pain, to heck diarrhœa to relax spasm of muscles, and to produce leep. The sleep from opium is generally quiet and re-

# Voluntary Reported Errors

Health Affairs, 2011

| | Chart Review | Claims Based Identification | Voluntary Reporting |
|---|---|---|---|
| Temporary Harm | 328 | 30 | 2 |
| Permanent Harm | 22 | 1 | 2 |
| Death | 4 | 4 | 0 |
| Total | 354 | 35 | 4 |

Classen DC, Resar R, Griffin F, Federico F, Frankel T, Kimmel N, Whittington JC, Frankel A, Seger A, James BC. “Global trigger tool” shows that adverse events in hospitals may be ten times greater than previously measured. Health Aff (Millwood) 2011;30:581-9.

# Outline Slide

- What we know about wrong patient errors
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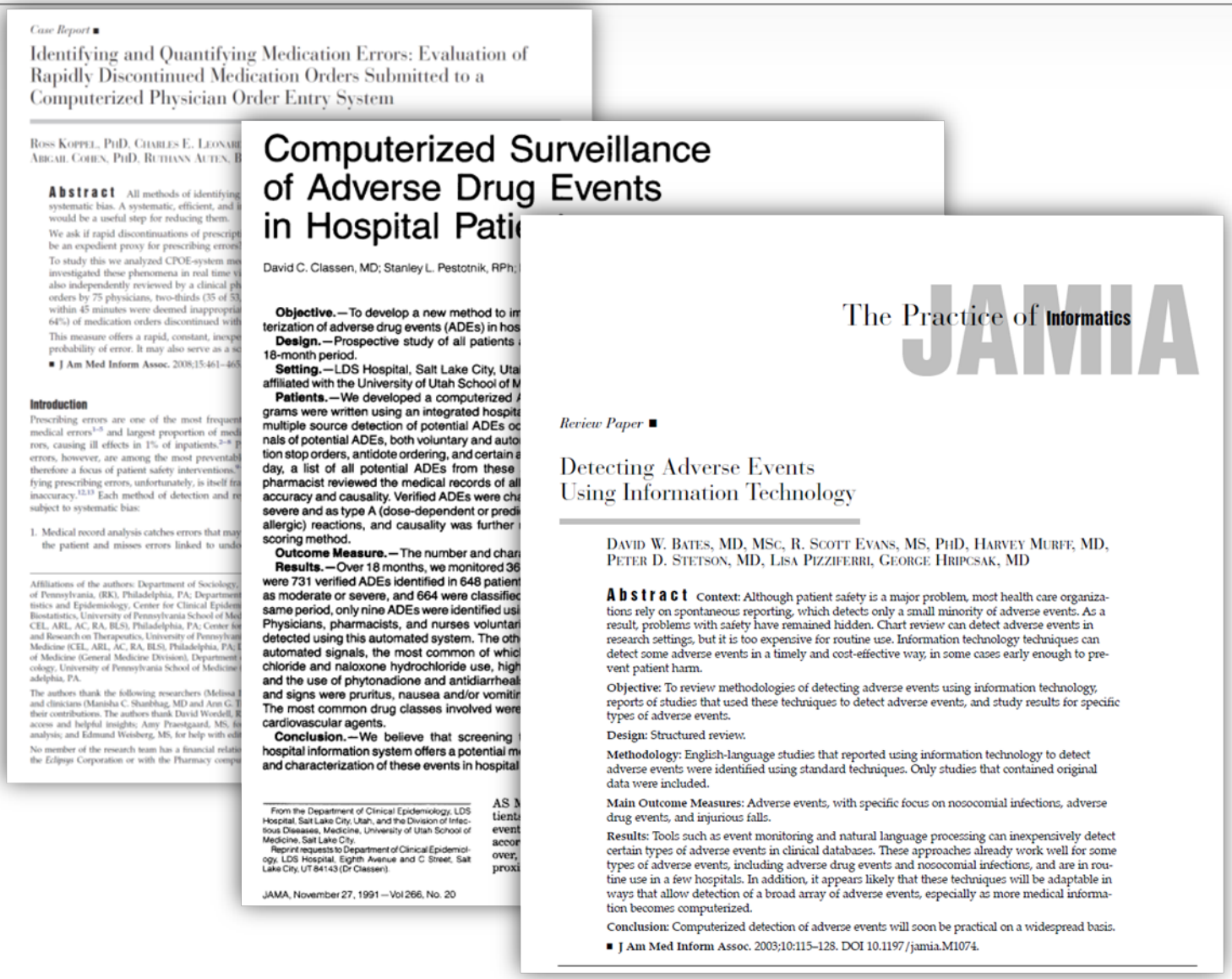
# Automated Error Surveillance



*Case Report* ■

Identifying and Quantifying Medication Errors: Evaluation of Rapidly Discontinued Medication Orders Submitted to a Computerized Physician Order Entry System

Ross Koppel, PhD, Charles E. Leonard, Abigail Cohen, PhD, Ruthann Auten, B

**Abstract** All methods of identifying systematic bias. A systematic, efficient, and would be a useful step for reducing them.

We ask if rapid discontinuations of prescript be an expedient proxy for prescribing errors.

To study this we analyzed CPOE-system me investigated these phenomena in real time vi also independently reviewed by a clinical ph orders by 75 physicians, two-thirds (35 of 53, within 45 minutes were deemed inappropria 64%) of medication orders discontinued with

This measure offers a rapid, constant, inexpe probability of error. It may also serve as a sc

■ J Am Med Inform Assoc. 2008;15:461–465.

**Introduction**

Prescribing errors are one of the most frequent medical errors[1–5] and largest proportion of medi rors, causing ill effects in 1% of inpatients.[2–6] errors, however, are among the most preventabl therefore a focus of patient safety interventions.[8] fying prescribing errors, unfortunately, is itself fra inaccuracy.[12,13] Each method of detection and re subject to systematic bias:

1. Medical record analysis catches errors that may the patient and misses errors linked to undo

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The authors thank the following researchers (Melissa and clinicians (Manisha C. Shanbhag, MD and Ann G. T their contributions. The authors thank David Wordell, R access and helpful insights; Amy Praestgaard, MS, fo analysis; and Edmund Weisberg, MS, for help with edi

No member of the research team has a financial relatio the *Eclipsys* Corporation or with the Pharmacy compu

Computerized Surveillance of Adverse Drug Events in Hospital Pati

David C. Classen, MD; Stanley L. Pestotnik, RPh;

**Objective.**—To develop a new method to im terization of adverse drug events (ADEs) in hos

**Design.**—Prospective study of all patients 18-month period.

**Setting.**—LDS Hospital, Salt Lake City, Uta affiliated with the University of Utah School of M

**Patients.**—We developed a computerized grams were written using an integrated hospita multiple source detection of potential ADEs oc nals of potential ADEs, both voluntary and auto tion stop orders, antidote ordering, and certain a day, a list of all potential ADEs from these pharmacist reviewed the medical records of all accuracy and causality. Verified ADEs were cha severe and as type A (dose-dependent or predi allergic) reactions, and causality was further scoring method.

**Outcome Measure.**—The number and char

**Results.**—Over 18 months, we monitored 36 were 731 verified ADEs identified in 648 patient as moderate or severe, and 664 were classifie same period, only nine ADEs were identified usi Physicians, pharmacists, and nurses voluntar detected using this automated system. The oth automated signals, the most common of whic chloride and naloxone hydrochloride use, high and the use of phytonadione and antidiarrheal and signs were pruritus, nausea and/or vomitin The most common drug classes involved were cardiovascular agents.

**Conclusion.**—We believe that screening hospital information system offers a potential m and characterization of these events in hospital

From the Department of Clinical Epidemiology, LDS Hospital, Salt Lake City, Utah, and the Division of Infectious Diseases, Medicine, University of Utah School of Medicine, Salt Lake City.

Reprint requests to Department of Clinical Epidemiology, LDS Hospital, Eighth Avenue and C Street, Salt Lake City, UT 84143 (Dr Classen).

JAMA, November 27, 1991—Vol 266, No. 20

The Practice of Informatics

JAMIA

*Review Paper* ■

Detecting Adverse Events Using Information Technology

David W. Bates, MD, MSc, R. Scott Evans, MS, PhD, Harvey Murff, MD, Peter D. Stetson, MD, Lisa Pizziferri, George Hripcsak, MD

**Abstract** **Context:** Although patient safety is a major problem, most health care organizations rely on spontaneous reporting, which detects only a small minority of adverse events. As a result, problems with safety have remained hidden. Chart review can detect adverse events in research settings, but it is too expensive for routine use. Information technology techniques can detect some adverse events in a timely and cost-effective way, in some cases early enough to prevent patient harm.

**Objective:** To review methodologies of detecting adverse events using information technology, reports of studies that used these techniques to detect adverse events, and study results for specific types of adverse events.

**Design:** Structured review.

**Methodology:** English-language studies that reported using information technology to detect adverse events were identified using standard techniques. Only studies that contained original data were included.

**Main Outcome Measures:** Adverse events, with specific focus on nosocomial infections, adverse drug events, and injurious falls.

**Results:** Tools such as event monitoring and natural language processing can inexpensively detect certain types of adverse events in clinical databases. These approaches already work well for some types of adverse events, including adverse drug events and nosocomial infections, and are in routine use in a few hospitals. In addition, it appears likely that these techniques will be adaptable in ways that allow detection of a broad array of adverse events, especially as more medical information becomes computerized.

**Conclusion:** Computerized detection of adverse events will soon be practical on a widespread basis.

■ J Am Med Inform Assoc. 2003;10:115–128. DOI 10.1197/jamia.M1074.

*Case Report* ■

# Identifying and Quantifying Medication Errors: Evaluation of Rapidly Discontinued Medication Orders Submitted to a Computerized Physician Order Entry System

Ross Koppel, PhD, Charles E. Leonard, PharmD, A. Russell Localio, JD, PhD, Abigail Cohen, PhD, Ruthann Auten, BA, Brian L. Strom, MD, MPH

- Medication orders discontinued (D/C'd) within 2 hours
- 75 physicians interviewed
- 63 of 114 rapidly D/C'd orders were errors (55%)

CLASSIC PAPER

# Computerized surveillance of adverse drug events in hospital patients*

D C Classen, S L Pestotnik, R S Evans, J P Burke

*Qual Saf Health Care* 2005;**14**:221–226. doi: 10.1136/qsh

- Monitored 36,653 patients over 18 months
- Signals included D/C'd orders, antidotes (i.e., Naloxone), and abnormal lab values.
- 731 adverse drug events identified
- Only 9 adverse drug events were voluntarily reported

# Automated Detection of Adverse Events Using Natural Language Processing of Discharge Summaries

Genevieve B. Melton, MD, George Hripcsak, MD, MS

**Abstract** **Objective:** To determine whether natural language processing (NLP) can effectively detect adverse events defined in the New York Patient Occurrence Reporting and Tracking System (NYPORTS) using discharge summaries.

**Design:** An adverse event detection system for discharge summaries using the NLP system MedLEE was constructed to identify 45 NYPORTS event types. The system was first applied to a random sample of 1,000 manually reviewed charts. The system then processed all inpatient cases with electronic discharge summaries for two years. All system-identified events were reviewed, and performance was compared with traditional reporting.

**Measurements:** System sensitivity, specificity, and predictive value, with manual review serving as the gold standard.

**Results:** The system correctly identified 16 of 65 events in 1,000 charts. Of 57,452 total electronic discharge summaries, the system identified 1,590 events in 1,461 cases, and manual review verified 704 events in 652 cases, resulting in an overall sensitivity of 0.28 (95% confidence interval [CI]: 0.17–0.42), specificity of 0.985 (CI: 0.984–0.986), and positive predictive value of 0.45 (CI: 0.42–0.47) for detecting cases with events and an average specificity of 0.9996 (CI: 0.9996–0.9997) per event type. Traditional event reporting detected 322 events during the period (sensitivity 0.09), of which the system identified 110 as well as 594 additional events missed by traditional methods.

**Conclusion:** NLP is an effective technique for detecting a broad range of adverse events in text documents and outperformed traditional and previous automated adverse event detection methods.

■ **J Am Med Inform Assoc.** 2005;12:448–457. DOI 10.1197/jamia.M1794.

# Outline Slide

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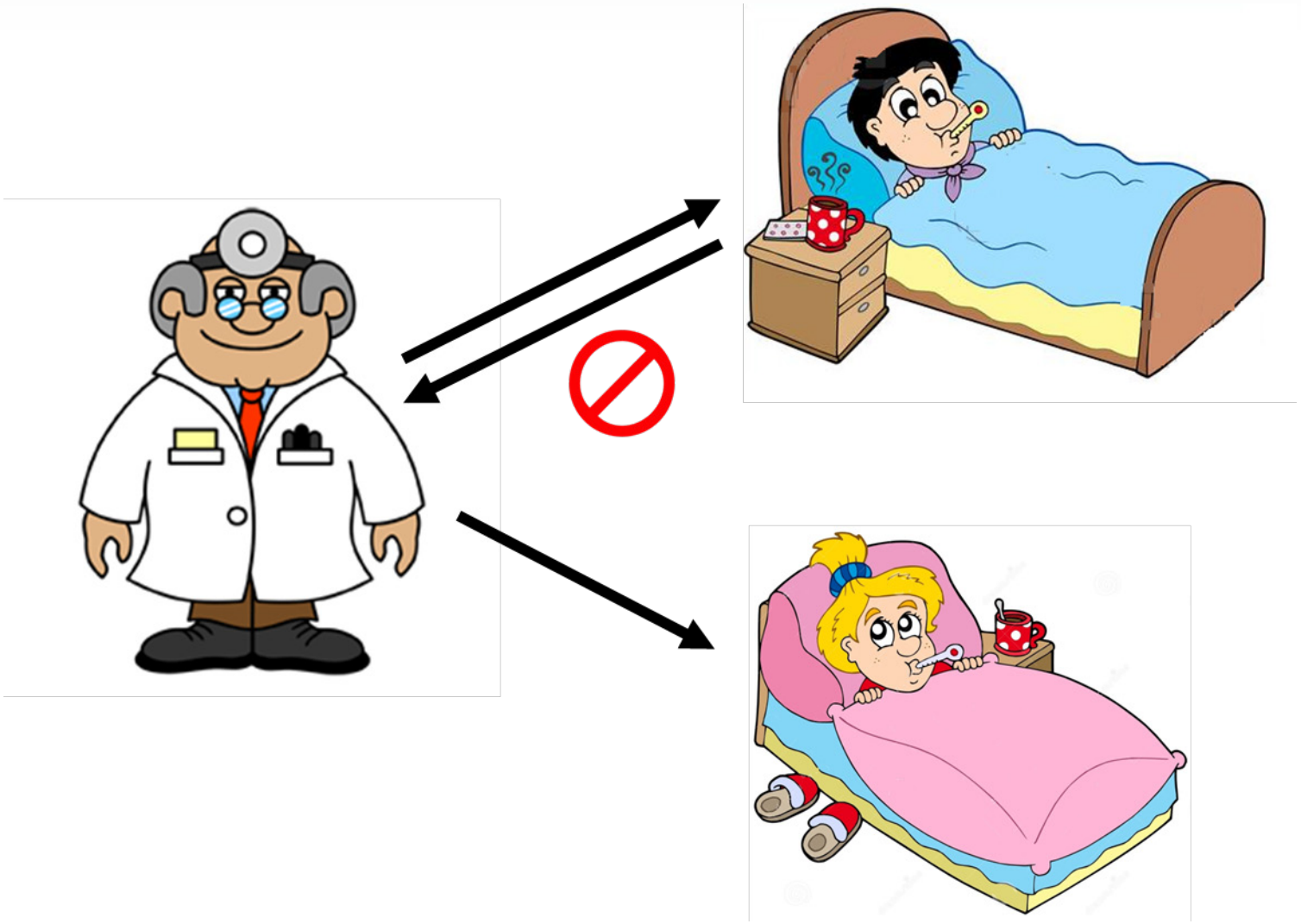
# Wrong-Patient Retract-and-Reorder Measure



# Wrong-Patient Retract-and-Reorder Measure

**RESULTS OF RETRACT-AND-REORDER MEASUREMENT TOOL**
**2009 DATA SET**

| Data Set | Measure |
|---|---|
| Wrong Patient Near Miss Errors | 6,885 |
| Avg. Time From Wrong Patient Order To Retraction | 1 minute, 18 seconds |
| Avg. Time From Retraction To Correct Patient Order | 2 minutes, 17 seconds |

# Validation of Retract-and-Reorder Tool With Near-Real Time Phone Survey

| Positive Predictive Value | Positive Predictive Value | Positive Predictive Value |
|---|---|---|
| Total | 236 | PPV |
| True Positive | 170 | 76.2% |
| False Positive | 53 | |

NATIONAL QUALITY FORUM

# Wrong-Patient Retract-and-Reorder Measure

# (NQF Measure #2723)

# *First Health IT Safety Measure Endorsed by NQF

# Retract-and-Reorder Tool Applied to Complete 2009 Data Set

- Measured
  - 6,885 retract-and-reorder events in 2009
- Estimated
  - 5,246 wrong-patient electronic orders
  - 14 wrong-patient electronic orders per day
  - 1 out of 6 providers placed an order on the wrong patient.
  - 1 of 37 admitted patients had an order placed for them that was intended for another patient.

| Examples of Orders Identified by the Retract-and-Reorder Measurement Tool in 2009 | |
|---|---|
| Type of Order | Number of Orders |
| Computed Tomography (CT Scan) | 193 |
| Chest X-Ray | 191 |
| Antihypertensive | 152 |
| Psychoactive Medication | 133 |
| Narcotic | 119 |
| Antibiotic | 89 |
| Insulin | 85 |
| Discharge Patient | 73 |
| Nil Per Os (NPO) | 61 |
| Anticoagulant | 42 |
| Blood Transfusion | 24 |
| Enema/Suppository | 28 |
| Radio-isotope Scan | 16 |
| Urinary Catheter | 13 |
| Do Not Resuscitate/Do Not Intubate | 9 |
| Restraint | 6 |
| Chemotherapeutic Agent | 4 |

# What We Knew Prior to Our Research

## (Voluntary Reporting)

### MEDMARX

*120 Facilities Voluntary Reported*

**5,246**

| Type of Error | Average ... CPOE Mean (SD) | ... POE (SD) | ... per 100,000 ... (SD) | ... No CPOE Mean (SD) |
|---|---|---|---|---|
| Pre... | 68 (222) | ...99) | 1 | 5 (20) |
| Im... ity | 59 (132) | ...74) | 1 | |
| W... dosage | 8 (23) | (8) | | 0.8 |
| Extra dose | 14 (24) | 19 (27) | | 3 (5) |
| Omission | 48 (84) | 107 (174) | | 19 (30 |
| Unauthorized dru... | 27 (52) | 36 (72) | | 6 (10) |
| W... atient | 9 (17) | 13 (18) | | 2 (3) |
| W... | 27 (7... | ...4) | | |
| Wron... ation | 6 (9... | ...2) | | |
| Wrong route | 6 (16) | 5 (7) | 0.8 (2) | 0.9 (2) |

# Retract-and-Reorder Tool Applied to Complete 2009 Data Set

| Retract-and-Reorder Events and Wrong-Patient Orders in 2009 by Provider Type, Order Type, Visit Type, and Degree of Harm | | | |
|---|---|---|---|
| **Total Orders** | | | |
| | Total Number of Orders | Retract-and-Reorder Events | Wrong-Patient Orders per 100,000 Orders |
| Totals | 9,024,723 | 6,885 | 58 |
| **By Provider Type** | | | |
| Physicians | 4,558,198 | 3,606 | 60 |
| Physician Assistants and Nurse Practitioners | 2,346,463 | 2,283 | 74 |
| Nurses | 1,238,011 | 543 | 33 |
| Pharmacist | 273,857 | 241 | 67 |
| Other/Unknown | 608,194 | 212 | 27 |

# Retract-and-Reorder Tool Applied to Complete 2009 Data Set

| Retract-and-Reorder Events and Wrong-Patient Orders in 2009 by Provider Type, Order Type, Visit Type, and Degree of Harm | | | |
|---|---|---|---|
| **Total Orders** | | | |
| | Total Number of Orders | Retract-and-Reorder Events | Wrong-Patient Orders per 100,000 Orders |
| Totals | 9,024,723 | 6,885 | 58 |
| **By Order Type** | | | |
| Radiology | 803,584 | 996 | 94 |
| Lab | 4,109,802 | 2,605 | 48 |
| Medications | 2,414,251 | 2,163 | 68 |
| Nursing Orders | 929,402 | 464 | 38 |
| Other | 767,684 | 657 | 65 |

# Retract-and-Reorder Tool Applied to Complete 2009 Data Set

| Retract-and-Reorder Events and Wrong-Patient Orders in 2009 by Provider Type, Order Type, Visit Type, and Degree of Harm | | | |
|---|---|---|---|
| **Total Orders** | | | |
| | Total Number of Orders | Retract-and-Reorder Events | Wrong-Patient Orders per 100,000 Orders |
| Totals | 9,024,723 | 6,885 | 58 |
| **By Visit Type** | | | |
| Inpatient | 6,141,346 | 5,193 | 64 |
| Emergency Department | 2,639,424 | 1,481 | 43 |
| Outpatient | 126,858 | 142 | 85 |
| Ambulatory Surgery | 117,095 | 69 | 45 |

# Retract-and-Reorder Tool Applied to Complete 2009 Data Set

| Potential for Harm | Potential for Harm | Potential for Harm |
|---|---|---|
| Life Threatening | 166 | (2/100,000) |
| Serious | 359 | (4/100,000) |
| Clinically Significant | 1,274 | (14/100,000) |

# Corroborative Research

## Minimizing electronic health record patient-note mismatches

Adam B Wilcox, Yueh-Hsia Chen, George Hripcsak

Department of Biomedical Informatics, Columbia University Medical Center, New York, New York, USA

**Correspondence to**
Dr George Hripcsak, Department of Biomedical Informatics, Columbia University Medical Center, 622 West 168th Street, VC5, New York, NY 10032, USA; hripcsak@columbia.edu

Received 4 November
Accepted 13 March
Published Online First
12 April 2011

**ABSTRACT**

We measured the prevalence (or rate) of patient-note mismatches (clinical notes judged to pertain to another patient) in the electronic medical record from 0.5% (95% CI
window
after

rate, they provided a subset from which we could estimate correction factors for the full sample, and they provided a directly measurable parameter that could be tracked to
the study

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nosis or therapy if another
note and takes an action that is inappropriate for the patient. There is a risk of patient-note mismatches with paper records, and the problem may be increased or decreased with electronic health records. There is currently little in the literature on this particular adverse event.

Based on our use of electronic health records at a teaching hospital, we estimated the rate of patient-note mismatches. We implemented an intervention in the middle of the study period that was intended to minimize the mismatch rate, and we measured its effect.

**CASE DESCRIPTION**

We estimated the prevalence of patient-note mismatches in two steps: first we quantified the rate of clinician-discovered mismatches between the note and the patient record, and then we inferred the total rate of mismatches by looking at inconsistencies between notes and the rest of the patient record. While the clinician-discovered mismatches were likely to underestimate the total mismatch

used the set of clin
to estimate the co
mismatch rate to the

During the study period, we introduced an intervention to minimize the patient-note mismatch rate. Before December 2007, the user interface showed the patient's name, gender, birthdate, and medical record number at the top of the screen that was used to write the note, and the user completed the note by clicking a submit button. In December 2007, a pop-up window was added to reiterate the patient's name and medical record number (figure 1).

**METHOD OF IMPLEMENTATION**

Our detailed methods for each step are as follows. For clinician-discovered mismatches, we reviewed note block requests from January to October 2007, and from January to October 2008 (November–December 2007 was unavailable). These two cohorts were sampled and reviewed manually to determine the rate at which the reason for the request was a patient-note mismatch.



NYP: 51 per 100,000 notes written on wrong chart

Montefiore: 58 per 100,000 orders written for the wrong patient

# Cause of Wrong-Patient Errors

*Viewpoint Paper* ■

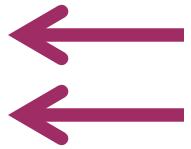
Some Unintended Consequences of Information Technology in Health Care: The Nature of Patient Care Information System-related Errors

Joan S. Ash, PhD, MLS, Marc Berg, MD, PhD, Enrico Coiera, MBBS, PhD

This mismatch between interface and use context often results in a *juxtaposition* error, the kind of error that can result when something is close to something else on the screen and the wrong option is too easily clicked in error. The following are typical quotations from physicians; note the allusions to the "interruptive" use context: "I have ordered the test that was right next to the one I thought I ordered, you know, right below it that my little thingie had come down and I clicked and I'm lookin' at this one but I in fact clicked on the thing before. By that time I turned my head and I'm hitting return and typing my signature and not seeing it" [physician, U.S. hospital]. "I was ordering Cortisporin, and Cortisporin solution and suspension comes up. The patient was talking to me, I accidentally put down solution, realized that's not what I wanted . . . . I would not have made that mistake, or potential mistake, if I had been writing it out because I would have put down what I wanted" [physician, U.S. outpatient setting].

# Causal Pathways of Wrong-Patient Errors

| Causal Pathways of Wrong-Patient Errors | Causal Pathways of Wrong-Patient Errors | Causal Pathways of Wrong-Patient Errors |
|---|---|---|
| Interruption/Distraction | 137 | 80.6% |
| Juxtaposition | 18 | 10.6% |
| Other | 15 | 8.8% |




# Are Patients with Similar Names at Greater Risk for Wrong-Patient Orders?

Hojjat Salmasian MD MPH[1], Robert A. Green MD MA[2,3], Carol Friedman PhD[1], George Hripcsak MD MS[1], David K. Vawdrey PhD[1]

[1] Department of Biomedical Informatics, Columbia University, New York, NY. [2] Division of Quality and Patient Safety, New York Presbyterian Hospital, New York, NY. [3] Department of Medicine, Columbia University Medical Center, New York, NY.

**Summary:** We assessed whether patients with similar names in computerized provider order entry (CPOE) systems are more likely to be subject to wrong-patient orders – i.e. orders that were meant to be placed for another patient. Using data from three emergency departments in New York City, we showed that patients whose surnames were identical in spelling or similar in pronunciation were more frequent in a case vs. control group; however, wrong-patient orders involving similar surnames comprised only a small fraction (<5%) of all wrong-patient orders.

**Introduction:** CPOE systems are associated with significant safety benefits[1], but their use has been associated with additional types of error, including order entry on the wrong patient. Approximately 1 in every 1000 orders placed electronically was intended for a different patient[2]. It has been hypothesized that clinicians who care for multiple patients with similar hypothesis has only been evaluated through st . Therefore, we measured the association betw s using data collected in a commonly used con

3.2% of RAR events had similar sounding surnames.

**Methods:** Our data New York City from October 2010 to Ap to identify orders that were placed for the wrong and re-ordered for the correct patient. Thes , we used a random sample of all other orders. For each randomly selected order, another order placed in the same location and for a different patient was randomly identified such that the two orders were placed within a 10-minute window. We then matched the control group to the case group based on order location and time of day. We then measured if the surnames associated with pairs of orders in the case group were more similar to each other than those in the control group. We used the following approaches to measure patient surname similarity: (i) exact string matching, which would return 1 when both patients had the same name and 0 otherwise, (ii) character-level similarity, which was measure using the Longest Common Substring (LCS) method and reports the level of similarity as a percentage[4], and (iii) Soundex match, which uses the Soundex algorithm to convert the names into phonetic representations and returns 1 when their phonetic representations are identical and 0 otherwise.

**Results:** There were 1511 pairs of orders in each groups. More patients had identical surnames in the case group compared to the control group (2.65% versus 0.23%, odds ratio = 8.67, $p < 0.001$), and more patients had similarly sounding surnames in the case group versus the control group (2.45% versus 0.40%, odds ratio = 6.29, $p < 0.001$). Analysis of results from LCS method showed that on average, 3.2% of the substrings in the pairs of surnames in the case group were similar, compared to 1.1% in the control group ($p < 0.001$), and the majority of surname pairs had no matching substrings (95.7% and 98.1% in case and control groups, respectively).

**Discussion:** Our findings suggest that although patients with similar names a more likely to be subject to wrong-patient orders, similarity of names is an infrequent root cause for this error and at least 95% of wrong-patient orders cannot be attributed to similarity in patient names. Future research should focus on identifying other, more frequent drivers for wrong-patient orders.

## References

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4. Friedman C, Sideli R. Tolerating spelling errors during patient validation. *Comput Biomed Res.* 1992 Oct;25(5):486–509.

# Outline Slide

- What we know about wrong patient errors
- Voluntary reporting of errors
- Automated detection of errors
- Our research on detecting wrong patient errors
- Our research on preventing wrong patient errors
- Future Health IT Safety Measures
- Summary

# Case Report

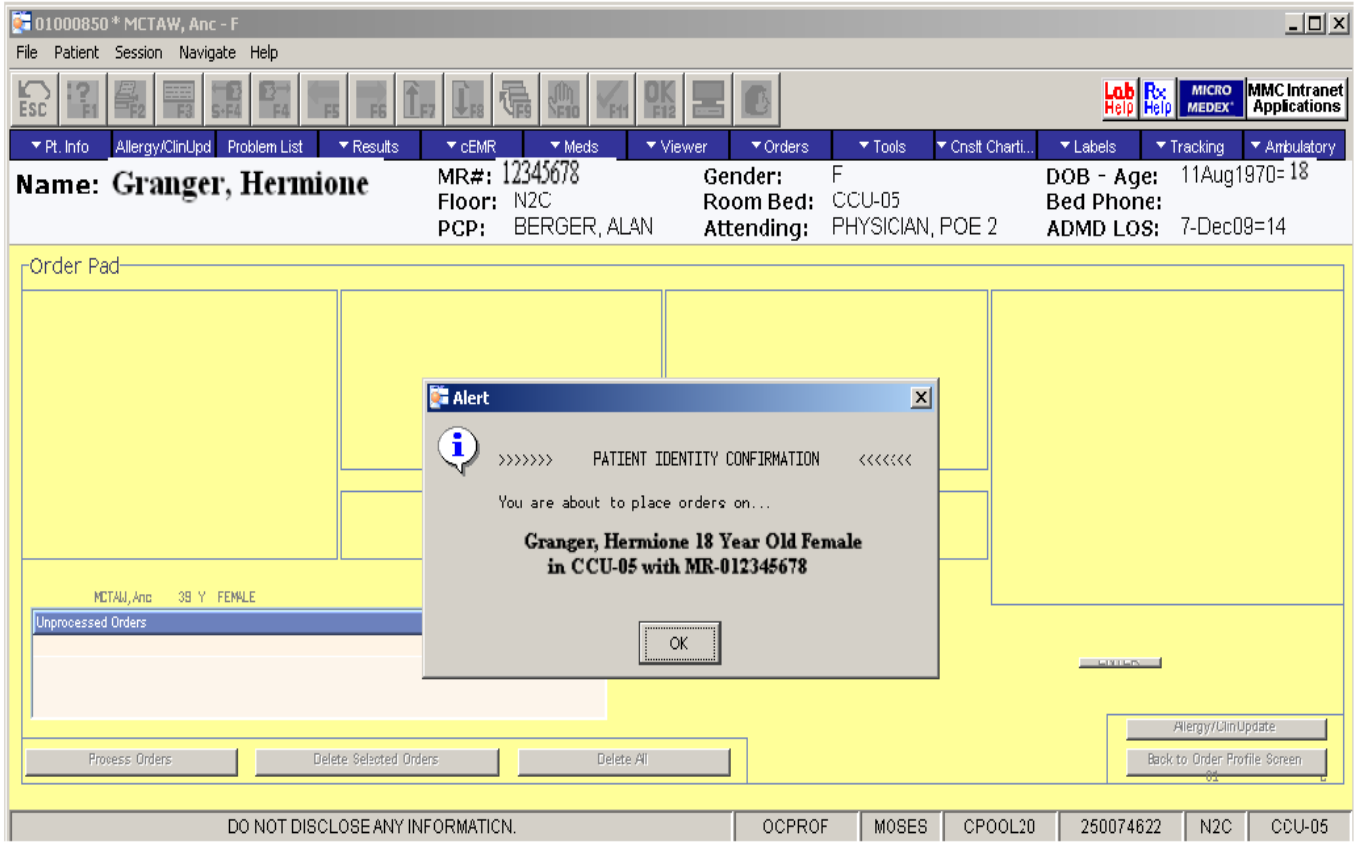
## Mrs. X

Peer review committee:

"The peer review committee recognized how easy it was for the system to allow this error. The checks and balances were not effective. Corrective action plans, as outlined by the RCA, included the formation of a subcommittee to look at what system modifications can be made to prevent wrong-patient errors."

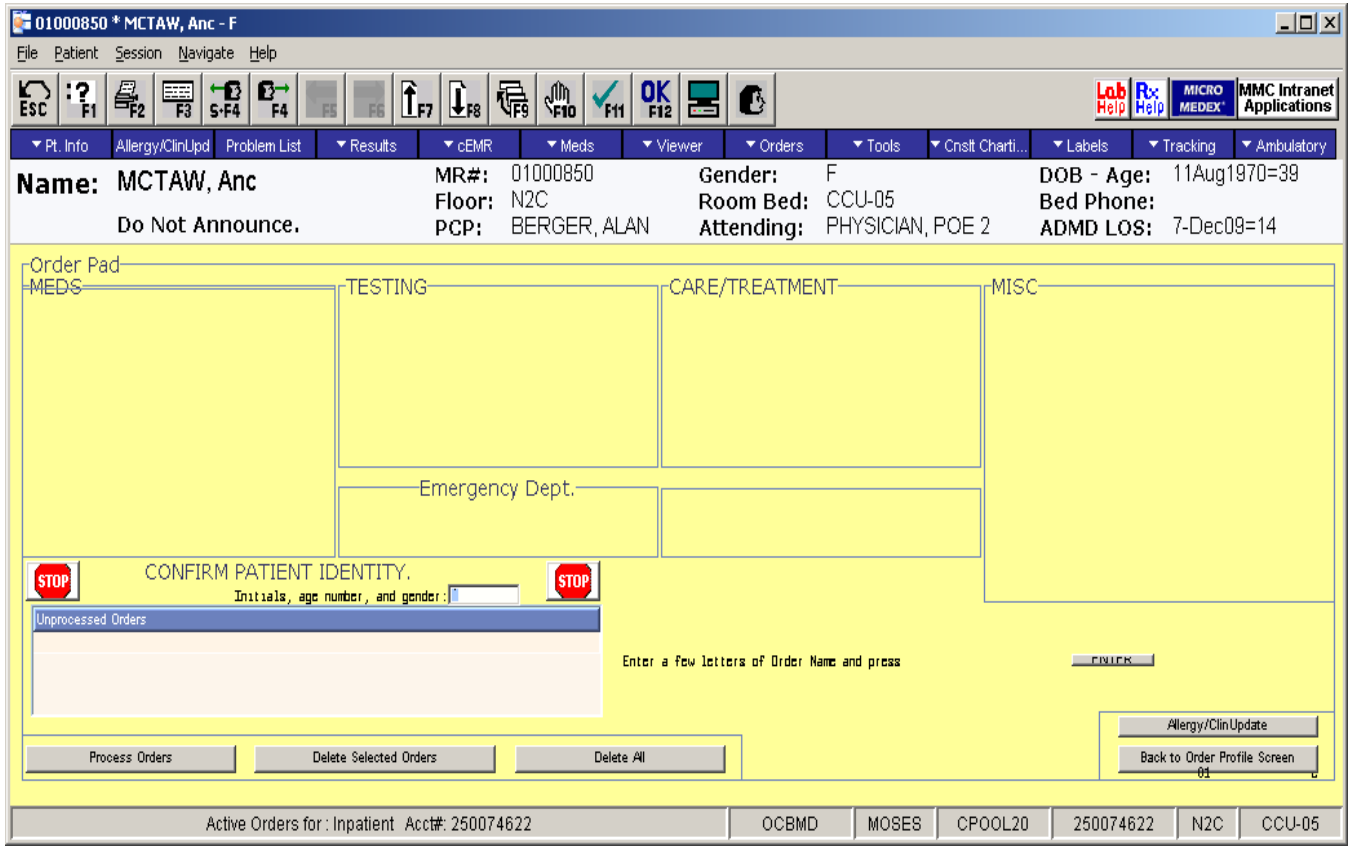
# Proposed Intervention

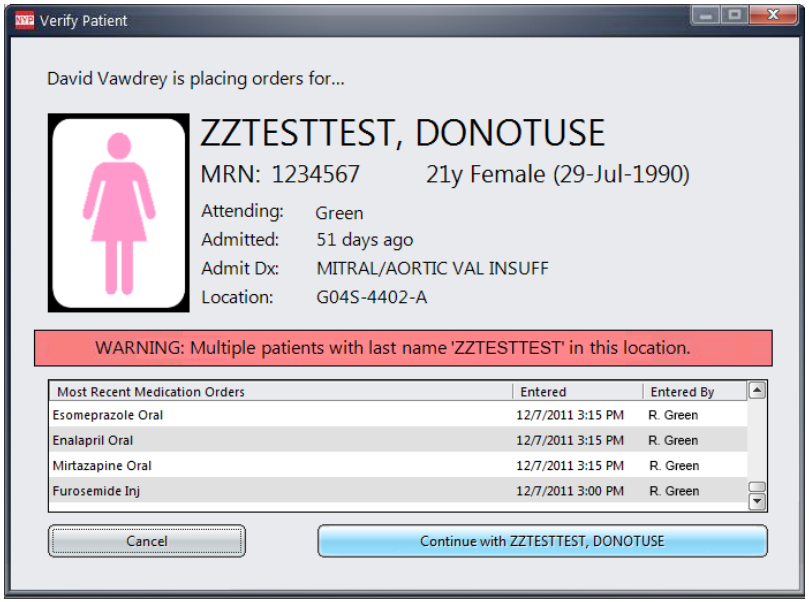
## ID-Verify Alert



# Proposed Intervention

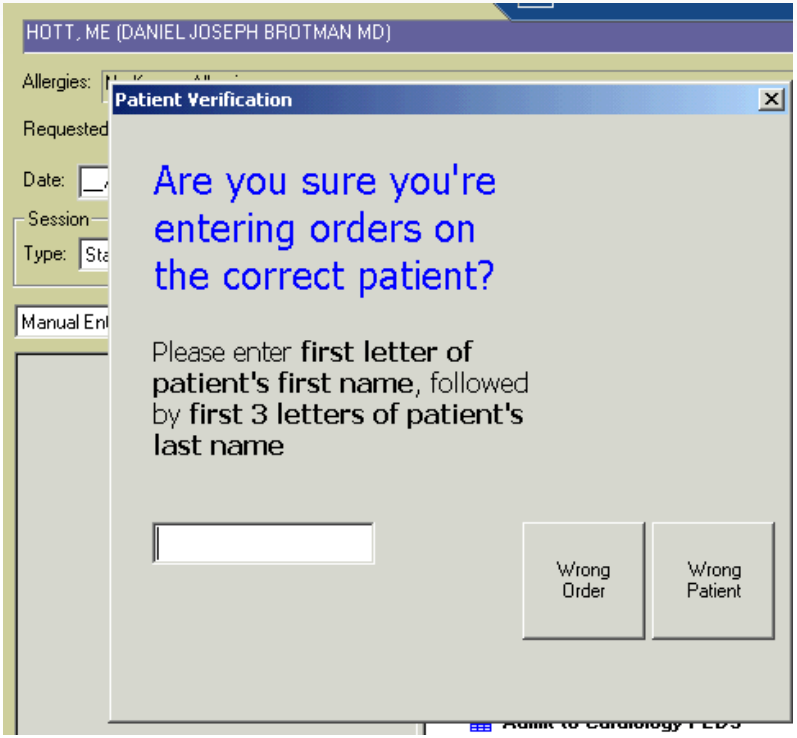
## ID-Re-entry Function






NewYork-Presbyterian
The University Hospital of Columbia and Cornell

*Screen shot courtesy of Robert Green, M.D.*



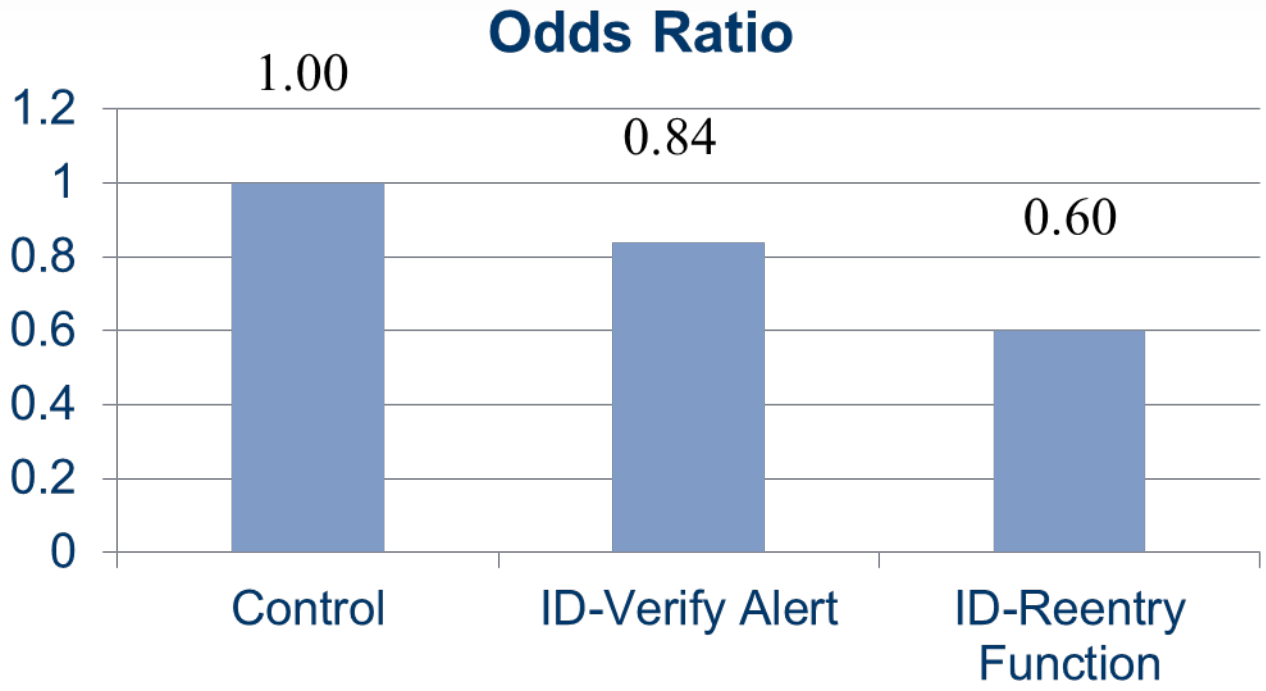

JOHNS HOPKINS MEDICINE

*Screen shot courtesy of Daniel Brotman, M.D.*

# Results

| | Control | ID-Verify Alert | ID-Reentry Function |
|---|---|---|---|
| Providers | 1,419 | 1,352 | 1,257 |
| Orders | 1,173,693 | 1,038,516 | 1,069,335 |
| Providers | 1,419 | 1,352 | 1,257 |

# Results




- Compared to control, ID-Verify Alert decreased errors by 16%.
- Compared to control, ID-Reentry Function decreased errors by 41%.

# Intercepting Wrong-Patient Orders in a Computerized Provider Order Entry System

Robert A. Green, MD, MA*; George Hripcsak, MD, MS; Hojjat Salmasian, MD, MPH; Eliot J. Lazar, MD, MBA; Susan B. Bostwick, MD, MBA; Suzanne R. Bakken, RN, PhD; David K. Vawdrey, PhD

*Corresponding Author. E-mail: greerob@nyp.org.

**Study objective:** We evaluate the short- and long-term effect of a computerized provider order entry–based patient verification intervention to reduce wrong-patient orders in 5 emergency departments.

**Methods:** A patient verification dialog appeared at the beginning of each ordering session, requiring providers to confirm the patient's identity after a mandatory 2.5-second delay. Using the retract-and-reorder technique, we estimated the rate of wrong-patient orders before and after the implementation of the intervention to intercept these errors. We conducted a short- and long-term quasi-experimental study with both historical and parallel controls. We also measured the amount of time providers spent addressing the verification system, and reasons for discontinuing ordering sessions as a result of the intervention.

**Results:** Wrong-patient orders were reduced by 30% immediately after implementation of the intervention. This reduction persisted when inpatients were used as a parallel control. After 2 years, the rate of wrong-patient orders remained 24.8% less than before intervention. The mean viewing time of the patient verification dialog was 4.2 seconds (SD=4.0 seconds) and was longer when providers indicated they placed the order for the wrong patient (4.9 versus 4.1 seconds). Although the display of each dialog took only seconds, the large number of display episodes triggered meant that the physician time to prevent each retract-and-reorder event was 1.5 hours.

**Conclusion:** A computerized provider order entry–based patient verification system led to a moderate reduction in wrong-patient orders that was sustained over time. Interception of wrong-patient orders at data entry is an important step in reducing these errors. [Ann Emerg Med. 2014;■:1-8.]

Please see page XX for the Editor's Capsule Summary of this article.

# Sustainability

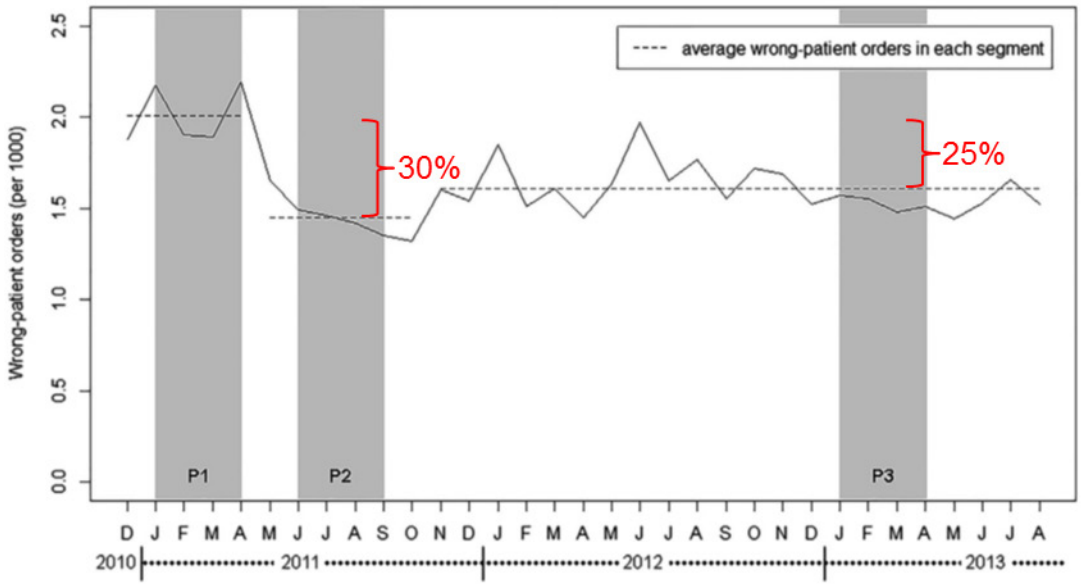



**Figure 2.** The rate of wrong-patient orders in each month, per 1,000 orders. Dashed lines show the average rate of wrong-patient orders in each segment detected in the data, using change-point analysis.[17] Shaded areas show the study periods: preintervention (P1), short-term follow-up after intervention (P2), and long-term follow-up after intervention (P3). On the x-axis, months are abbreviated to the first letter.

# "Just a Few Seconds of Your Time…" at Least 130 Million Times a Year

Robert L. Wears, MD, PhD*

*Corresponding Author. E-mail: r.wears@imperial.ac.uk, Twitter: @wears_r.

0196-0644/$-see front matter

http://dx.doi.org/10.1016/j.annemergmed.2015.02.006

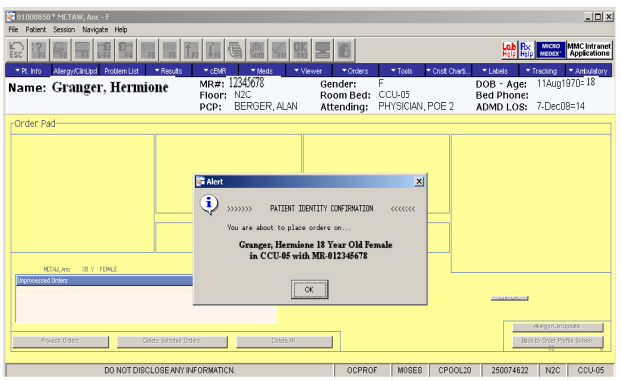
A **podcast** for this article is available at www.annemergmed.com.

**SEE RELATED ARTICLE, P. 679.**

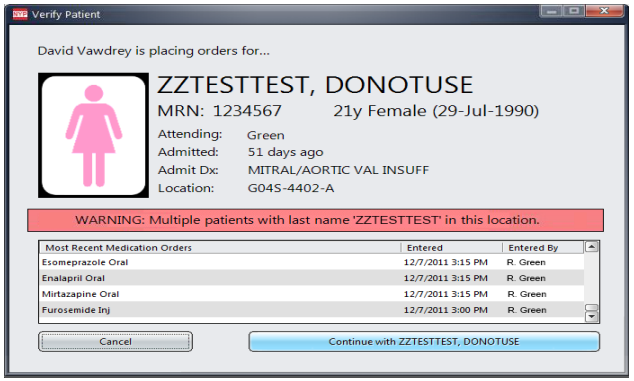
[Ann Emerg Med. 2015;65:687-689.]

On the heels of the Institute of Medicine's somewhat contested report on the safety of health information technology,[1,2] an international group of informatics experts warned that health care was entering a decade of danger.[3] They feared that the widespread deployment of health information technology systems that are "less mature than using paper orders. Although many wrong-patient orders are intercepted before being carried out, and others may be inconsequential, the potential for devastating harm is obvious.

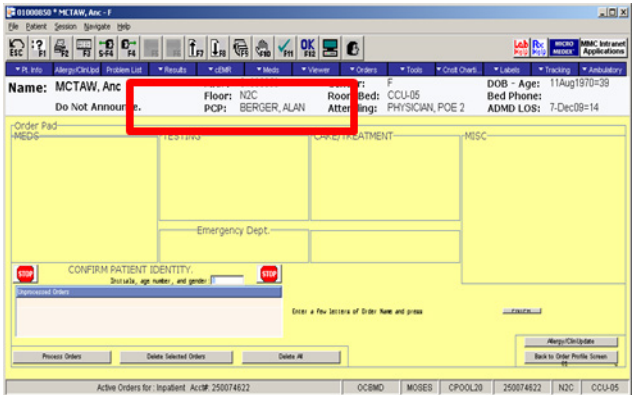
The intervention by Green et al[5] involved displaying a patient verification dialogue screen that required active confirmation from the physician before moving on to the order placement screen. It was designed so that physicians could not "click ahead" in anticipation of the confirmation request by means of a 2.5-second delay before any input other than canceling the order session would be accepted.




0.5 seconds ↓16%




2.5 seconds ↓30%

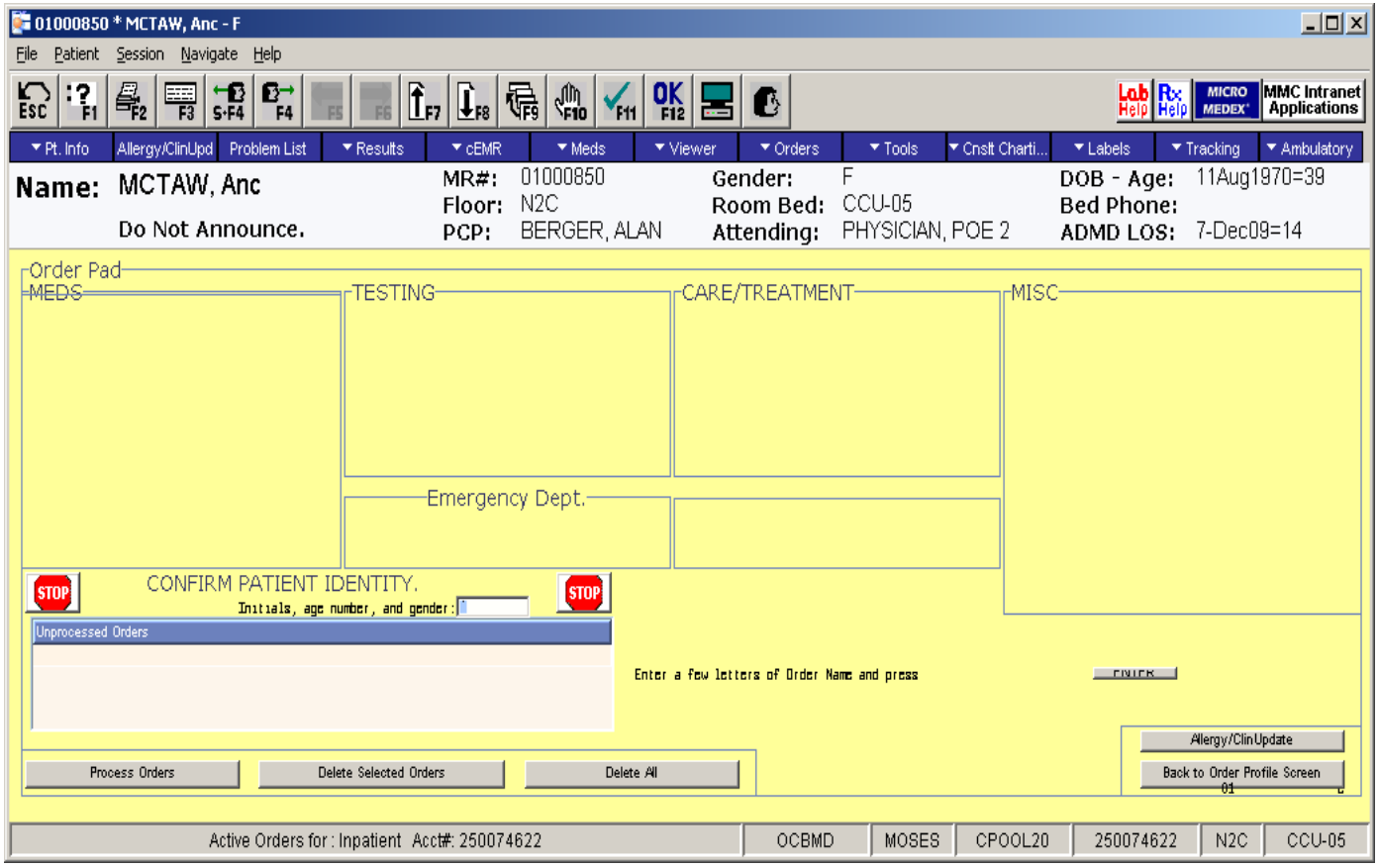



6.6 seconds ↓41%

# What We Need is a *Multipronged Approach*

# Proposed Intervention

## ID-Reentry Function



# Indication-based prescribing prevents wrong-patient medication errors in computerized provider order entry (CPOE)

William Galanter,[1] Suzanne Falck,[1] Matthew Burns,[1] Marci Laragh,[1] Bruce L Lambert[2]

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[2]Department of Pharmacy Administration, University of Illinois at Chicago, Chicago, Illinois, USA

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Received 6 December 2012
Revised 17 January 2013
Accepted 20 January 2

**ABSTRACT**

**Objective** To determine whether indication-based computer order entry alerts intercept wrong-patient medication errors.

**Materials and methods** At an academic medical center serving inpatients and outpatients, we developed and implemented a clinical decision support system to prompt clinicians for indications when certain medications were ordered without an appro… coded indication on the proble… alerts that fired, we id… medication or… within …

Removed problems

oblems

In working set filter (IWS):
Show 'In working set' only
Show all

Add:

| # | 2nd | Pri | IWS | St | Category | Ref | Problem and Modifier | Onset | ICD9 | La |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | | | Y | A | Ongoing | | Cholecystitis | 07Oct12 | 575.10 | 7-Oc |
| 3 | | | Y | A | Ongoing | | Choledocholithiasis | 08Oct12 | 574.50 | 8-Oct1 |
| 4 | | | Y | A | Ongoing | | Diabetes mellitus | 16Dec12 | 250.00 | 16Dec.. |
| 7 | | | Y | A | Limited | | Community acquired pneumonia | 06Oct13 | 480.8 | 6-Oct13 |
| 8 | | | Y | A | Limited | | Abdominal pain | 06Oct13 | 789.00 | 6-Oct13 |
| 5 | | | Y | A | Hlth Mt | | Vaccination for pneumococcus, Over 65 | 18Dec12 | V03.82 | 18Dec. |
| 6 | | | Y | A | Hlth Mt | | Vaccination for influenza, 10/12 | 18Dec12 | V04.81 | 18Dec |
| 9 | | | Y | A | Hlth Mt | | History of skin cancer, face | 06Oct13 | V10.83 | 6-Oc |
| | | | N | A | Limited | | Bronchiectasis with acute exacerbation | 08Oct13 | 494.1 | 8 |

BAC…
Use of co… systems for the … part of the hospital-base… components of the US goverm… use incentives.[1] While CPOE has been sho… decrease medication errors[2–4] and in some studies mortality,[5] use of CPOE can also have unintended negative consequences, creating opportunities for or increasing the likelihood of certain types of medication errors.[6–9]

One potential problem with an electronic medical record (EMR) is the risk that a physician will accidentally enter orders in the wrong patient's chart.[8–10] In spite of all their disadvantages, paper charts afforded prescribers multiple visual cues that served to orient them to whether or not they were ordering for the correct patient, including the thickness of the chart, the handwriting, and the patient's problem list.[10] Most of these cues are either missing entirely or are less salient in the electronic environment, increasing the opportunity for wrong-chart errors. Use of patient lists may cause 'pick-list' or other user–interface driven errors,[7 11] and wrong patient…

## MATERIALS AND METHODS

The University of Illinois Hospital and Health Sciences System (UI-Health) has a 450-bed teaching hospital and a large multi-specialty ambulatory clinic utilizing a commercial EMR (Millennium; Cerner Corporation, Kansas City, Missouri, USA) for problem lists, clinical notes, test results, medication lists, and orders. The EMR is used by all specialties, allowing any clinician to update patient records and problem lists either as free text or using common discrete coded nomenclatures

**To cite:** Galanter W, Falck S, Burns M, *et al. J Am Med Inform Assoc* Published Online First: [*please include* Day Month Year] doi:10.1136/amiajnl-2012-001555

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**The Use of Patient Pictures and Verification Screens to Reduce Computerized Provider Order Entry Errors**

Daniel Hyman, Mariel Laire, Diane Redmond and David W. Kaplan

*Pediatrics*; originally published online June 4, 2012;
DOI: 10.1542/peds.2011-2984


**TABLE 1** Patients Receiving Care Not Intended for Them Because of Erroneous Chart Orders

| | Raw Number of Ordering Errors (Orders on Incorrect Patient Chart) | Rate per 1000 Adjusted Patient Days |
|---|---|---|
| 2010 | 12 | 0.09 |
| 2011 | 3 | 0.02 |
| % Reduction from 2010 to 2011 | 75% | 77.8% |

# Wrong Patient Errors in the NICU

# Patient Misidentification in the Neonatal Intensive Care Unit: Quantification of Risk

James E. Gray, MD[a,b], Gautham Suresh, MD[a,c], Robert Ursprung, MD[a,d], William H. Edwards, MD[a,e], Julianne Nickerson, MSW[a], Pat H. Shiono, PhD[a], Paul Plsek, MS[a], Donald A. Goldmann, MD[a,b,f], Jeffrey Horbar, MD[a,g]

## ABSTRACT

OBJECTIVE. To quantify the potential for misidentification among NICU patients resulting from similarities in patient names or hospital medical record numbers (MRNs).

METHODS. A listing of [illegible] was obtained from [illegible] considered at risk f[illegible] similar-sounding s[illegible] for in the NICU on[illegible]

RESULTS. During the [illegible] to 1260 patients. T[illegible] was 48. Not a sing[illegible] number of patient[illegible] representing just o[illegible] year, the risk ranged from 20.6% to a high of 72.9% of the average daily census. The most common causes of misidentification risk were similar-appearing MRNs (44% of patient days). Identical surnames were present in 34% of patient days, and similar-sounding names were present in 9.7% of days. Twins and triplets contributed one third of patient days in the NICU. After these multiple births were excluded from analysis, 26.3% of patient days remained at risk for misidentification. Among singletons, the contribution to misidentification risk of similar-sounding surnames was relatively unchanged (9.1% of patient days), whereas that of similar MRNs and identical surnames decreased (17.6% and 1.0%, respectively).

CONCLUSIONS. NICU patients are frequently at risk for misidentification errors as a result of similarities in standard identifiers. This risk persists even after exclusion of multiple births and is substantially higher than has been reported in other hospitalized populations.

"The mean number of patients who were at risk for a wrong patient error on any given day was just over 50% of the average daily census."

/doi/10.1542/

-0291

identification,

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ul 5, 2005

o James E. Gray, , Neonatology, 330 Brookline Ave, Boston, MA 02215. E-mail: jgray@bidmc.harvard.edu

Physician Desktop

**Current Patient List:** CNSL: Census EINST 5N

| MRN | Patient Name | cEMR | Other Information |
|---|---|---|---|
| 03618[redacted] | [redacted],Babygirl | | NICU-01 |
| 03583[redacted] | [redacted],Babygi | | NICU-02 |
| 03619[redacted] | [redacted],Babyboy | | NICU-03 |
| 03588[redacted] | [redacted],Babygirl | | NICU-04 |
| 03609[redacted] | [redacted],Babygirl | | NICU-05 |
| 03621[redacted] | [redacted],Babyboy | | NICU-06 |
| 03622[redacted] | [redacted]Babyboy | | NICU-07 |
| 03609[redacted] | [redacted],Babyboy a | | NICU-08 |
| 03610[redacted] | [redacted],B... | | NICU-09 |
| 03606[redacted] | [redacted],Babyboy | | NICU-10 |
| 03621[redacted] | [redacted],Babygirl | | NICU-11 |
| 03601[redacted] | [redacted]Babygirl | | NICU-12 |
| 03611[redacted] | [redacted]Babyboy | | NICU-13 |
| 03623[redacted] | [redacted],Babyboy | | NICU-14 |
| 03622[redacted] | [redacted],Babyboy | | NICU-15 |
| 03623[redacted] | [redacted],Babygirl | | NICU-16 |
| 03623[redacted] | [redacted],Babyboy | | NICU-17 |
| 03614[redacted] | [redacted],Babygirl a | | NICU-18 |

Activate | Remove | Add Active | Find Name | Temp Locn | Print List | Refresh

# NICU Data

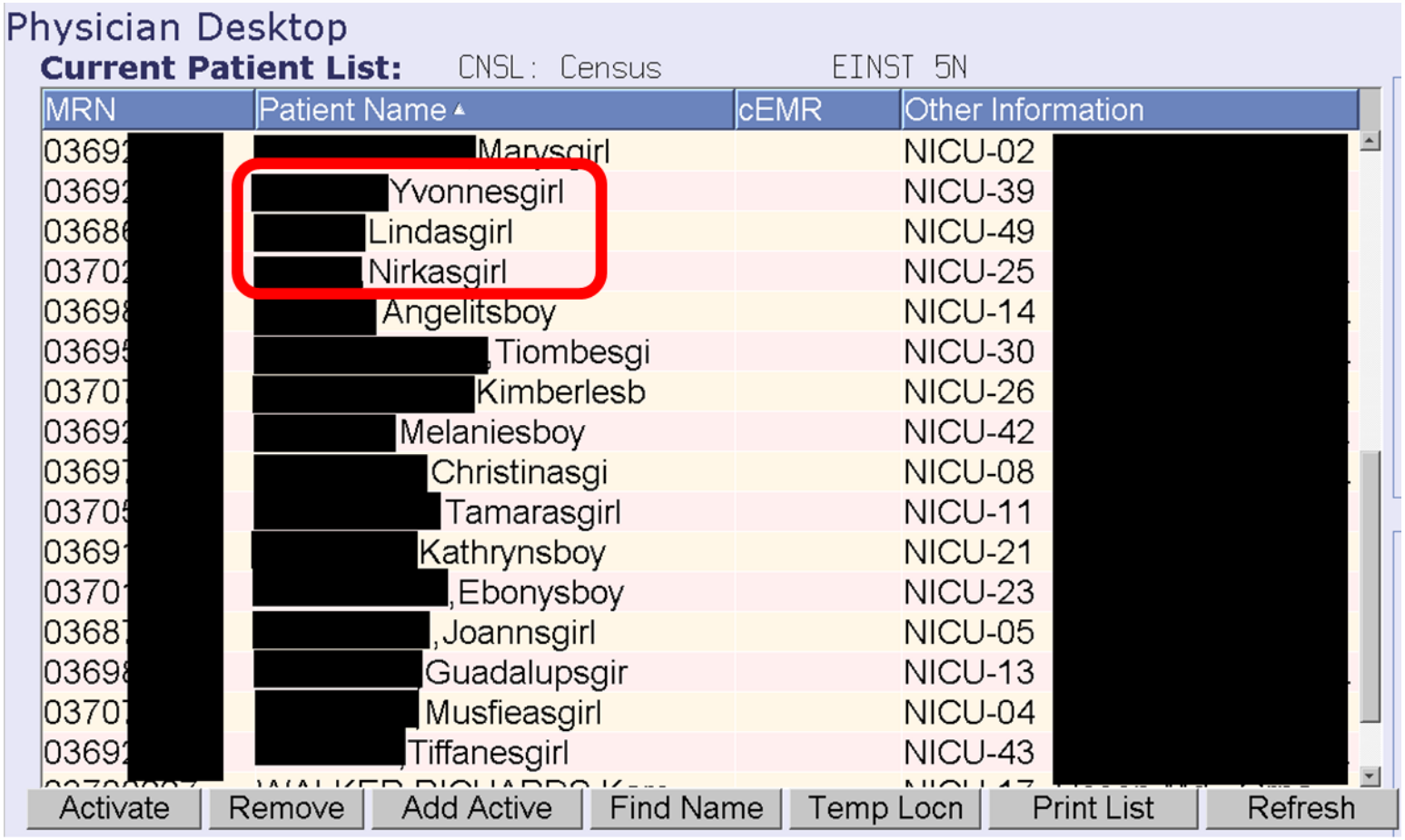
| | General Pediatrics | NICU | Multiples |
|---|---|---|---|
| Orders | 1,516,152 | 343,045 | 63,719 |
| RAR Events | 1,136 | 402 | 88 |
| RAR Events/100,000 Orders | 75 | 117 | 138 |

Multiples compared to Multiples= 1.8

# American Academy of Pediatrics Survey

- 335 NICUs responded (37.8% response rate)
- 81.8% of the NICUs reported using a non-distinct naming convention.
- The most common non-distinct naming conventions in use:
  - Babyboy/Babygirl (48.5%)
  - BB/BG (26.3%)
  - Boy/Girl (11.3%)
  - Others: Male/Female, Inf daughter/Inf son, Master/Miss, Fe/Ma, M/F, B/G, BBaby/Gbaby, and NBM/NBF.

# Proposed Intervention



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# Use of Temporary Names for Newborns and Associated Risks

Jason Adelman, MD, MS[a,b], Judy Aschner, MD[b,c], Clyde Schechter, MD[a,d], Robert Angert, MD[b,c], Jeffrey Weiss, MD[a,b], Amisha Rai, PA-C, MHS[b], Matthew Berger, MD[a,b], Stan Reissman, MSW[b], Vibin Parakkattu[e], Bejoy Chacko[b], Andrew Racine, MD, PhD[b,c], William Southern, MD, MS[a,b]

abstract

**BACKGROUND:** Because there can be no delay in providing identification wristbands to newborns, some hospitals assign newborns temporary first names such as Babyboy or Babygirl. These nondistinct naming conventions result in a large number of patients with similar identifiers in NICUs. To determine the level of risk associated with nondistinct naming conventions, we performed an intervention study to evaluate if assigning distinct first names at birth would result in a reduction in wrong-patient errors.

**METHODS:** We conducted a 2-year before/after implementation study to examine the effect of a distinct naming convention that incorporates the mother's first name into the newborn's first name (eg, Wendysgirl) on the incidence of wrong-patient errors. We used the Retract-and-Reorder (RAR) tool, an established, automated tool for detecting the outcome of wrong-patient electronic orders. The RAR tool identifies orders placed on a patient that are retracted within 10 minutes and then placed by the same clinician on a different patient within the next 10 minutes.

**RESULTS:** The reduction in RAR events post- versus preintervention was 36.3%. After accounting for clusters of orders within order sessions, the odds ratio of an RAR event post- versus preintervention was 0.64 (95% confidence interval: 0.42–0.97).

**CONCLUSIONS:** The study results suggest that nondistinct naming conventions are associated with an increased risk of wrong-patient errors and that this risk can be mitigated by changing to a more distinct naming convention.

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Quick Safety - Issue 17, October 2015

October 21, 2015

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Temporary names put newborns at risk

Issue:

A common practice in hospitals is to give newborns temporary names at birth, since the parents may not have decided on the baby's name. While the practice is intended to identify newborns, it results in a large number of patients with similar identifiers and who could potentially have the same date of birth, gender and surname – circumstances that put newborns

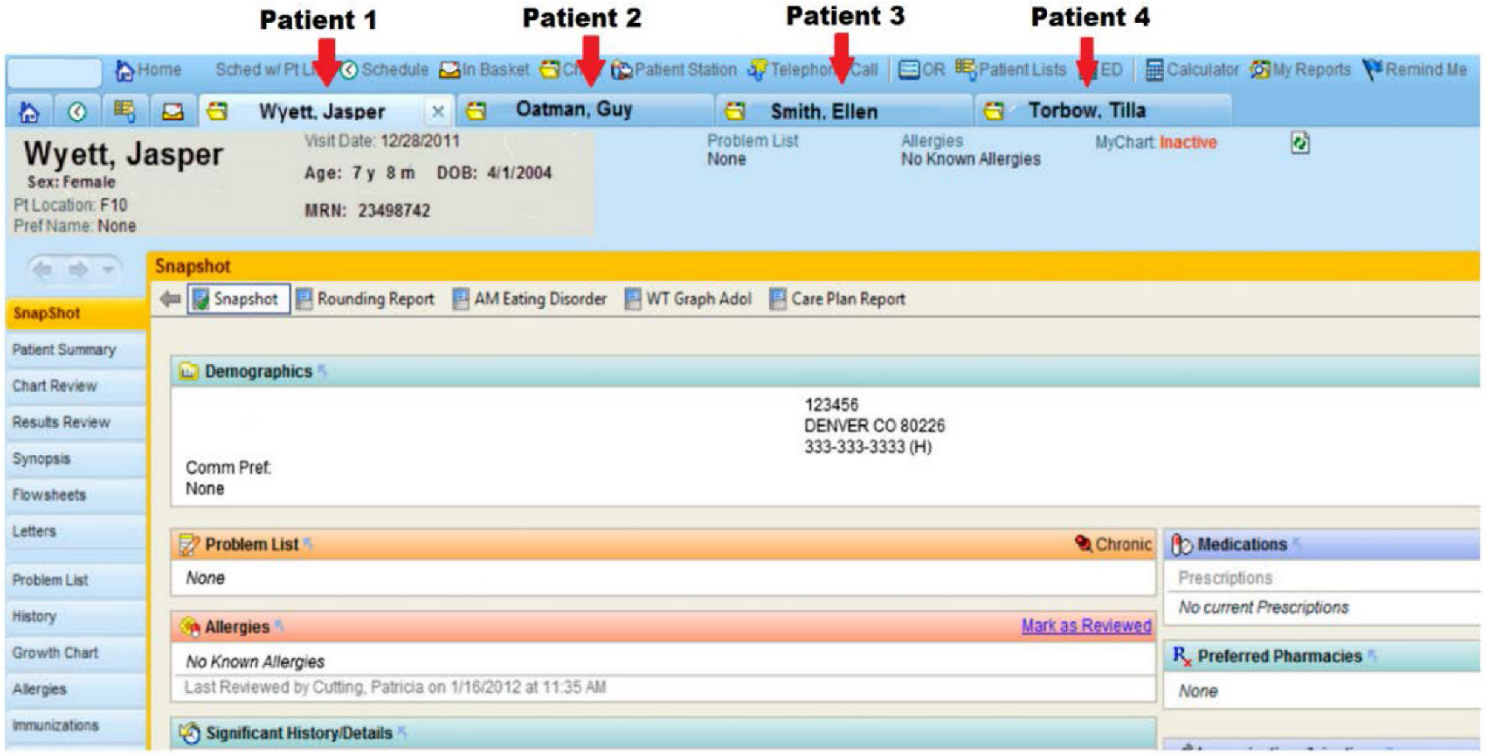
name is Babyboy Smith, using the baby's gender and the parent's last name. This naming convention is not distinct enough to prevent patient identification errors that could result in harm.

Newborn misidentification errors include:

# WRONG PATIENT ERRORS WHEN MULTIPLE RECORDS ARE OPEN AT ONCE

# Assess Risk of Multiple Records Open at Once

AHRQ-Funded Study (R21)
1R21HS023704



# CMIO Survey

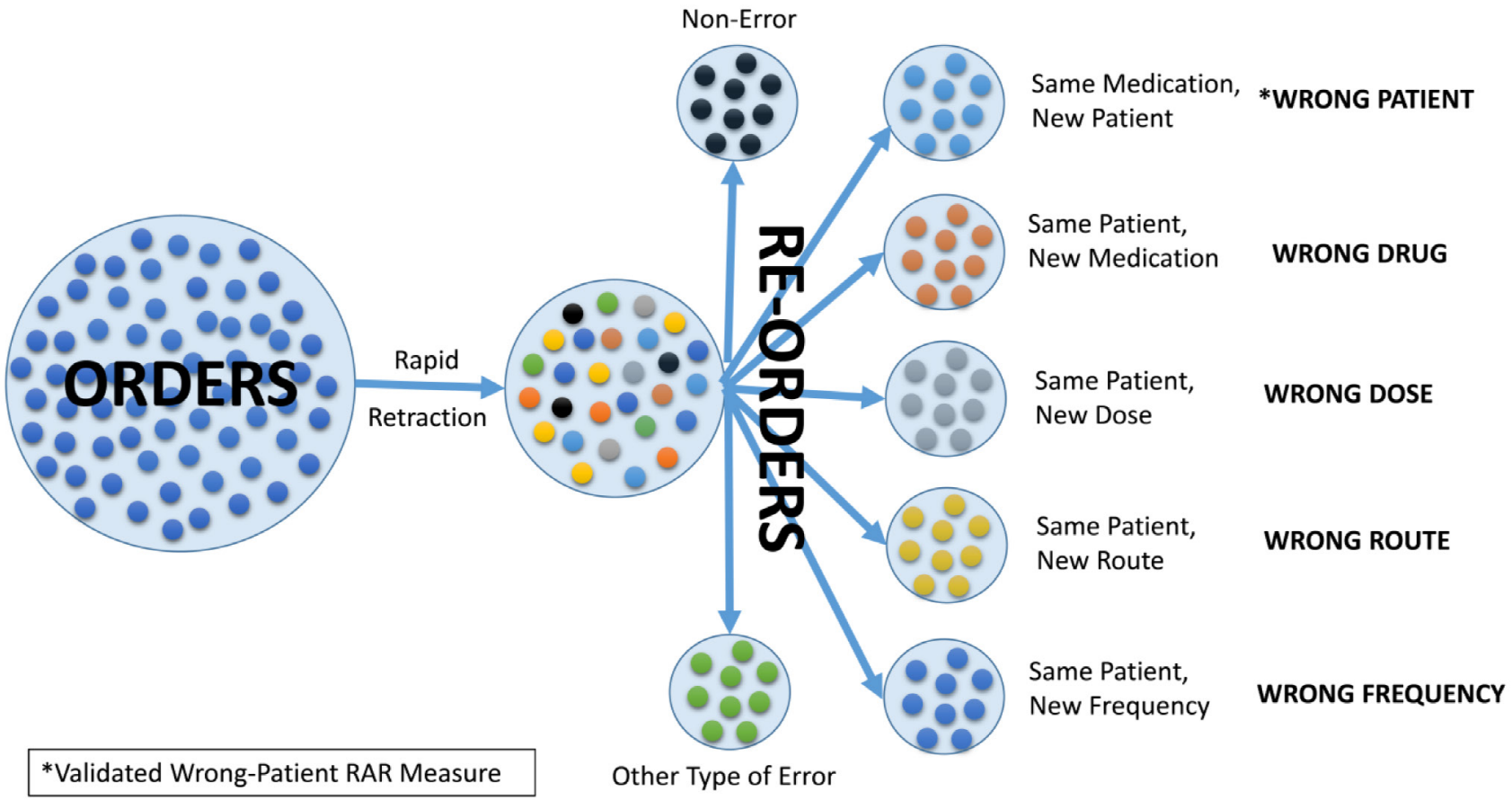
| | Max (3 or More Records) | Hedge (2 Records) | Restrict (1 Record) | Total |
|---|---|---|---|---|
| Inpatient | 38 (41.8%) | 16 (17.6%) | 37 (40.7%) | 91 |
| Outpatient | 36 (47.4%) | 13 (17.1%) | 27 (35.5%) | 76 |
| Total | 74 (44.3%) | 29 (17.4%) | 64 (38.3%) | 167 |

- Example comment from a hospital that allowed three or more charts open:
  - "The efficiency benefits are such that allowing multiple records open is justified. There are other ways to prevent wrong patient errors."
- Example comment from a hospital that allowed only one chart open at a time:
  - "My organization chooses to allow only one EHR open at a time to decrease potential wrong-patient errors. We feel, as do the organizations we polled, that multiple records open by the same person is not good practice and is an error waiting to happen."
- Example comment from a hospital that hedged at two charts open at a time:
  - "Two seems to represent the sweet spot between efficiency and safety as long as training is present to mitigate the risks."

# Outline Slide

- What we know about wrong patient errors
- Voluntary reporting of errors
- Automated detection of errors
- Research on detecting wrong patient errors
- Research on preventing wrong patient errors
- Future Health IT Safety Measures
- Summary

# AHRQ-Funded R01 (R01HS024538) Develop New Health IT Safety Measures



# Outline Slide

- What we know about wrong patient errors
- Voluntary reporting of errors
- Automated detection of errors
- Research on detecting wrong patient errors
- Research on preventing wrong patient errors
- Future Health IT Safety Measures
- Summary

# Take Home Points

1) Wrong patient errors are common.
2) Voluntary reporting greatly underestimates actual error rates.
3) Automated tools for identifying errors shows great promise.
4) Multiple synergistic interventions will likely be needed to truly eliminate the hazard of wrong patient errors.
5) More research is needed.

# Case Report

## Mrs. X

“Shortly after Mrs. X was intubated, the error was discovered.  She was given Narcan 0.4 mg and became alert with normal pupils. Her mental status returned to baseline, and she was weaned off the ventilator and extubated within a few hours of being transferred to the MICU. She remained alert and oriented and was discharged home two days after the error was made.”

# Contact Information


Jason Adelman

jsa2163@cumc.columbia.edu

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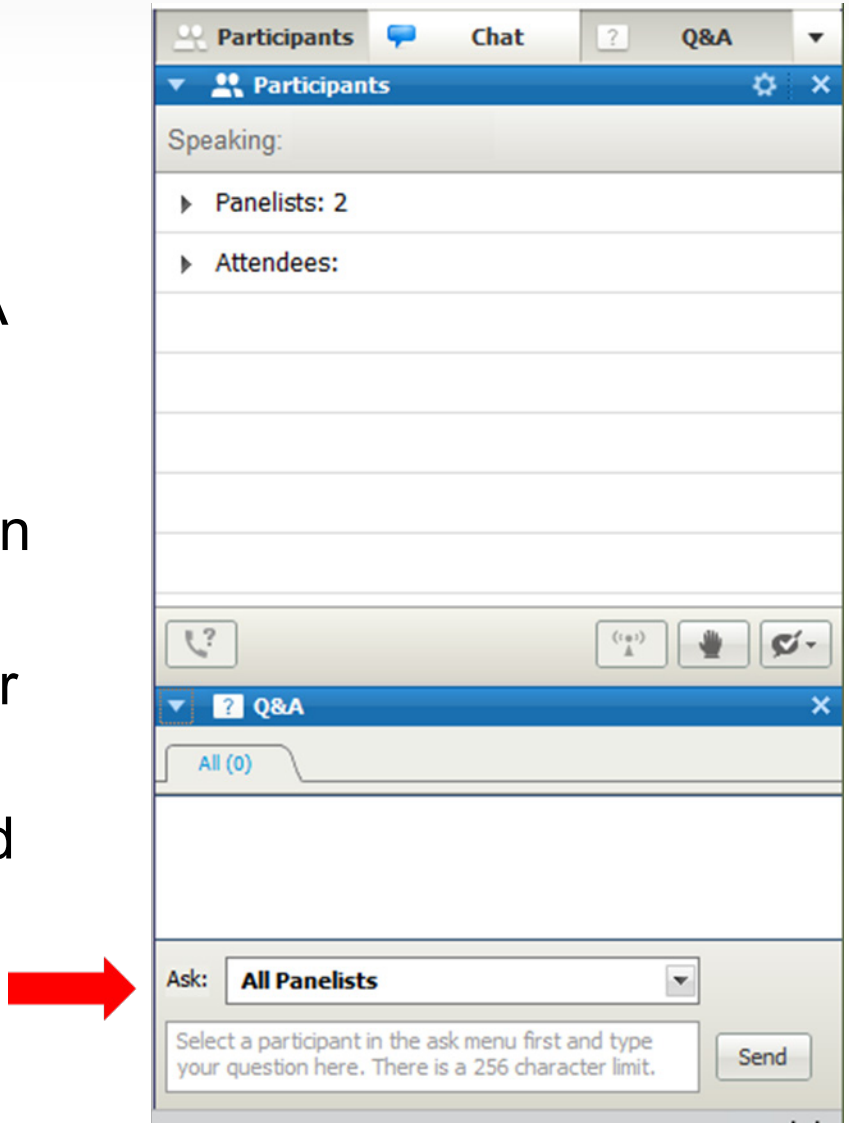
- Please address your questions to “All Panelists” in the drop-down menu.
- Select “Send” to submit your question to the moderator.
- Questions will be read aloud by the moderator.



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