National Web-Based Teleconference on Health IT

Preventing Errors and Promoting Safety Through Better Medication Management

February 16, 2011

Moderator:

Angela Lavanderos

Agency for Healthcare Research and Quality

Presenters:

Donna Horn

Andrea Wessel

Chris Lehmann

Judy Smetzer

AHRQ National Resource Center for Health Information Technology

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Preventing Errors and Promoting Safety through Better Medication Management

Introduction

Donna Horn RPh, DPh

I do not have any relevant financial relationships with any commercial interests to disclose.

Definitions

- Medication errors
  - Wrong patient, drug, dose, frequency, route, dosage form, administration directions
  - Presence of contraindication
  - Inappropriate duplicative therapy
  - Important drug-drug interaction
- Adverse drug events (ADEs)
  - Injuries from drug therapy
- Preventable adverse drug events (PADEs)
  - At least a quarter of ADEs are preventable[1-3]
  - Among the most common causes of harm during care

Scope and Significance

Are PADEs really that bad…?

Scope and Significance

Inpatient

- Prescription errors (PADEs)
  - 3.7 to 84.1 per 1,000 admissions[3-7]
- Preparation/dispensing errors (PADEs)
  - 1.1 to 1.6 per 1,000 admissions[3,7]
- Drug administration errors (PADEs)
  - 2.1 to 17.9 per 1,000 admissions[3,7]
- 450,000 patients experience PADE each year[3,8]
  - 4% (1.4-15.4%) of all hospital admissions[9-15]

Scope and Significance

Outpatient

- Community pharmacies
  - 1.7% to 24% dispensing error rate[16-19]
- Even with lowest error rate (1.7%)
  - 4 errors per 250 prescriptions[5]
  - 60 million PADEs annually[20]
- 5% ambulatory patients experience PADEs[15]
  - Dosing errors highest clinical significance
- $121.5 billion for hospital admissions[21]
    - 70% of total costs of drug-related problems

Scope and Significance

Other ambulatory settings

- Outpatient pediatric clinics
  - 15% wrong dose prescribing errors for 22 common drugs[22]
- Ambulatory clinics
  - 21% prescribing errors[23]
  - 17% samples dispensed refer to absent packaging information[24]
- Hemodialysis unit
  - 97.7% patients subject to prescribing errors[25]

Patients at Higher Risk for PADEs

- Patients on multiple medications
- Patients with low health literacy
- Elderly patients
- Patients with renal or liver impairment
- Pediatrics

High-Alert Medications (Ambulatory)

Drug Class/Category

- Antiretroviral agents
- Chemotherapy, oral
- Hypoglycemic agents, oral
- Immunosuppressant agents
- Insulin
- Opioids, all formulations
- Pregnancy category X drugs
- Pediatric liquid medications that require measurement

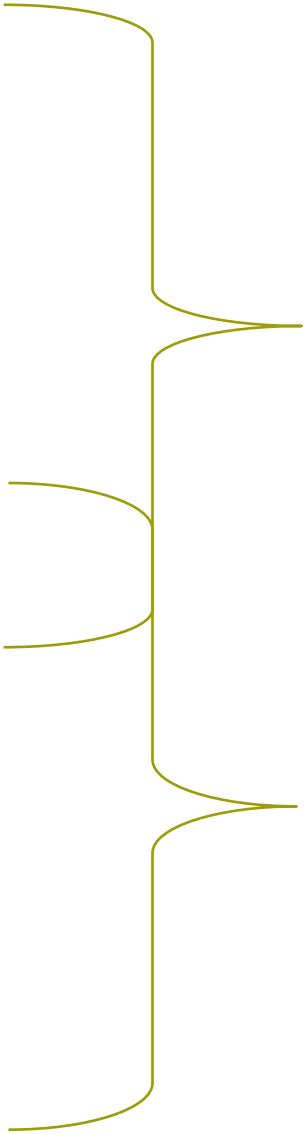
Individual Drugs

- carbamazepine
- chloral hydrate liquid
  - sedation of children
- heparin
- methotrexate
  - non-oncologic use
- midazolam liquid
  - sedation of children
- propylthiouracil
- warfarin

Error-Reduction Strategies

- Forcing functions
- Barriers and fail-safes
- Automation and computerization
- Redundancies
- Recovery
- Standardization and protocols
- Performance shaping factors

  (e.g., checklists, reminders)
- Rules and policies
- Education
- Information
- Make no mistake



Improve system reliability

Improve human reliability

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Preventing Errors and Promoting Safety through Better Medication Management: The PPRNet Experience

Andrea Wessell, PharmD, BCPS, CDE
PPRNet, Medical University of South Carolina
Charleston, SC

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- PPRNet practices
- Agency for Healthcare Research and Quality Ambulatory Safety and Quality Program: Improving Quality through Clinician Use of Health IT

Learning Objectives

1. Describe the importance of health IT in preventing patient safety errors.

2. **Examine successful error prevention strategies from real-world practice.**

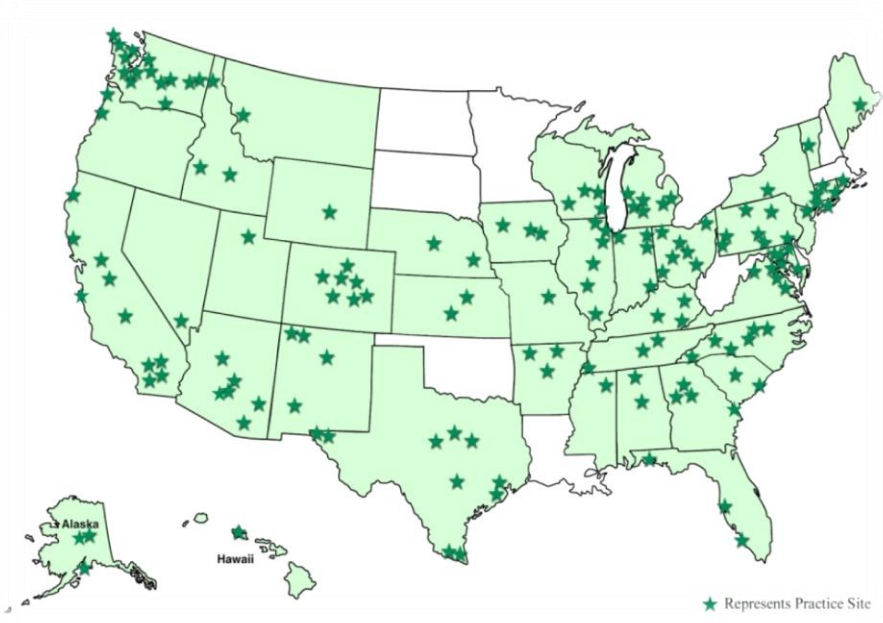
MS-TRIP: Medication Safety in Primary Care Practice – Translating Research into Practice

- 3-year demonstration project in 20 PPRNet practices
- Goals:
  1. Develop a set of medication safety indicators relevant to primary care
  2. Incorporate indicators into PPRNet quarterly reports
  3. Assess impact of PPRNet-TRIP quality improvement model on indicators

Background: PPRNet

- Nationwide primary care practice-based research network among users of a common electronic health record (EHR)

- Medication safety decision support features within EHR
  - Allergy, drug-drug and drug-disease and interaction alerts
  - Dosing calculators
  - Monitoring prompts



MS-TRIP Practice Characteristics

		Practice count
Geographic location	South	9
	Midwest	5
	West	4
	Northeast	2
Number of clinicians	1 or 2	11
	3 or 4	7
	10 or greater	2
Practice type	Physician-owned	14
	Hospital-owned	3
	Other	3

Quality and Safety in Health Care 2010; 19:1-5.

MS-TRIP Intervention

Reports

- Quarterly
- Performance over time with benchmarks
- Lists of de-identified patients with potential errors

Site Visits

Network Meetings

MS-TRIP Intervention

Reports

- Quarterly
- Performance over time with benchmarks
- Lists of de-identified patients with potential errors

Site Visits

- Annually
- On site meeting with practice staff and clinicians
- Academic detailing
- Performance review
- Improvement planning
- QI implementation assistance

Network Meetings

MS-TRIP Intervention

Reports

- Quarterly
- Performance over time with benchmarks
- Lists of de-identified patients with potential errors

Site Visits

- Annually
- On site meeting with practice staff and clinicians
- Academic detailing
- Performance review
- Improvement planning
- QI implementation assistance

Network Meetings

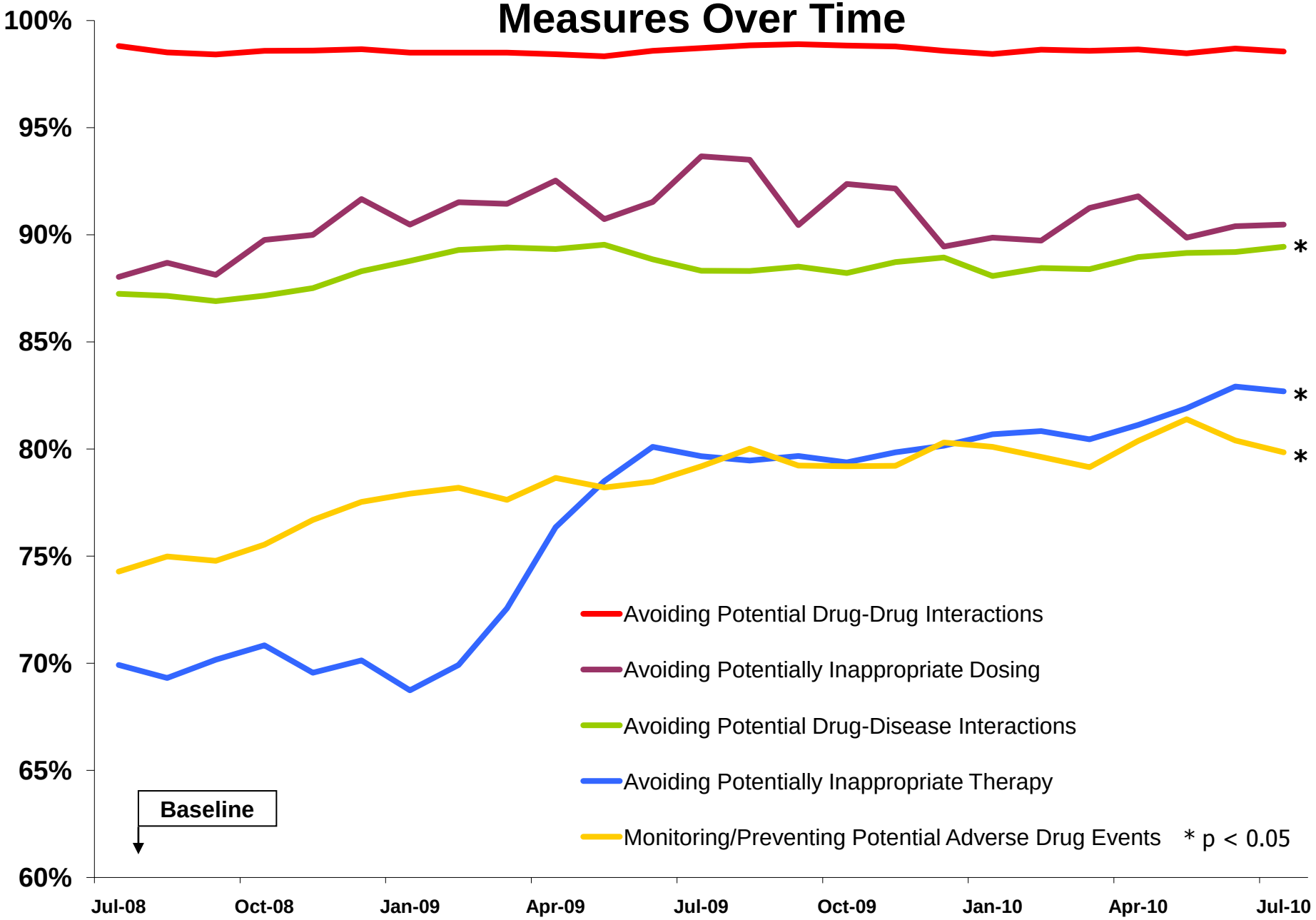
- Annually
- "Best practice" dissemination
- Small group workshops on overcoming challenges in implementation

MS-TRIP Indicator Set

- Avoiding potentially inappropriate therapy (3)
- Avoiding potentially inappropriate dosages (4)
- Avoiding potential drug-drug interactions (8)
- Avoiding potential drug-disease interactions (9)
- Monitoring of potential adverse events (20)

Quality and Safety in Health Care 2010; 19:1-5.

Median Summary Performance in Medication Safety Measures Over Time



Medication Error Prevention Strategies

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Practice Strategies

- Assure the accuracy of each patient's recorded medication list
- Integrate EHR decision support features into routine practice
- Implement a practice refill and monitoring protocol
- Utilize medication safety practice performance reports

Journal of Patient Safety 2010;6(4):238-43.

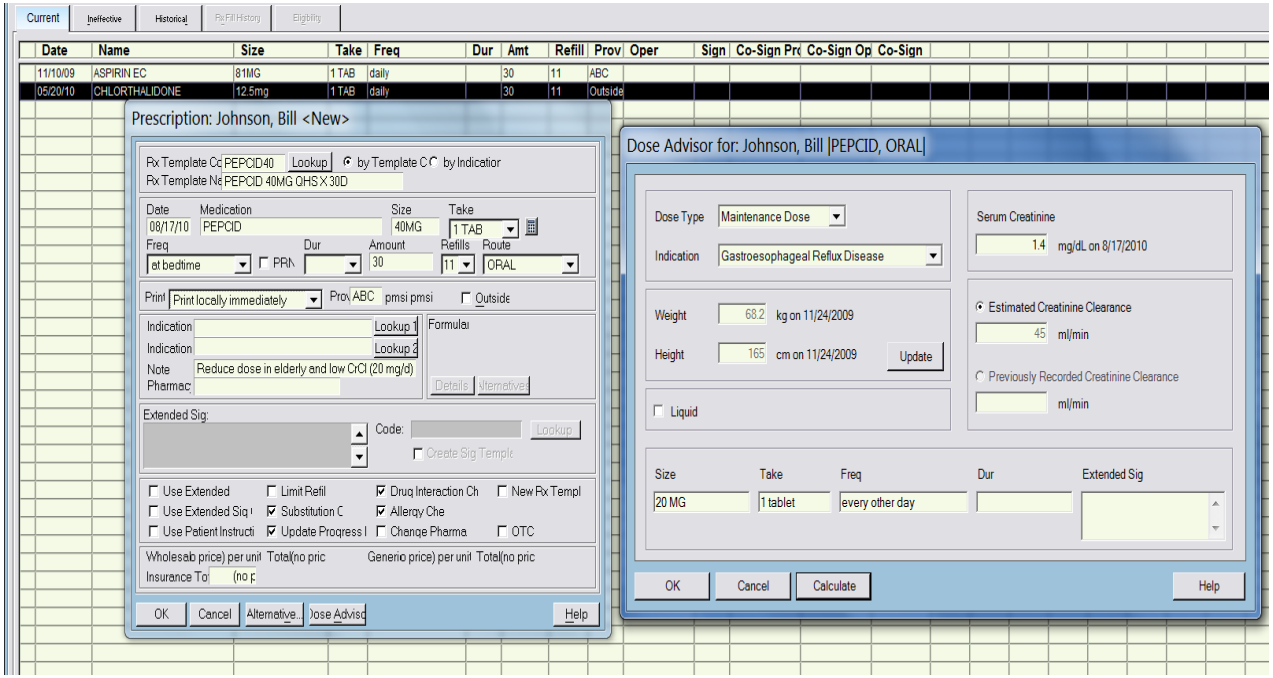
Accurate Medication Lists

- Document all medications prescribed by practice providers
- Implement a process for patient review of EHR medication list
  - Inquire and evaluate use of nonprescription therapy and medications from outside providers

- Distribute printed medication list at the end of each visit

EHR Decision Support

- Review alerts and adjust prescribing as necessary
- Calculate doses based on renal function
- Apply medication monitoring protocols



Refill and Monitoring Protocols

- Educate staff on refill protocol and use of decision support
  - Schedule refills according to monitoring requirements
  - Limit refills if overdue for follow-up
- Empower staff to review monitoring prompts and implement standing orders

Health Maintenance Summary: Johnson, Bill

	Recommend F	Due (seq.#)	08/17/201	11/24/200	11/22/200	10/3
Alcohol	65-74 YEAR OLD	11/25/2011		X		X
Aspirin therapy	Multiple					X
BP	Multiple	05/24/2010		X		
Cholesterol	65-74 YEAR OLD	11/24/2014		X		
Colonoscopy	65-74 YEAR OLD	11/10/2009		O		
Creatinine	ARB	08/17/2011	X			
Depression	65-74 YEAR OLD	11/10/2009				
Diet Counseling	DIABETES MELL	11/10/2009				
Exercise Counsel	DIABETES MELL	11/24/2010		X		
Eye exam	DIABETES MELL	11/24/2010		X		
F.O.B.	65-74 YEAR OLD			N		
Flex Sig	65-74 YEAR OLD			N		
Foot Exam	DIABETES MELL	11/24/2010		X		
Glucose,Fasting	65-74 YEAR OLD			X		
HDL Cholesterol	Multiple	05/24/2010		X		
Hearing	65-74 YEAR OLD	11/24/2014		X		
Height	65-74 YEAR OLD	11/24/2011		X		
Hemoglobin A1C	DIABETES MELL	05/24/2010		X		
Influenza vaccine	Multiple	11/10/2009				
LDL Cholesterol	Multiple	11/24/2010		X		
Microalbumin, Ur	DIABETES MELL	11/10/2009				
Pneumococcal poly.	Multiple	01/16/2002				
Potassium	ARB	08/17/2011	X			
Smoking Counseling	Multiple	11/24/2010		X		X
Td	65-74 YEAR OLD	11/10/2009				
Triglycerides	Multiple	11/24/2010		X		
Visual Acuity	65-74 YEAR OLD	11/24/2011		X		
Weight	65-74 YEAR OLD	11/25/2010		X	X	X
Zoster	65-74 YEAR OLD	01/16/2002		R		

Reports

- Utilize reports to evaluate performance and guide improvement plans
- Design and execute case management for patients with potential error
  - Message providers within EHR
  - Highlight potential error on EHR medication list
  - Contact patients with adjustments or monitoring instructions

Measure Description/Criterion	Description of Eligible Patients	Number of Eligible Patients	Percent Meeting Criterion	Number Not Meeting Criterion	PPRNet Median	PPRNet Benchmark
Avoiding Potentially Inappropriate Dosages:						
Allopurinol: Greater than 200 mg/day; Greater than 100 mg/day	Pts with an active rx* and GFR^ 20-60 ml/min or GFR <= 20 ml/min	23	48%	12	71%	100%
Benzodiazepines: Greater than daily dose for alprazolam 2mg, lorazepam 3mg, oxazepam 60mg, temazepam 15mg, and triazolam 0.25mg	Pts >= 65 years and active rx	87	94%	5	95%	99%
Digoxin: Greater than 0.125 mg/day	Pts >= 65 yrs with Dx of Heart Failure and active	3	100%	0	95%	100%
H-2 blocker: Greater than daily dose for cimetidine 1200mg, famotidine 20mg, nizatidine 150mg, ranitidine 150mg	Pts with GFR < 50 ml/min and an active rx	14	57%	6	50%	77%

Preventing Errors and Promoting Safety through Better Medication Management: The PPRNet Experience

- In the context of a quality improvement intervention, PPRNet practices implemented a consistent set of safety strategies in:
  - Practice redesign
  - Team involvement
  - Patient activation
  - Enhanced use of health IT tools

Thank You!

The Road to Safer Patient Care: Leveraging IT

Christoph U. Lehmann, MD
Director, Clinical Information Technology
Johns Hopkins Children's Medical and Surgical Center

clehmann@jhmi.edu

I do not have any relevant financial relationships with any commercial interests to disclose.

Approach to Errors

- Person approach
  - based on assigning blame
  - focuses on individuals
  - punitive in nature
- Systems approach
  - based on preventing recurrence of errors
  - focuses on system vulnerabilities
  - constructive and inclusive in nature

Reason J. Human error: models and management. BMJ. 2000 Mar 18;320(7237):768-70

System Failures

- Human fallibility is only part of the problem
- Failures at the system level
  - in disseminating pharmaceutical information
  - in checking drug dosages and patient identities
  - in making patient information available
- accounted for > 75% of adverse drug events

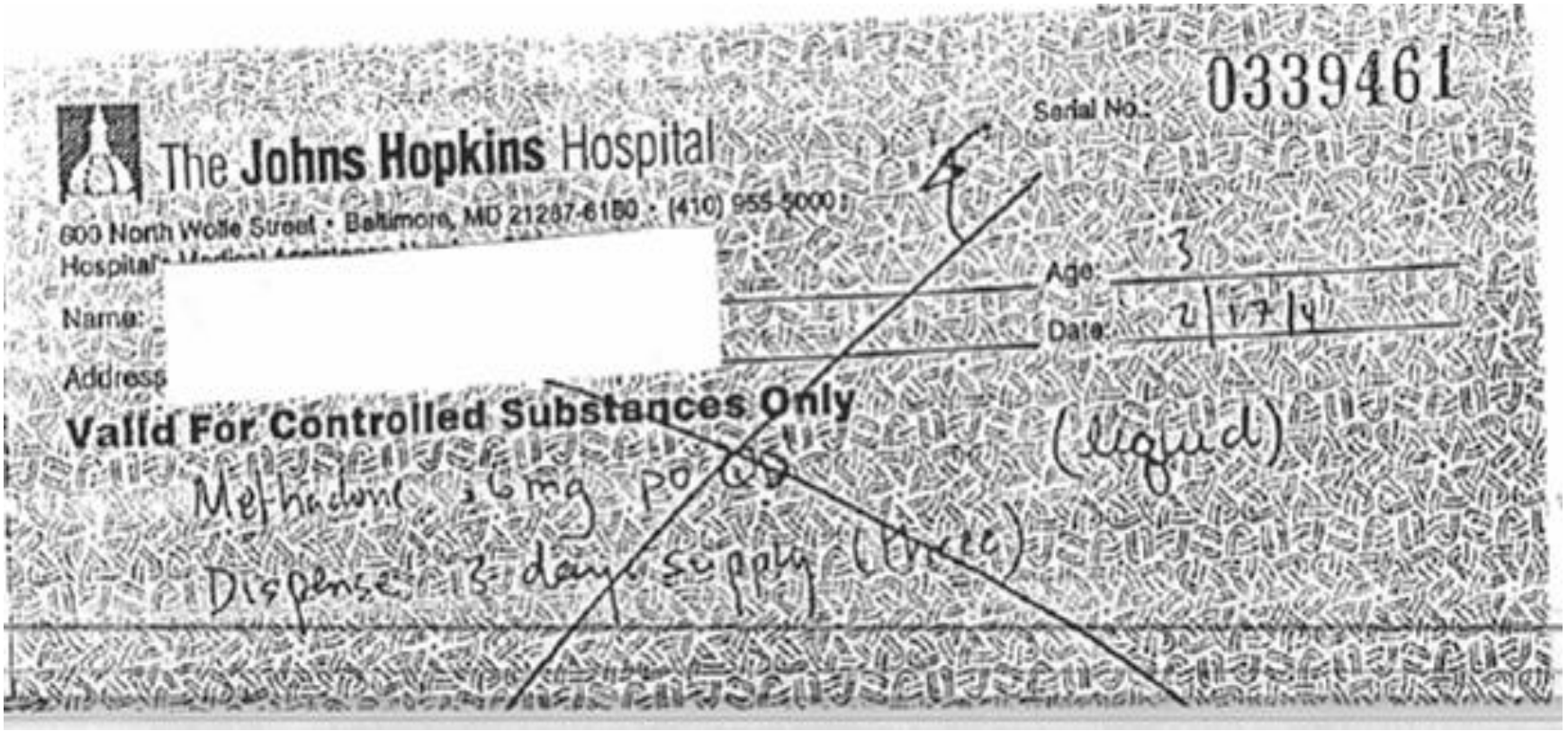
(Leape et al, 1995)

Injuries are not Accidents

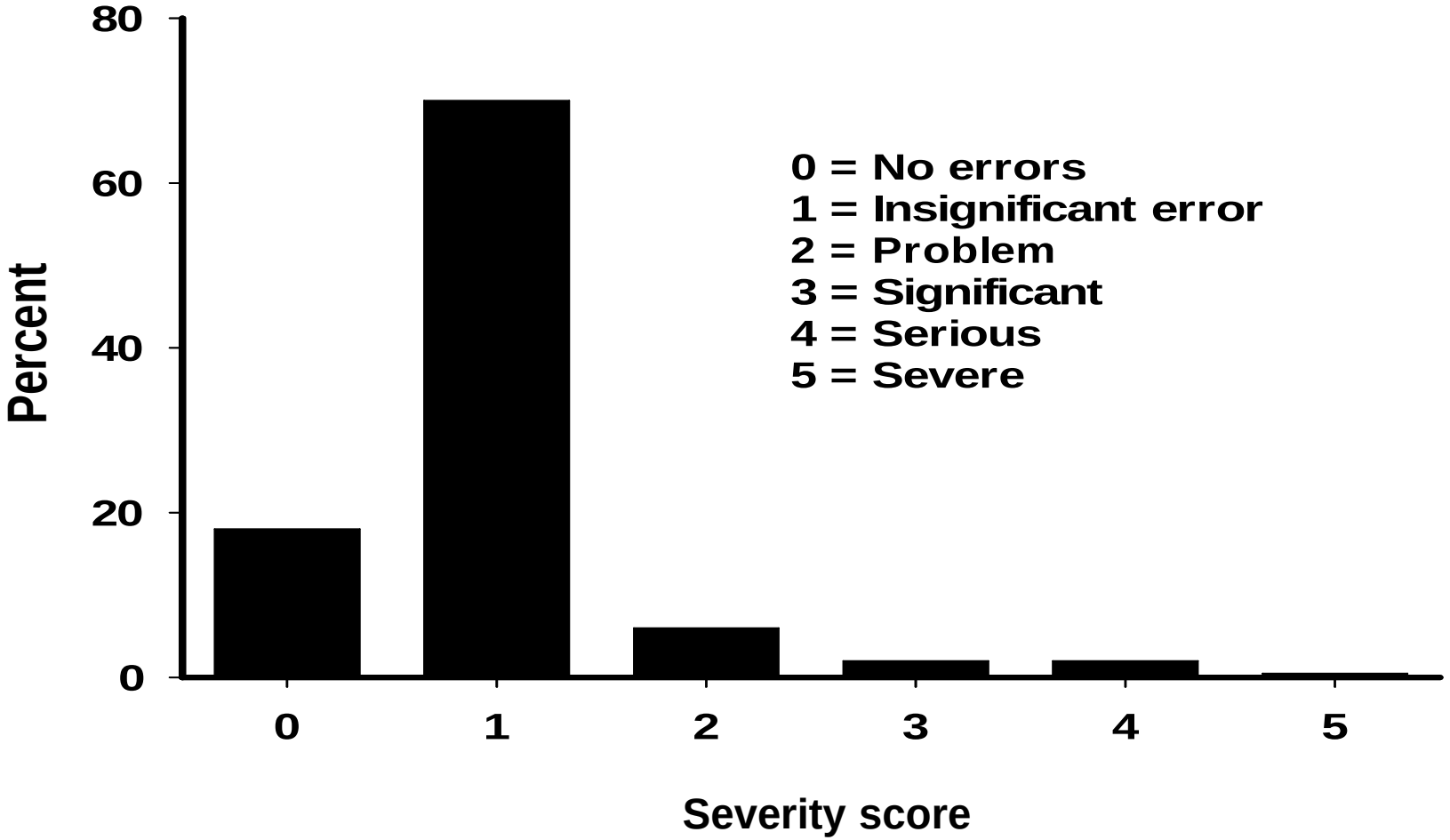
- Distinct patterns
- Systems issues
- Risk groups-vulnerable populations
- Profiles of harmed patients
- Near misses precede many/all of these events
- The focus on the human actors detracts from an examination of the full range of factors that contribute to injuries

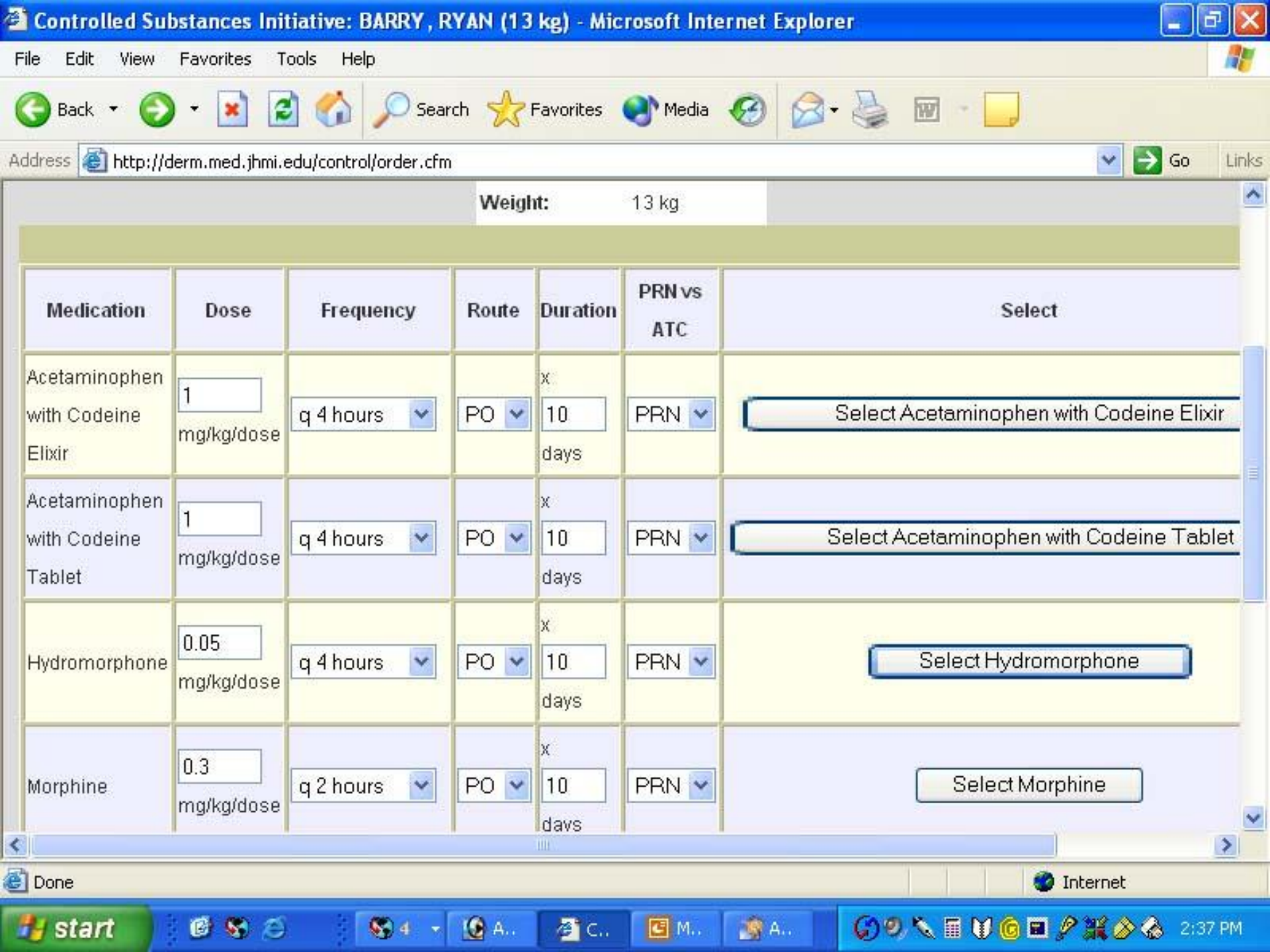
Narcotic RxWriter

Narcotic Prescriptions for Children on Discharge



Errors on Narcotic Prescriptions (N=314)




Controlled Substances Initiative: BARRY, RYAN (13 kg) - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://derm.med.jhmi.edu/control/order.cfm
Go Links
Weight: 13 kg
Medication
Dose
Frequency
Route
Duration
PRN vs ATC
Select
Acetaminophen with Codeine Elixir
1
mg/kg/dose
q 4 hours
PO
x 10 days
PRN
Select Acetaminophen with Codeine Elixir
Acetaminophen with Codeine Tablet
1
mg/kg/dose
q 4 hours
PO
x 10 days
PRN
Select Acetaminophen with Codeine Tablet
Hydromorphone
0.05
mg/kg/dose
q 4 hours
PO
x 10 days
PRN
Select Hydromorphone
Morphine
0.3
mg/kg/dose
q 2 hours
PO
x 10 days
PRN
Select Morphine
Done
Internet
start
2:37 PM

Number of Alerts: 5

The **Johns Hopkins** Hospital

600 North Wolfe Street * Baltimore, MD 21287-6180 * (410) 955-5000

Hospital's Medical Assistance Number: 064-872-800

Serial No.:1007977

10-26-2006

Name: John Doe

Age: 16 years DOB: 05/24/1990

Address:_____

Weight: 22 kg

Valid For Controlled Substances Only

Hydromorphone 1 mg/kg/dose =

Please select | q 4 hours PO | PRN (50% of ATC dose dispensed) | for 10 days

- Please select
- 22 mg = 22 mL of Hydromorphone (1 mg per 1 mL)
- 24 mg = 3 Tab of Hydromorphone (8 mg per 1 tab) [ROUNDED by 9%]

Your prescription has triggered alerts.

Please note that HARD limits can overridden only by the PAIN service.

Please go back and correct your order.

Maximum Dose for Hydromorphone is 8 mg/dose (Hard Limit)

Maximum Dose for Hydromorphone is 0.2 mg/kg/dose (Hard Limit)

Maximum Dose for Hydromorphone is 0.15 mg/kg/dose (Soft Limit)

Maximum Dose for Hydromorphone is 24 mg/day (Soft Limit)

Maximum Dose for Hydromorphone is 0.9 mg/kg/day (Soft Limit)

Refill: 0 Times

May substitute: ☑

Brand medically necessary: ☐

Physician Signature:

The **Johns Hopkins** Hospital

Serial No.:1007976

600 North Wolfe Street * Baltimore, MD 21287-6180 * (410) 955-5000
Hospital's Medical Assistance Number: 064-872-800

10-26-2006

Name: John Doe

Age: 3 years DOB: 06/26/2003

Address: _____

Weight: 22 kg

Valid For Controlled Substances Only

Hydromorphone Liquid 1 mg per 1 mL
Dispense: #30 mL (thirty)
Sig: Take 1 mL (1 mg Hydromorphone) PO q 4 hours prn pain for 10 days
(= 0.05 mg/kg/dose [Rounded by 9 %])
Please dispense with measuring device.
May substitute

Refill: 0 (zero) Times

Physician Signature: _____ , M.D.

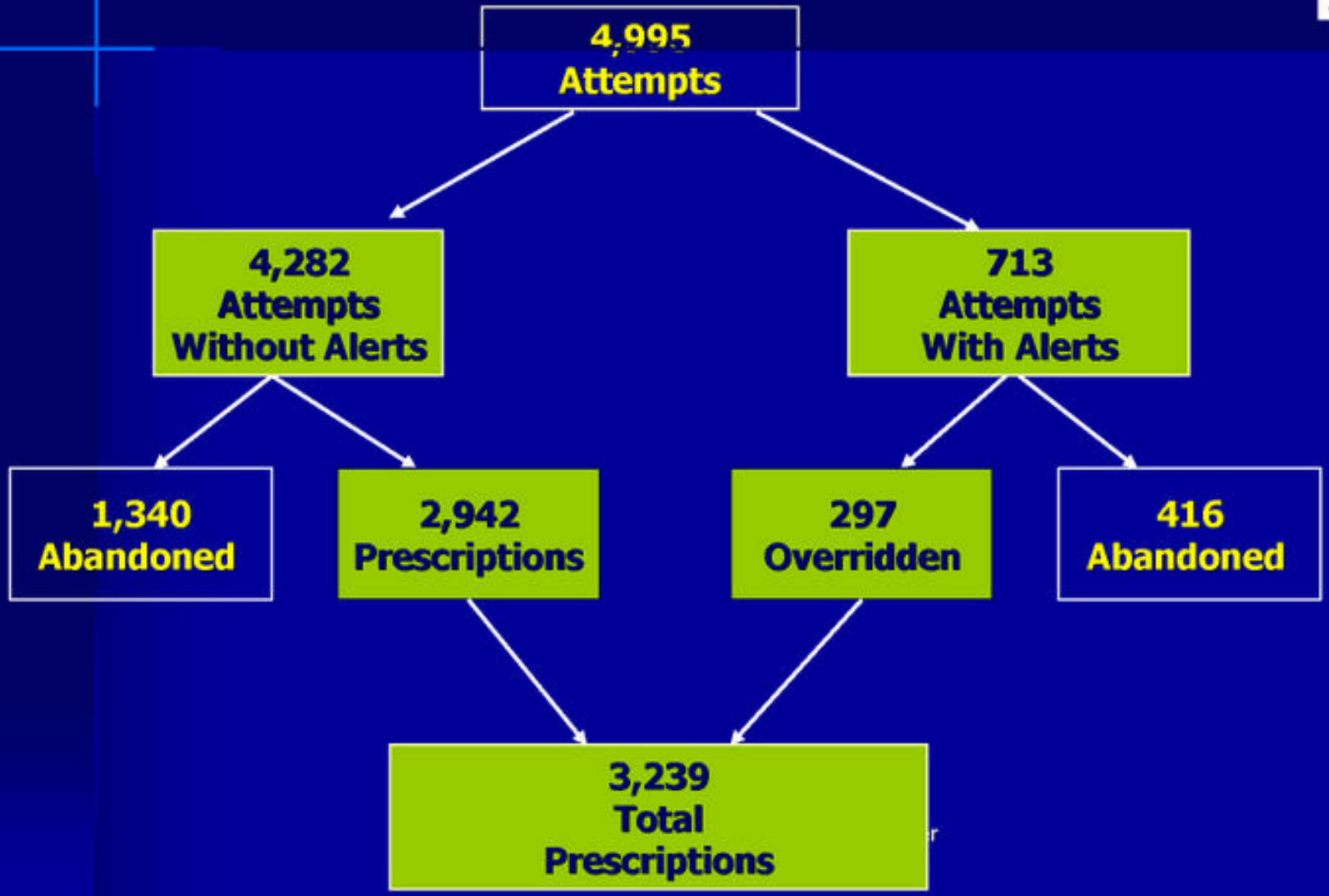
Physician Print Name: CHRISTOPH LEHMANN, M.D.

J.H.H. Physician ID No.: N2412

DEA No.: BL

0039 (6/03) This prescription is NOT valid as a copy. Pharmacist please check for signature indentation/imprint.

Outcome of Prescription Attempts



Medication Ordering to Reduce Errors

Prevention of Medication Errors in the Pediatric Inpatient Setting
(AAP RE9751, *Pediatrics* 1998 102:428-430)

- Confirm patient's weight
- Identify drug allergies
- Avoid abbr. (instructions, drug names, units)
- Avoid vague instructions
- Specify exact dosage strength
- Avoid terminal zero to right of decimal
- Use zero to left of decimal for numbers < 1
- Legibility

How does one change error rates?

- *Education*: Traditional approach
- *Incentives*: Nice if you can afford it
- *Automation*: Where computers come in

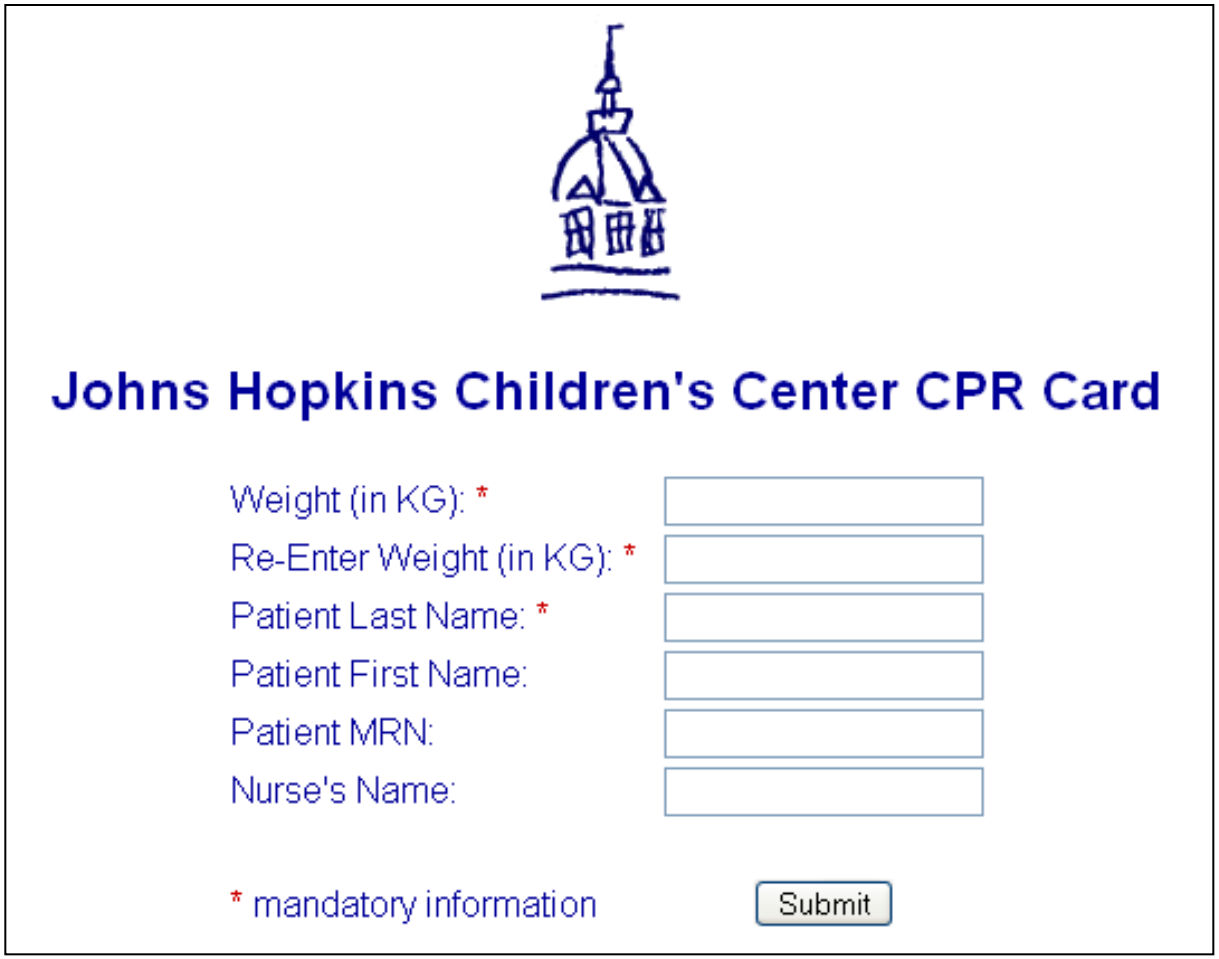
Errors

- Humans
  - erratic
  - err in unexpected ways
  - resourceful, inventive and flexible
  - more likely to recover from errors
- Machines
  - more dependable
  - little ability to adjust behaviors to correct to minor problems

Code Card Project

- One month survey in PICU:
  - 5% calculation errors on code cards
  - Outdated doses in infants (weight change)

Code Card Project



Johns Hopkins Children's Center CPR Card

Weight (in KG): *

Re-Enter Weight (in KG): *

Patient Last Name: *

Patient First Name:

Patient MRN:

Nurse's Name:

* mandatory information

Submit

Johns Hopkins Children's Center CPR Card Page 1/2

Patient Weight: **12 KG** *Name:* **Smith , John**

Patient History #: **123-45-67** *Date:* **12/07/2003**

These doses are intended for EMERGENCY / ARREST situations only

PALS DRUGS	CONCENTRATION	DOSE mL/KG	FINAL DOSE (mL)
Adenosine (0.1 mg/kg) [may double & repeat]	3mg/mL	0.033 x 12	0.4 mL ADENOSINE
Amiodarone (5 mg/kg)	50 mg/mL	0.1 x 12	1.2 mL AMIO
Atropine [Bristojet] (0.02 mg/kg) *	0.1 mg/mL	0.2 x 12	2.4 mL ATRO
Calcium Chloride 10% (20 mg/kg) [PALS Dose]	100 mg/mL	0.2 x 12	2.4 mL Ca Cl
Epinephrine 1:10,000 [IV / IO]	0.1 mg/mL	0.1 x 12	1.2 mL EPI
Epinephrine 1:1,000 [ALL ETT and High Dose]	1 mg/mL	0.1 x 12	1.2 mL EPI
Lidocaine (1 mg/kg) *	20 mg/mL	0.05 x 12	0.6 mL LIDO
Magnesium Sulfate (25 mg/kg)	500 mg/mL	0.05 x 12	0.6 mL MAG SULF
Naloxone TEST DOSE (0.01 mg/kg) *	0.4 mg/mL	0.025 x 12	0.3 mL NARC TEST
Naloxone (0.1 mg/kg) *	0.4 mg/mL	0.25 x 12	3 mL NARC
Sodium Bicarb (1 mEq/kg)	1 mEq/mL	1 x 12	12 mL NaHCO3
* = *ETT Dose 2-3 times IV Dose*	*After any med is administered in a peripheral line flush with 5 mL NS*		
DEFIBRILLATION = 25 JOULES	MAY DOUBLE AND REPEAT		
CARDIOVERSION = 6 JOULES	MAY DOUBLE AND REPEAT		

PARALYTIC DRUGS	CONCENTRATION	DOSE mL/KG	FINAL DOSE (mL)
Atropine (0.01 mg/kg) [for less than 8 years old only]	1 mg/mL	give minimum dose	0.15 mL ATRO
Rocuronium (1.2 mg/kg)	10 mg/mL	0.12 x 12	1.4 mL ROC
Succinylcholine (2 mg/kg)	20 mg/mL	0.1 x 12	1.2 mL SUCC
Vecuronium (0.2 mg/kg)	1 mg/mL	0.2 x 12	2.4 mL VEC

Hype and Reality

- Institute of Medicine reports
  - POE one of 14 med-safety recommendations, not centerpiece
    - *To Err Is Human, p. 183, 191-92*
  - Greater emphasis on simple, proven fixes
    - Unit dosing, pharmaceutical software, standard solutions
- Leapfrog: altruism and self-interest
  - Not just Fortune 500 employers
  - Every major insurer (formulary control, physician-specific drug usage)
  - Every major clinical IT vendor

POE meets clinical reality

- Pre-POE written orders expressed *intent*, which a domain expert (pharmacist, RN, rad tech, etc.) translated into action
- POE removes the translator
    - Precision vs. accuracy
    - End-user data entry requires either simple interface or expert user; POE has complex interface, part-time users
    - Order nuances (schedule, stop date, linking) often opaque even to expert users
    - POE requires unfamiliar granularity in each order (schedule, carrier, formulation, etc.)
    - POE picklists make visible entire formulary, including unfamiliar options (20 forms of insulin, 10 of morphine, etc.) that users sometimes order by mistake
    - Ancillaries, previously expert fixers/mediators, now simply reject orders and tell docs to re-enter➔delay in care delivery

Standard alert signal & noise

- Drug-drug interaction
  - 15% of drug orders triggered alerts
  - House staff overrode 97.4% of alerts
  - 2.6% that resulted in order changes,
    - two-thirds of substitutions inappropriate or dangerous
      - » Heparin + coumadin, clopidogrel + aspirin, spironolactone + potassium
  - Ambiguous messages such as “GENERALLY AVOID” or “CONTRAINDICATED”
  - Alert invisible to pharmacists
  - Did not distinguish med route (ophthalmic beta blockers)

The Paper Albatross

- Creates more paper
- Paper is recycled faster
- Orders have to be printed to provide a hard copy back up
- 24 hour summary printout
- One screen order set may translate into 13 pages of printed orders

Interface Problems

- Juxtaposition Error
  - "Something is too close to something else"
  - "Clicked the wrong thing"
- Wrong Patient
  - Not all interfaces make the patient context clear
- Wrong Time

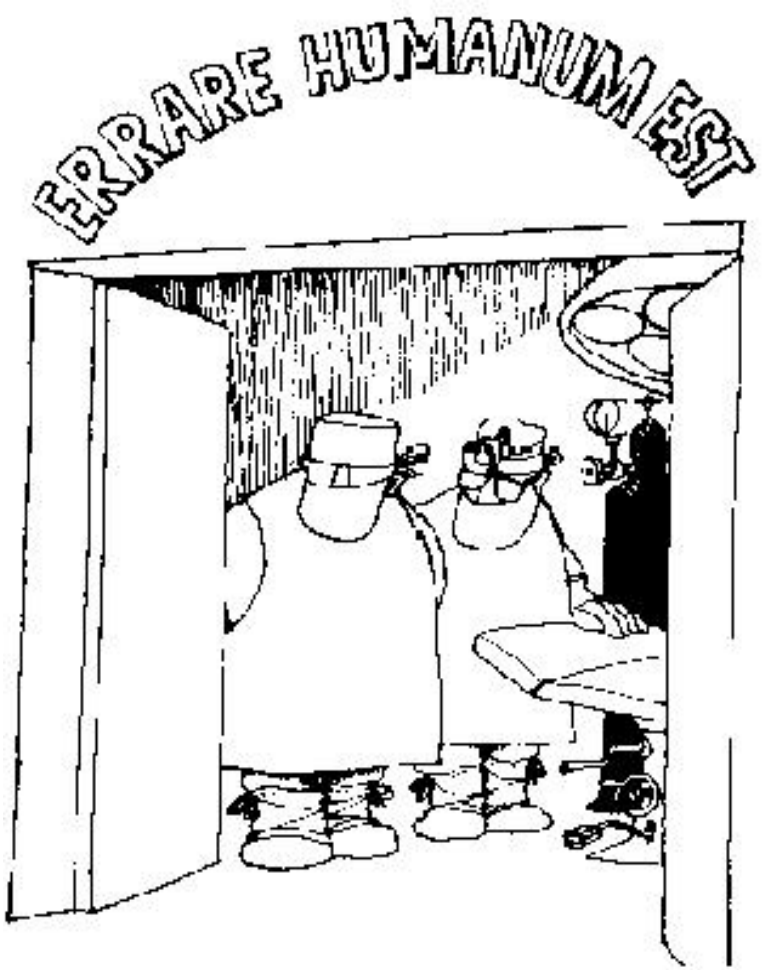
Cost

- High Profile failure (Cedars Sinai)
- Purchase prize low compared to implementation costs (1:10)

- Brigham and Women's Hospital
  - cumulative net savings of $16.7 million
  - net operating budget savings of $9.5 million
  - break-even after 5-8 years)

Kaushal R, Jha AK, Franz C, Glaser J, Shetty KD, Jaggi T, Middleton B, Kuperman GJ, Khorasani R, Tanasijevic M, Bates DW. Return on Investment for a Computerized Physician Order Entry System.J Am Med Inform Assoc. 2006 Feb 24;

THANK YOU



clehmann@jhmi.edu

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Year 1: Using Risk Models to Identify and Prioritize Outpatient High-Alert Medications

Years 2-4: Risk-Informed Interventions in Community Pharmacy: Implementation and Evaluation

Donna Horn, RPh, DPh
Judy Smetzer, RN, BSN, FISMP

These studies are supported by grant numbers 1P20HS017107 and R18HSO17910 from the Agency For Healthcare Research and Quality

I do not have any relevant financial relationships with any commercial interests to disclose.

Year 1: Using Risk Models to Identify and Prioritize Outpatient High-Alert Medications

Aims

- Develop risk models for four high-alert medications
- Identify error pathways
- Identify approaches for reducing the risk of harm

Methods

- Mapped out the dispensing processes
- Focus group provided input into the construction of the risk models for each high-alert medication
- Quantified the risk of failures within risk models
- Determined the impact of error-reduction strategies

Details: Point-of-Sale Errors

- Initiating errors
  - Bagging error: 0.4/1,000
  - Retrieval error: 3/1,000
- PADE: 1.22/1,000 (64% capture)
- Opening bag at point of sale
  - 56% reduction in PADE (0.534/1,000)
- Increase compliance with identification from 50% to 80%
  - 34% reduction in PADE (0.804/1,000)
- Increase patient counseling from 30% to 80%
  - 27% reduction in PADE
- Interventions together: 86% reduction

Details: Selecting the Wrong Dose

- Wrong dose of warfarin
  - Initiating error 1/10 prescriptions
  - PADE: 9.25/10 million prescriptions (99.9% capture)
  - Eliminate barcode scanning
    - 95,340% increase in risk (9/10,000)
  - Use cheat sheet 30% of time
    - 265,011% increase in risk (2/10,000)
  - Increase patient counseling from 30% to 80%
    - 67% reduction in risk (3/10 million)
  - Increase automated dispensing from 20% to 50%
    - 35% reduction in risk (5/10 million)
  - Two interventions together: 78% reduction in risk

Details: Prescribing Errors

- Wrong dose of fentanyl or inappropriate use of drug
  - Initiating error 1/1,000 prescriptions
  - PADE: 7.30/10,000 prescriptions (27.0% capture)
  - Opioid history at drop off (50% patients, 40% capture rate)
    - 40% decrease in risk (0.439/1,000)
  - Increase patient counseling from 10% to 80%
    - 64% decrease in risk (0.263/1,000)
  - Two interventions together
    - 78% decrease in risk

Discussion and Conclusions

- Prescribing errors
  - Designed to capture straightforward mistakes
  - Poorly designed to capture errors associated with inappropriate drugs or doses due to patient factors
  - More frequent and effective counseling
    - Reduce PADEs by 64%
- Dispensing errors
  - Vulnerable to data entry errors, wrong patient errors
    - Second verification process reduced risk by 87%
    - Opening bag during customer sale reduced risk by 56%
  - Reliable for detecting drug/dose selection errors due to bar-coding, automated dispensing, pill images

Years 2-4: Risk-Informed Interventions in Community Pharmacy: Implementation

- Intervention 1
  - Scripted mandatory patient counseling
    - Warfarin and low-molecular weight heparin
    - Fentanyl patches
    - Methotrexate
    - Insulin analogs
    - Hydrocodone and oxycodone (with acetaminophen)
- Intervention 2
  - Readiness assessment for bar-coding technology
- Intervention 3
  - Risk assessment/intervention scorecard using risk models from first study: HAMERS tool

Intervention 1: Patient Counseling

- Pre-intervention observation in pharmacies
  - 50 observations completed
  - 4 states
    - 2 with mandatory counseling
    - 2 with mandatory offer to counsel
  - Preliminary findings
    - No counseling in states with offer to counsel
      - Counseling for OTCs more common than for prescription drugs
    - More frequent counseling in states with mandatory counseling
      - Differences between state enforcement of counseling
      - Not covering information linked to PADEs

Intervention 1: Patient Counseling

- Implementation Tool Kit
  - Scripted counseling materials, checklists, health questions
  - Consumer handouts about targeted drugs
    - Specifically targets known causes of PADEs

Read this important information before taking:

Warfarin

Brought to you by the Institute for Safe Medication Practices

[Extra care is needed because warfarin is considered a high-alert medicine.]

Just a handful of medicines are considered high-alert medicines. These medicines are necessary to keep people healthy. They have been proven to be safe and effective when taken properly. But these medicines can cause serious *injury* if a mistake happens while taking them. This means that it is vitally important for you to know about this medicine and take it exactly as intend.

Top 10 List of Safety Tips for Warfarin

When taking your medicine

☐ **1 Take exactly as directed.** Take your medicine at the same time each day, preferably in the evening. Do not take extra doses or skip doses. _____

When the doctor changes your dose

☐ **2 Keep a record of telephone calls.** When your doctor calls to change your dose: write down the dose and any other instructions; read the dose and instructions back to the doctor to make sure you understand them; and date the instructions so they won't be mixed up with older instructions. _____

☐ **3 Know your dose.** Always tell your doctor the strength of warfarin tablets that you have on hand. Then ask him how much warfarin to take, and how many tablets in that strength to take to equal the dose. If you are running low on tablets, ask for a new prescription. _____

☐ **4 Keep instructions nearby.** Keep the dated instructions near the medicine, and read them every time before taking your warfarin. _____

☐ **5 Restart your medicine.** If your doctor told you to stop taking warfarin until your next blood test, call him if you don't hear from him within 24 hours of the test to find out your new dose. _____

To avoid serious side effects

☐ **6 Keep to your regular habits.** Keep your eating habits and exercise regular. Know the foods high in vitamin K to avoid or eat consistently (see back). Tell your doctor if there has been a recent change in your level of exercise, smoking, or diet. _____

☐ **7 Take precautions.** Because serious bleeding can occur, take precautions such as avoiding fall risks and sharp objects, and using an electric razor. _____

☐ **8 Get periodic blood tests.** Keep all appointments for blood tests (called INR). Call your doctor for your test results if you are not contacted within 1 day of the test. _____

When you should call your doctor

☐ **9 Signs of bleeding or clot.** Call your doctor immediately if you experience any signs of bleeding or clot formation, which are listed on the back. _____

☐ **10 New medicines.** Do not start or stop any prescription or non-prescription medicines, herbals, and vitamins, without telling your doctor. Non-prescription medicines to avoid can be found on the back. _____

STOP **Watch for Signs of Bleeding or Clot!**

Serious bleeding can occur even if you take warfarin exactly as prescribed. Also, you can still get a blood clot while taking warfarin. Report any signs of bleeding and clots–listed on the back–to your doctor immediately.

Warfarin tablets may come in different shapes. But each strength comes in just one color. Make sure the color of your tablets matches the strength your doctor prescribed.

For more information to help keep you safe, visit: www.consumermedsafety.org.

Warfarin

Report these signs to your doctor immediately!

Too little, too much!

Too little warfarin can lead to a blood clot. Too much warfarin can lead to bleeding.

Signs of bleeding

- Unusual pain, swelling, discomfort
- Unusual or easy bruising
- Pink or brown urine
- Prolonged bleeding from cuts or gums
- Persistent frequent nosebleeds that don't stop within 7 minutes
- Unusually heavy/long menstrual flow
- Coughing up blood
- Vomit that is bloody or looks like coffee grounds
- Severe dizziness, weakness, headache, fainting, unusual or persistent tiredness
- Bloody or black stools
- Chest pain, shortness of breath, difficulty swallowing
- Pain in joints or back

Signs of a clot

- Lung: chest pain, fast heart rate, coughing, shortness of breath, fever
- Arm or leg: sudden leg, arm, or back pain, swelling, redness and warmth, tenderness
- Brain: headache, vision changes, seizure, slurred speech, weakness on one side of body, loss of balance
- Heart: chest pain, shortness of breath, sweating, nausea and vomiting
- Abdomen: abdominal pain, vomiting, diarrhea

Foods high in vitamin K

Avoid

- Cranberries/cranberry juice

Avoid or eat in consistent amounts

- Beef or pork liver
- Green tea
- Broccoli and Brussels sprouts
- Chick peas
- Green leafy vegetables spinach, kale, green turnips
- Parsley
- Many oils

Topics	Fast Facts
Generic name	■ warfarin (pronounced WAR far in) (generic medicine available)
Common brand names	■ Coumadin and Jantoven
Uses	■ Prevent and treat blood clots in certain conditions that increase the risk of clots: surgery, heart attack, heart rhythm problem, heart valve replacement, immobility after an accident ■ Prevent transient ischemic attacks (brief episodes of inadequate oxygen to the brain)
Usual dose limits	■ 2 mg to 10 mg daily for adult patients ■ Doses are adjusted based on INR blood test results
What to do if you miss a dose	■ If it is still the same day, take the dose as soon as you remember it ■ If it is the next day, skip the missed dose and take your normal dose ■ Do not double the dose to catch up ■ Contact your doctor if you miss two or more doses in a row
Special instructions and precautions	■ Take exactly as prescribed, the same time each day in the evening ■ Avoid alcohol, keep eating habits and exercise regular ■ You will have a tendency to bleed easily, so use a soft toothbrush, waxed dental floss, electric razor, avoid sharp objects and falling risks ■ Do not start or stop any medicine, including over-the-counter medicines, herbals, and vitamins, without letting your doctor or pharmacist know
Safety during pregnancy/breastfeeding	■ Do not take when pregnant, may cause fetal bleeding or abnormalities ■ May take while breastfeeding, but let the infant's doctor know for proper monitoring
Tell your doctor if you have:	■ *Diseases:* bleeding disorders, kidney, liver, thyroid disease, severe high blood pressure, diabetes ■ *Conditions:* surgery, history of falls or if you are at risk for falls, open wound
Storage and disposal	■ Store at room temperature, protect from light and moisture (do not store in bathroom) ■ Dispose tablets securely in the trash, do not flush down the toilet
Side effects to report to your doctor immediately	■ Signs of bleeding or clot (see above), skin irritation, painful red-purple patches on skin (toe, breast, abdomen), unusual fever, unhealed wounds, yellowing eyes or skin
Other conditions to report to your doctor	■ Accidents or falls, new or stopped medicines (including over-the-counter, herbals, and vitamins), changes in smoking or eating habits, infection, fever, use of antibiotics
Over-the-counter medicines/herbals/vitamins that should not be taken with warfarin	■ Aspirin, non-steroidal anti-inflammatory drugs (ibuprofen [Advil, Motrin], naproxen [Aleve]), most herbals (particularly cranberry, fenugreek, garlic, ginkgo biloba, glucosamine, ginseng (American), ginger, goldenseal, coenzyme Q, St. John's wort, alfalfa, anise, bilberry), cimetidine (Tagamet), vitamin A, vitamin E
Prescription medicines that should not be taken with warfarin	■ Many prescription medicines interact with warfarin ■ Tell your doctor about all the medicines you take
Special tests your doctor may prescribe	■ You must have blood tests (called "INR") checked regularly ■ Your doctor will determine the right INR level (usually between 2.5 to 4) for you

This information does not replace the need to read the drug information leaflet provided with your prescription and follow your doctor's instructions.

This project was supported by grant number R18HS017910 from the Agency for Healthcare Research and Quality. The content is solely the responsibility of the authors and does not represent the official views of the Agency for Healthcare Research and Quality.

Intervention 1: Patient Counseling

Measures

- Post-implementation observation
  - Prescribing/dispensing/self-administration errors
  - Barriers/facilitators to counseling
  - Quality of counseling sessions
- Self-administered surveys to patients
  - Perception of counseling encounter/value of handouts
    - Increase understanding? New information? Change behavior?
  - Require treatment for a PADE?
- Self-administered surveys to pharmacists
  - Perceived value and impact of counseling

Intervention 2: Bar-coding Readiness Assessment

- 46-50% of community pharmacies in the US **do not** use barcode technology for product verification
- 100 pharmacies participating in the study
- Survey to determine why non-users are still non-users
- Phase 1
  - 5 pharmacies pilot testing the tool
  - 100 pharmacies will complete the assessment and submit findings
  - Pharmacies will complete survey to measure perceived value
- Phase 2
  - Pharmacies from Phase 1 that have since implemented bar-coding will complete survey to measure actual value

Assessing Barcode Verification System Readiness in Community Pharmacies

FROM THE INSTITUTE FOR SAFE MEDICATION PRACTICES

ISMP
INSTITUTE FOR SAFE MEDICATION PRACTICES

Educating the healthcare community about safe medication practices

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Table of Contents

*Photo on front cover courtesy of Kirby Lester, LLC.

① No activity

② Possible Implementation

③ Partially Implemented

④ Fully Implemented *Some*

⑤ Fully Implemented *All*

Prerequisite: Item should be in place before implementing bar-coding

Facilitator: Item not required but would make it easier to implement bar-coding

Item #	Prerequisite/ Facilitator	Element	①	②	③	④	⑤	NA
		Technology Environment						
1	F	The pharmacy has successful experience with integrating/ interfacing information system technologies.						
2	F	Barcode technology is available and already used for various functions in the pharmacy (e.g., point of sale, reordering stock)						
3	F	A network to support information transfer via radio frequency is available in the pharmacy.						
4	P	Information systems are protected with security and access control systems.						
5	P	An information system back-up process has been prepared in case of a technology failure.						
6	P	Recovery and back-up plans associated with technology failures are regularly tested in the pharmacy or pharmacies.						
7	P	Resource allocation plans for a barcode product verification system have factored in the costs associated with hardware and software requirements (including interface costs), and staffing resources needed to maintain the system.						
		Physical Environment						
8	P	Consideration has been given to where to place computer terminals, docking stations, battery chargers, and other equipment associated with a barcode verification system in a manner that best supports the natural workflow of the dispensing process.						
9	P	There is adequate space in the production section of the pharmacy for computer terminals and other hardware associated with a barcode verification system.						
10	P	There is adequate space in the prescription verification section of the pharmacy for computer terminals and other hardware associated with a barcode verification system.						
11	P	There are sufficient electrical outlets in the pharmacy for charging and operating the equipment associated with a barcode verification system.						
12	P	Resource allocation plans for a barcode product verification system have factored in costs associated with changes needed in the physical environment.						
		Workflow						
13	P	The processes associated with medication dispensing have been thoroughly examined through flowcharting or process mapping to promote detailed understanding of staff needs and the current workflow.						

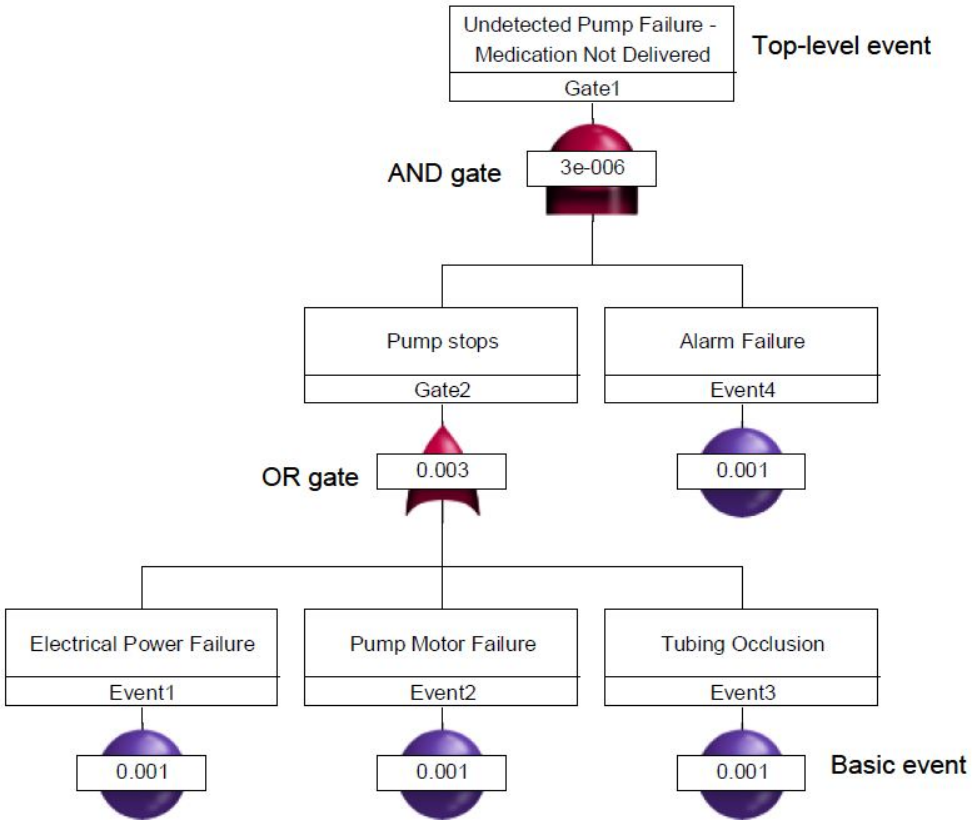
continued on next page

Intervention 3: HAMERS
(High-Alert Medication Error Risk Scorecard)

- Risk models translated into practical assessment tool and scorecard
- Tool Kit will include:
  - HAMERS tool (webpage download)
    - Scorecard with qualitative (distribution of risk) and quantitative (PADE rates) information
    - Tool calculations driven by reports from original risk models

Intervention 3: HAMERS

- 3 principal elements
  - AND gates
  - OR gates
  - basic events
- Includes the effects of:
  - Capture opportunities
  - Human errors
  - At-risk behaviors and procedural deviations
  - Mechanical/technology failures
- Modeling team estimates rates of failure based on human factors



Human Error Probabilities

Probability estimates to quantify risk

Unfamiliar task performed at speed/no idea of consequences	5:10
Task involving high stress levels	3:10
Complex task requiring high comprehension and skill	15:100
Select ambiguously labeled control/package	5:100
Failure to perform a check correctly	5:100
Error in routine operation when care required	1:100
Well designed, familiar task under ideal conditions	4:10,000
Human performance limit	1:10,000

Intervention 3: HAMERS

Inputs

- Set-up questions
  - System attributes: Require data entry verification for pharmacists?
  - Availability: Use bar-coding technology? Specific computer alerts?
  - Prescription volumes?
- Exposure rates
  - Frequency of counseling patients?
- Capture opportunities
  - What percent of errors will not be caught during this step?
- At-risk behaviors
  - Frequency of choosing not to ask a customer for a second identifier?
- Human errors
  - Frequency of forgetting to read back an oral prescription? (preset)

Intervention 3: HAMERS

Outputs

- Scorecard that quantifies the risk of specific PADEs
- Bar graph that shows distribution of risk
  - Which tasks/elements contribute most to the PADE?
- Menu of interventions to reduce risk
  - Pharmacy makes changes to inputs based on the planned interventions
  - Pharmacy receives a revised scorecard that quantifies improvements based on planned interventions
    - If (intervention) is implemented, then risk that the PADE will reach the patient is ___%.
    - If risk factor is (increased/decreased) by __%, then risk that the PADE will reach the customer is __%.

High-Alert Medication Error Reduction Scorecard (HAMERS)

Drug Selection

Instructions

You have selected the tool associated with wrong dose prescribing errors. Now you must specify which high-alert medication(s) you want to evaulate, and how often you fill prescriptions for these medications. While this tool can be used to evaulate wrong dose prescribing errors with any drug, focusing on high-alert medications helps to reduce the risk of errors that can cause the greatest harm to patients.

OK

Question 1a

Please list the name(s) of the medication(s) or class of medications involved in the wrong dose prescribing errors you want to evaluate.

Answer - Medications List:

Question 1b

Please provide the number of prescriptions (new prescriptions and refills combined) filled annually for the medications involved in these errors.

Include generic brands and all strengths if applicable. Add all generics, brands, and strengths together.

Answer - Number of prescriptions filled annually:

Denominator

BACK SAVE FAQ

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High-Alert Medication Error Reduction Scorecard (HAMERS)

Data Entry of Prescription (Drug Type and Error)

Instructions

The next set of questions are associated with the process of entering the prescription into the pharmacy computer. The questions will explore how often pharmacists and pharmacy associates enter prescriptions for these medications, and how many prescriptions are for refills or for new patients (patients new to the pharmacy or new to the drug therapy). You will aslo be asked to estimate how often the wrong dose prescribing errors are missed during data entry given specified conditions. This set of questions apply only to the data entry process. The data entry verification process and drug utilization review process are addressed in a later section.

OK

Question 7

What percent of prescriptions for these medications are entered into the pharmacy computer by a pharmacy associate (e.g., technician, pharmacy student, pharmacy resident)? (E57 and E59)

Please be sure to consider daytime, nighttime, and weekend/holiday staffing when averaging the percents.

Answer: 0%, <1%, 1%, 5%, then 5% increments

EXPOSURE RATE

BACK

SAVE

FAQ

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Question 9

A pharmacist is entering a prescription into the profile of an existing patient who has previously taken the same drug or another drug within the same class. On average, what percent of the wrong dose prescribing errors will be missed by a pharmacist during data entry (when there are no computer dose alerts)? (E68)

Note: This does not include response to computer alerts; alerts are factored in during the pharmacists' drug utilization review (DUR). Just estimate how often the pharmacist would miss the prescribing error during the data entry process without the help of a computer alert.

Answer: <1%, 1%, 5%, then 5% increments

Missed Capture Opportunity

Question 25

What percent of the time does a pharmacist ignore the duplicate therapy alert for the medications in question or fail to give the alert his/her full attention? (E63)

Answer: 10%, 15%, then in 5% increments

At-risk Behavior

High-Alert Medication Error Reduction Scorecard (HAMERS)

Scorecard Risk Report

Rank ordering of Risk Contributors

Print SAVE

Funded through a grant from the Agency for Healthcare Research and Quality (AHRQ).

Thank You!

Donna Horn: dhorn@ismp.org
Judy Smetzer: jsmetzer@ismp.org

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Questions & Answers

Our Panel:

Donna Horn, R.Ph., D.Ph., director of patient safety at the Institute for Safe Medical Practices (ISMP)

Andrea M. Wessell, PharmD., B.C.P.S., C.D.E., associate professor at the Medical University of South Carolina and PPRNet (Practice Partner Research Network) investigator

Christoph "Chris" U. Lehmann, M.D., F.A.A.P., associate professor of pediatrics and a board-certified neonatologist in the Eudowood Neonatal Pulmonary Division at the Johns Hopkins University School of Medicine

Judy Smetzer, R.N., B.S.N., vice president at the Institute for Safe Medication Practices (ISMP)

Coming Soon!

Our next event

A webinar examining health information technology and patient centered care

Stay tuned for exact date, time and registration information

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http://healthit.ahrq.gov

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Median Summary Performance in Medication Safety Measures Over Time

	Jul 08	*Oct 08*	*Jan 09*	*Apr 09*	*Jul 09*	*Oct 09*	*Jan 10*	*Apr 10*	*Jul 10*
Avoiding Potential Drug-Drug Interactions	98.8%	98.5%	98.5%	98.4%	98.7%	98.8%	98.4%	98.6%	98.5%
Avoiding Potentially Inappropriate Dosing	88.0%	89.7%	90.4%	92.5%	93.6%	92.3%	89.8%	91.8%	90.4%
Avoiding Potential Drug-Disease Interactions	87.2%	87.1%	88.7%	89.3%	88.3%	88.2%	88.0%	88.9%	89.4%
Avoiding Potentially Inappropriate Therapy	69.9%	70.8%	68.7%	76.3%	79.6%	79.3%	80.6%	81.1%	82.6%
Monitoring/ Preventing Potential Adverse Drug Events	74.2%	75.5%	77.9%	78.6%	79.2%	79.2%	80.1%	80.3%	79.8%

*P= 0.05

1=No activity
2=Possible Implementation
3=Partially Implemented
4=Fully Implemented (some)
5=Fully Implemented (all)

Prerequisite: Item should be in place before implementing bar coding

Facilitator: Item not required but would make it easier to implement bar coding

Item #	Prerequisite/ Facilitator	Element	1	2	3	4	5	N/A
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