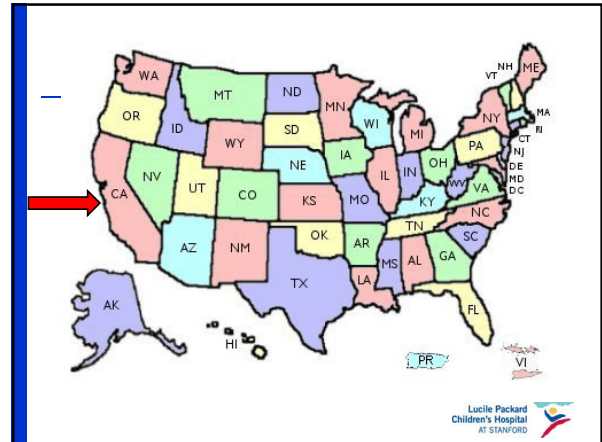


Patient Safety in Children: Challenges and Solutions *Related to Medications*

Paul Sharek, MD, MPH

Assistant Professor of Pediatrics, Stanford University
 Medical Director of Quality Management
 Chief Clinical Patient Safety Officer
 Vice President of Quality, Safety, and Outcomes Management
 Lucile Packard Children's Hospital



Home of...



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The Basics

- Learning objectives
 - Unique challenges to ensuring medication safety in children
 - Burden of medication harm in children
 - Review Best Practices in pediatric medication safety
 - Introduce "next generation" strategies (high reliability constructs) for pediatric medication safety
- Take home messages
 - Children are not just little adults
 - Harm (including medication related harm) occurs at high frequency in children's hospitals
 - Numerous best practices to improve medication safety.
 - Taking it the next level: Translating high reliability concepts into health care is the next generation of medication safety



I. Uniqueness of Children

- Special issues for children- relevant to medication safety
 1. Weight based dosing (and weights change frequently)
 2. Organ system development is variable, affecting metabolizing and excretion
 3. Meds mixed by pharmacists or nurses at time of use
 4. Pediatric meds often need to be diluted from adult formulations
 5. Many pediatric medications come in multiple formulations
 6. Children less likely to recognize/communicate an error or harm



II. The Burden of Harm in Children Harm vs. Error (IHI)

- “Error”: concept of preventability, process-focused
- “Adverse event”: harm, outcome focused
- Relationship between errors and adverse events

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II. The Burden of Harm in Children Medication errors and ADEs in Children

Kaushal et al, *JAMA*, 2001;285:2114-2120

Category	Ped (Per 100 orders)	Adult (Per 100 orders)
Medication Errors	~5.5	~5.0
Potential ADE (x10)	~11.0*	~3.5
ADE (x10)	~2.5	~2.5
Preventable ADE (x10)	~0.5	~0.5

*p value < 0.005

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II. The Burden of Harm in Children Age Specific Error Rates (per 100 admissions)

Kaushal et al, *JAMA*, 2001;285:2114-2120

Age Group	Med errors (per 100 admissions)	Potential ADEs (per 100 admissions)
Neonates	~60	~20
Infants	~40	~10
Preschoolers	~50	~10
School Age	~60	~10
Teenagers	~65	~10
Adults	~80	~15

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Kaushal et al, *JAMA*;2001

II. The Burden of Harm in Children Unit Specific Error Rates (per 100 orders)

Kaushal et al, *JAMA*, 2001;285:2114-2120

Unit	Med Errors (per 100 orders)	Potential ADEs (per 100 orders)
NICU	~5.5	~2.8
PICU	~5.8	~1.5
Gen Med	~6.0	~0.8
Med/Surg	~6.2	~0.8
Gen Surg	~4.5	~0.5

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Kaushal et al, *JAMA*;2001

II. The Burden of Harm in Children ADE Rates with Trigger Tool

Takata, Mason, Taketomo, Logsdon, Sharek. *Pediatrics* April 2008

ARTICLE

Development, Testing, and Findings of a Pediatric-Focused Trigger Tool to Identify Medication-Related Harm in US Children's Hospitals

Glenn S. Takata, MD¹, Wilbert Mason, MD MHP², Carol Taketomo, PharmD³, Tina Logsdon, MS⁴, Paul J. Sharek, MD, MHP⁵

**960 Pediatric Inpatients;
11.1 ADEs per 100 admissions;
22x more ADEs than incident reports**

ABSTRACT OBJECTIVES: The purpose of this study was to develop a pediatric-focused tool for adverse drug event detection and describe the incidence and characteristics of adverse drug events in children's hospitals identified by this tool.

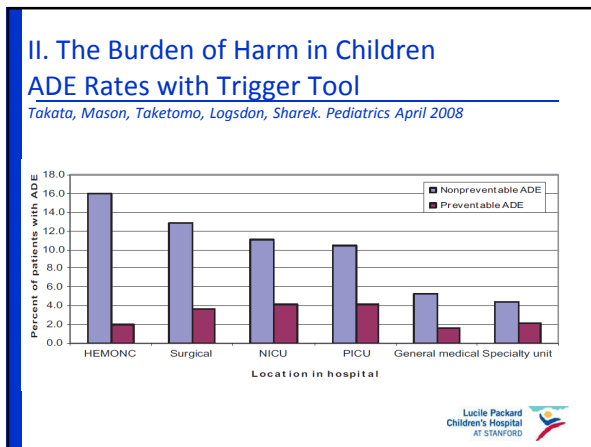
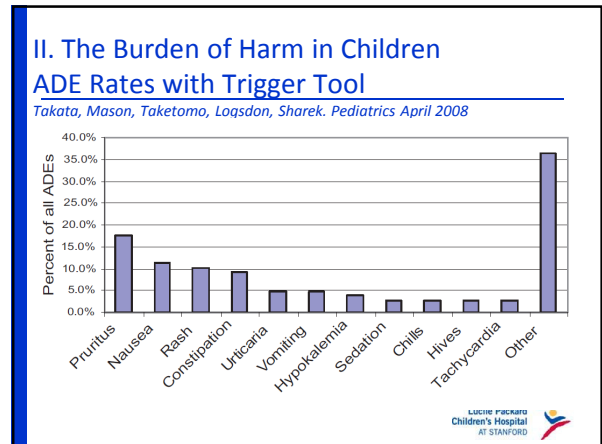
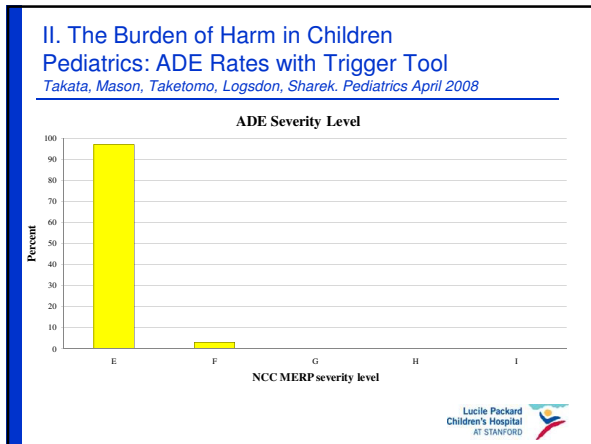
www.pediatrics.org/cgi/doi/10.1159/00011779
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II. The Burden of Harm in Children ADE Rates with Trigger Tool

Takata, Mason, Taketomo, Logsdon, Sharek. *Pediatrics* April 2008

Medication class	Nonpreventable	Preventable
Analgesic, opioid	~35	~20
Antibiotic	~15	~10
Antifungal agent	~10	~5
Antiepileptic agent	~5	~5
Bronchodilator	~5	~5
Intravenous fluid	~5	~5
Antiemetic	~5	~5
Electrolyte	~5	~5
Antipsychotic	~5	~5
Antispasmodic	~5	~5
Antiinflammatory	~5	~5
Coagula-agent	~5	~5
Lasix	~5	~5
Immunosuppressant	~5	~5
Other	~15	~10

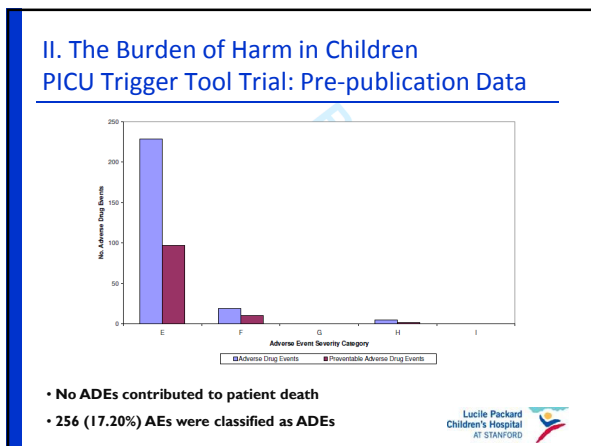
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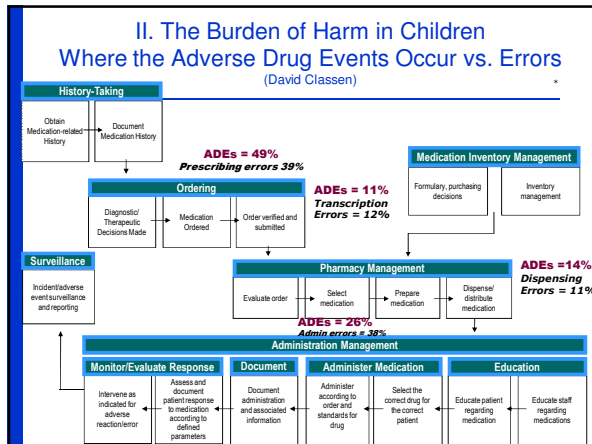
II. The Burden of Harm in Children PICU Trigger Tool Trial: Pre-publication Data

- Total Patient Count: 734**
- Total Triggers: 2,816**
- Total # AEs identified: 1,488**
- Total Number of Patients with Adverse Events: 455 (62%)
- 91% of patients with an AE identified with a Trigger (=416/455)
- Number of patients with multiple (> 1) Unique AEs: 245 (33%)
- Average LOS: 7.1 Days
- Average AEs over all Patients: 2.03/patient**
- Average AEs in patients with adverse events: 3.27 / patient
- Overall # AEs per 100 pt. Days= 28.6**
- Average AEs per Trigger (Positive Predictive Value of any given trigger): 0.444
- Average Triggers per Patient: 3.84
- Mean Time for Chart Reviews: 24.7 minutes (per reviewer)

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- ### II. The Burden of Harm in Children PICU Trigger Tool Trial: Pre-publication Data
- Statically significant risk factors:
 - Surgical patients (preventable ADEs)
 - Intubated patients (preventable ADEs)
 - >18 yo patients (preventable ADEs)
 - 13-18 yo and >18 yo patients (total ADEs)
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- ### II. The Burden of Harm in Children Summary findings
- Overall: 11.1 ADEs per 100 admissions
 - Opiates 51% of all ADEs in children
 - Vast majority of harm is temporary
 - Hospital wide
 - PICU setting
 - Most harm occurs at ordering and administration stages
 - 17% of all harm in PICU setting is drug related
 - ADEs in PICU: Risk factors
 - Surgical risk
 - Intubated risk
 - Increasing age
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- ### III. Best practices-overview
- Institute for Healthcare Improvement (IHI)
 - National Initiative for Child Health Quality (NICHQ)
 - Harvard group (Bates/Kaushal/etc) recommendations
 - American Academy of Pediatrics (AAP) recommendations- see slides in handouts
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- ### III. Best Practices IHI 100,000 Lives Campaign (12.2004)
- Deploy **Rapid Response Teams**...at the first sign of patient decline
 - Deliver **Reliable, Evidence-Based Care** for **Acute Myocardial Infarction**...to prevent deaths from heart attack
 - Prevent **Adverse Drug Events (ADEs)** ...**by implementing medication reconciliation**
 - Prevent **Central Line Infections**...by implementing a series of interdependent, scientifically grounded steps
 - Prevent **Surgical Site Infections**...by reliably delivering the correct perioperative antibiotics at the proper time
 - Prevent **Ventilator-Associated Pneumonia**...by implementing a series of interdependent, scientifically grounded steps
- December 12-15, 2004, Orlando, Florida
- Lucile Packard Children's Hospital AT STANFORD

- ### III. Best Practices IHI Generation 2: The 5 Million Lives Campaign
- 100,000 lives campaign interventions PLUS New interventions targeted at harm:
- Prevent Pressure Ulcers...
 - Reduce Methicillin-Resistant *Staphylococcus aureus* (MRSA) Infection...
 - Reduce Surgical Complications...
 - Deliver Reliable, Evidence-Based Care for Congestive Heart Failure...
 - Get Boards on Board...
 - Prevent Harm from High-Alert Medications... starting with a focus on anticoagulants, sedatives, narcotics, and insulin
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- ### IHI Recommended strategies to decrease ADEs (F Federico. JQPS. 2007;13(9):537-542)
- Design systems that prevent errors and harm
 - Orders sets
 - Pre-printed order forms
 - Clinical pathways/protocols (standardize approach to similar med/diseases)
 - Reminders /information about monitoring parameters in the order sets
 - Standardize concentrations/dose strengths
 - Identify errors before they reach the patient
 - Pharmacist review of orders
 - Double checks (where appropriate)
 - Critical lab information at the point of care
 - Construct systems that quickly mitigate error/harm once it reaches the patient
 - Antidotes available at bedside
 - Protocols that allow RNs to administer antidotes
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III. Best Practices

NICHQ* recommended *additional tactics*: Pediatrics

- Use Trigger tools to detect and track harm
- Appropriate use of standardization
 - Standardize doses
 - Standardize concentrations
 - Standardize order sets
- Reconcile medications
 - Establish accurate home medication lists (include herbs/remedies)
 - Maintain current medication lists
 - Documents allergies
- Avoid allergens


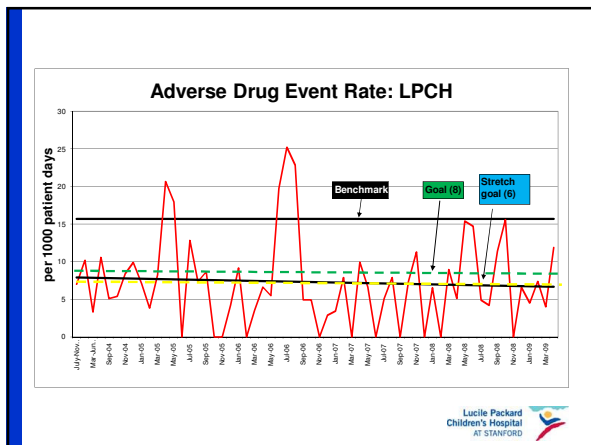
* National Initiative for Children's Healthcare Quality



Prioritizing Strategies for Preventing Medication Errors and Adverse Drug Events in Pediatric Inpatients

Elizabeth B. Fortescue, MD¹; Rainu Kaushal, MD, MPH^{2,3}; Christopher P. Landrigan, MD, MPH⁴; Kathryn J. McKenna, MS, RN⁵; Margaret D. Clapp, RPh⁶; Frank Federico, RPh⁶; Donald A. Goldmann, MD⁷; and David W. Bates, MD, MSc¹

1. Ward based Clinical Pharmacists: 82% reduction in medication errors (88% potential ADEs)
2. CPOE with Decision Support: 73% reduction in medication errors (75% of potential ADEs)
3. Improved communication: between physicians, nurses, and pharmacists 65% reduction in medical errors (86% of potential ADEs)


IV. Next Generation Medication Safety

Attributes of High Reliability Organizations*: Weick

1. Preoccupation with failure
2. Reluctance to simplify interpretations
3. Sensitivity to operations
4. Commitment to resilience
5. Deference to expertise

*Think about processes with "Catastrophic consequences" (ex. K infusion, anesthesia, ECMO, etc)


Weick, et al. Research in Organizational Behavior. 1999;21:81-123
Weick, Managing the Unexpected: Assuring High Performance in an Age of Complexity, Jossey Bass 2001



IV. Next Generation Medication Safety


Paul's Practical Solutions to Move Toward High Reliability

- Leadership
 - "Patient first" mantra
- Organizational clarity
 - Mission statement
 - Goals/incentives aligned
- Human factors integration
 - Fatigue, staffing ratios, labels
- Culture
 - "patients first", collegiality, communication, reporting
- Simulation
 - Prepare in advance for high risk situations
- Zero defect philosophy
 - Defects in care not accepted as inevitable
- Stop the line
 - Responsibility to stop dangerous processes and fix
- Systems thinking
 - Systems and processes drive outcomes
- Standardization
 - Checklists, boarding passes, order sets
- Data driven
 - Data driven and evidenced based decision making
- Technology: Tools for supporting ideal processes

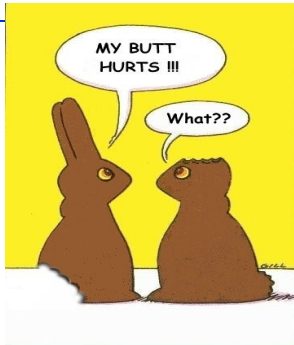


Conclusions

- Adverse Drug Events in hospitals occur frequently
- Multiple specific evidence based interventions to improve medication safety in children
- The next generation of medication safety
 - Use tenets of reliability science
 - Integrate attributes of highly reliable organization
- And remember...



It is all about preventing harm...



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