Patient Safety in EMS: Strategies to Reduce Medication Errors

John D. Hoyle, Jr. MD, FACEP, FAAP
Sabina Braithwaite, MD, MPH, FACEP

Conflict of Interest Disclosures:
John D. Hoyle, Jr. MD, FACEP, FAAP
I hold the U.S. patents on 2 drug dosing devices.
I receive no royalties and have no royalty arrangements.
Sabina Braithwaite, MD, MPH, FACEP
Consultant for Masimo: October, 2012
Steering Committee Chair, EMS Culture of Safety Strategy Project

Objectives

• Describe components of the EMS environment that create risk of medication errors and specific process points at which these are likely
• Review a taxonomy of medication errors that could be applied to EMS for quality monitoring purposes
• Discuss pediatric-specific issues related to medication administration
• Provide specific strategies, processes, and tools that can be used to limit or trap medication errors in EMS
• Discuss how a Just Culture approach and practices consistent with high reliability organizations can help promote a change in EMS’ approach to medication safety
Medication Errors
“Few tools have as great a potential to cause harm as the laryngoscope, the syringe and the ink pen”


Medical Errors
• 1999 Institute of Medicine (IOM) report:
  – 3-4% of hospital patients are harmed by the health care system
  – 7% of hospital patients are exposed to a serious medication error
  – 50,000 – 100,000 deaths/yr from medical mistakes
  • Equivalent of 280 747s crashing in a year with no survivors
  • Would that get you attention?

IOM Preventing Medication Errors: http://www.nap.edu/catalog.php?record_id=11623

Medication Error Definition
"A medication error is any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labeling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use."

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EMS Environmental Risks

- Emergency situation
- No written order
- No external crosscheck
- No electronic decision support
- High-risk medications
- Drug shortage issues and substitutions

Prehospital Pediatric Dosing Errors

Prehospital Errors

- Kaji, et al Pediatrics, October 2006
- LA County Paramedics
- 1994-1997 epinephrine dose error: 65.8% incorrect
  - Fewer errors when Broselow tape used.
- Extensive quality improvement program to decrease error
- 2003-2004 epinephrine dose error: 35% incorrect

IOM Testimony to Congress 5-3-2001:
http://www7.nationalacademies.org/ocga/testimony/Patient_Safety_and_Medication_Errors.asp
Prehospital Errors

- EMTPs completed pediatric patient simulation scenarios
- Epinephrine dose incorrect: 68-73%
- Failure to use Broselow tape: 50%
- Incorrect use of Broselow tape: 47%

Prehospital Pediatric Medication Errors

JD Hoyle, Jr, AT Davis, K K Putman, JA Trytko, WD Fales

- The 3 studies I mentioned are the only ones looking at pediatric prehospital medication errors
- Our team’s objective: identify the prevalence of drug-dosing errors in pediatric patients treated by EMS
  – Prehospital Emergency Care Jan 2012

Methods

Design:

- Retrospective cohort
- Data from 8 EMS agencies were examined
  – Serve 10% of Michigan’s population (1,009,500 persons)
  – Serve a demographically diverse population
Methods

• **Inclusion Criteria:**
  – ≤11 years of age
  – Scene runs
  – Interhospital transfers

• **Exclusion Criteria:**
  – Patients without a documented weight or Broselow tape color
  – Drugs administered ≤ 10 times were excluded from this analysis

• Standards for correct drug doses were based on Michigan’s model EMS pediatric protocols

• Error was defined as > 20% difference in dose from the protocol standard based on the patient’s documented weight or Broselow tape color
Results

- Pediatric patients who received drugs were 0.14% of all encounters

- For the 10,566 patient encounters:
  - Patient mean age: 3.8 ± 3.5 years
  - 71.1% were male

- 34.7% of all drug doses were incorrect

Results

- 69% of paramedics did not administer a drug to a pediatric patient during the study period (2.25 years).
  - Average number of drugs administered by individual paramedics for the study period: 2.7 ± 2.4

- In patients ≤11 years, weight determination via Broselow tape was documented in 28/230 (12.2%).

Incorrect Doses

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**Did the Broselow Tape Help?**

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<td>0.04</td>
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**Where/ How can an error occur?**

Wt x dose = mg ÷ conc = ml → dose to pt

How often do EMTPs do this?
How often do EMTPs practice this?

Do all this under the most stress you could be under:
- sick/critically ill child
- parent's/care givers stressed
- poor working conditions
With all of these opportunities for error can any of us get it right?

- Correct dose requires complicated string of events
- Individual may not experience such a patient in ≥ 2 years
- High stress situation
- Aids such as Broselow tape help but still aren’t perfect

Broselow Tape

- **Can** be very helpful
- Has to be used to work
- Frequently used upside down ("RED to HEAD")
- **Still requires mg to ml conversion**
Take Home Points

- Pediatric drug dosing errors occur at a very high rate in the prehospital environment
  - Contributing factors:
    - Infrequent pediatric patient exposure
    - Infrequent practice of drug calculations
      - Lack of exposure and practice is a set up for errors to occur
    - Lack of error prevention systems in place for EMS

Conclusions

- Now is the time to begin solving this problem for EMS and your pediatric patients
  - Will take all involved to fix this
  - Will require unique solutions for prehospital environment
- For now:
  - Use the Broselow tape (practice, practice, practice)
  - Weight specific drug cards with doses in mls
    - Remove the calculation from the equation
  - Do regular pediatric mock codes and cases
Pharmacists:
Medication errors are more likely to occur tend to be characterized by:

- disorganized work flow
- fatigued staff
- frequent interruptions and distractions
- poor physician handwriting
- emphasis on volume over service quality
- stress
- ineffective communication with patients
- improper technician training
- a pattern of inadequate staffing.

Medication Errors
“Every paramedic has memorized the five rights of medication administration—right patient, right route, right dose, right time and right medication. However, not all indications, precautions and contraindications for medications can be so easily classified.”
What is the lay of the land?

- When you administer a medication, do you use a verification process for accuracy?
- How do you perform your verification process?
- Do you perform a verbal verification on every medication administration (including NTG, albuterol, etc)?
- Have you ever had a medication error?

Survey says . . .

Credentialing

- Assessment of knowledgebase
  - Individual provider
  - System as a whole
- Components
  - “Random” selection by agency
  - Recommendation from agency
  - Written exam
  - Practical exam based on explicit criteria
  - Airway management validation by portfolio
Medication Administration Cross-Check (MACC):
Standardized method for medication administration, every time, every med

- 2 person verbal procedure
- Contains error traps
- Fast, simple
- Only the 2nd provider ‘authorizes’ the med administration
- barrier to error reaching the patient
- Creates a pause point
Dosing Decision Support
Dosing Decision Support

Systems approach to clinical process improvement

- Magnitude & frequency of medication errors?
- Reporting mechanism?
- Is issue at an individual or system level?
- Need to intervene?
- Ability to modify behavior?
- What tools are needed?
Intersection with Just Culture and High Reliability Organizational Culture

What happened after IOM?
Medicine looked to high reliability organizations (commercial aviation, nuclear energy, military) for models of how to decrease errors.

Systems and errors

- “Every system is perfectly designed to get the results it consistently achieves.”
  Why Hospitals Should Fly John Nance JD

- “Medical mistakes are merely human mistakes committed within a human system inadequately designed to catch & neutralize those mistakes”
**Swiss Cheese Model of Error**

[Image of Swiss Cheese Model]


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**Routine Hospital Drug**

- Physician enters order in computer for patient
  - Computer:
    - Checks that entered weight is appropriate for age
    - Calculates dose for weight and checks dose against child’s weight to assure it is correct
  - Order goes to pharmacist who checks dose/ mixes drug
  - Drug is bar-coded with patient’s name, drug dose
  - Nurse scans drug & patient’s ID band
    - Scanner confirms right drug and right patient
    - Nurse double checks pt name and drug

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**Hospital Code Drug (Peds)**

- Broselow tape used to determine pt weight
- Doctor and nurse “check back” and agree on weight
- Code sheet for that weight gives dose in ml
- Pharmacist draws up medication
- Doctor, Nurse and Pharmacist “check back”
- Dose is delivered to pt
Drug prehospital

- EMTP determines drug to be given
- EMTP calculates dose
  - With or without calculator?
  - May consult protocol
  - May use drug dosing aid (Broselow tape)
- EMTP draws up dose or grabs preload
- EMTP administers drug

How do we fix this?

- EMTPs and EMS medical directors need to put systems/technology in place to help reduce errors
  - EMTPs don't have the tools needed to perform well with an infrequent event

How do we fix this?

- Requires a change of our culture!
  - All humans make mistakes
  - Treat errors as a system failure, not a failure of the person that made them
  - Errors need to be freely reported, without repercussions so that the system can be corrected
  - Systems need to be designed, specifically for EMS to decrease the incidence of medical errors
  - Treat every drug admin as if it's wrong and will kill the patient (John Nance)
High Reliability Organizations

• Definition: Organizations that function in hazardous, fast-paced, and highly complex technological systems error-free for long periods of time.
  • Preoccupation with failure
  • Culture of safety
  • Widely distributed sense of responsibility & accountability
  • Continuous personnel training
  • Redundancy and a variety of checks and counter checks (safety systems)

How we look at errors:

• An individual failure
• A systems failure

Just Culture Approach

• No more blame game
• Look at the whole picture with the goal of solving the problem

www.emscultureofsafety.org
Just Culture

- **Human error:**
  - Individual should have done something other than what he or she did, and
  - The action(s) inadvertently caused (or could have caused) an undesirable outcome

- **Negligent conduct:**
  - Falls below the standard reasonable level of skill expected

- **Reckless conduct:**
  - Greater culpability than negligence because it is conscious, unjustified, and done in spite of understanding of the likelihood of harm

- **Intentional/willful violations:**
  - Know the negative result of the action but do it anyway.

Just Culture

- Separate behaviors from outcomes
  - Base the response to unsafe acts on the behavior itself and the risk it presents,
  - Not on the outcome

- **Console** human error.

- **Coach** at-risk behavior.

- **Punish** reckless behavior.

- ...independent of outcome.

Toolkit
What is most important: Deliver medication quickly? Deliver medication correctly?

Change to a Culture of Safety
- acknowledgment of the high-risk nature of an organization's activities and the determination to achieve consistently safe operations
- a blame-free environment where individuals are able to report errors or near misses without fear of reprimand or punishment
- encouragement of collaboration across ranks and disciplines to seek solutions to patient safety problems
- organizational commitment of resources to address safety concerns

James Reason: Building a Safer Healthcare System
- Principles
- Policies
- Procedures
- Practices
Human Factors Engineering

- No one-size fits all solution
- Usability testing
- Forcing functions
- Standardization
- Resiliency efforts

Checklists

How do we fix this?

- My recommendations:
  - EMTPs should look at the Broselow tape at the start of every shift
  - EMTPs should use Broselow tape on every child
    - If you have questions, ask your medical director or an EM doctor
  - EMS reference book with all the doses for all the weights on the Broselow tape in ml
    - Has to be standardized to the drug concentrations you use!!
    - May not be valid if you get replacement drugs outside of your system
How do we fix this?

- Regular (monthly) pediatric mock codes/cases
- How often is your PALS/PEPP training?
- Encourage PALS review at least twice a month
- Check back all of your drug doses (EMT-P partner)
- Law of unintended consequences
  - Any new way of doing things needs thorough testing prior to implementation


VA Hospital Bar Coding

www.himss.org/content/files/proceedings/2000/sessions/ses073.pdf
Quality Monitoring

- Embed quality measure monitoring mechanism into electronic health record
- ISMP: Medication Safety Tools and Resources

Anonymous Reporting

[Anonymous Reporting](http://event.clirems.org/)

Areas of Information for Hospital Nurses

- Patient Information
- Drug Information
- Communication of Drug Orders and Other Drug Information Evaluation

[Areas of Information for Hospital Nurses](http://www.ismp.org/Tools/PathwaySection2.pdf)
How do we fix this?

• Recommendations from the Audience
  – What are the issues for you with delivering correct drug doses to children
  – What are you doing that works?
  – What are the barriers to fixing this?

Take-Home Points

• Recognize that medication errors are happening, whether reported / recognized or not. Look for ways to determine and address errors that are being made
• Provide decision support tools and error traps that are immediately available, particularly if meds/ concentrations change
• Promote a culture of reporting and thoughtful analysis of incidents coupled with appropriate changes to address both system and provider level gaps

Thank You

John D. Hoyle, Jr. MD, FACEP, FAAP
jhoyle@hotmail.com
Sabina Braithwaite, MD, MPH, FACEP
Sabina.Braithwaite@gmail.com