

# **Pediatric Patient Safety**

James Chamberlain, MD

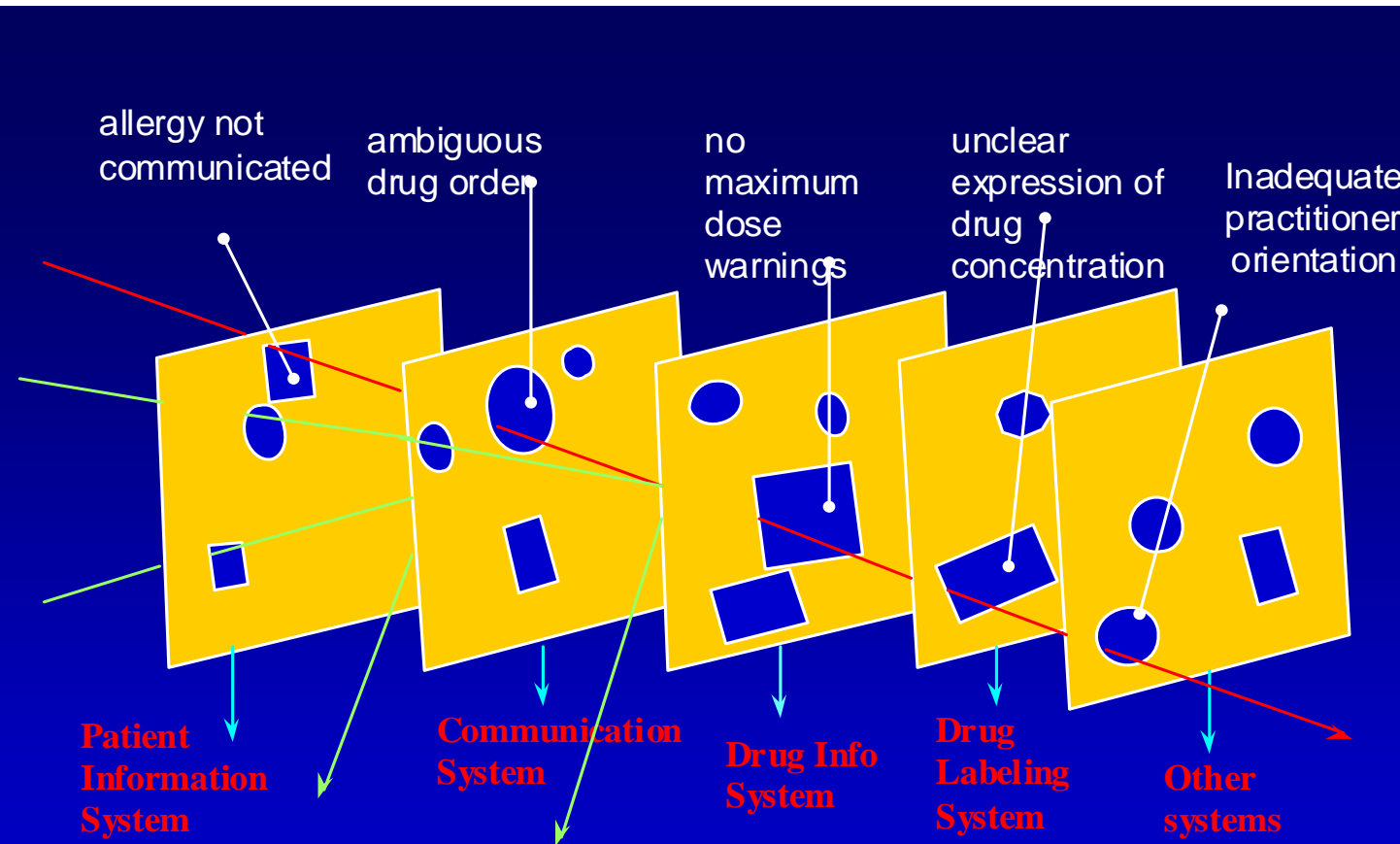
October 30, 2009

To err is human...  
but it feels divine (Mae West)

# Objectives

- Epidemiology and impact of medical errors
- Unique factors in pediatrics
- Current approaches to error reduction
- A research agenda
- PECARN's current efforts

**Qualifier: Safety event = medical error**



The latent failure model of complex system failure

*modified from James Reason, 1991*

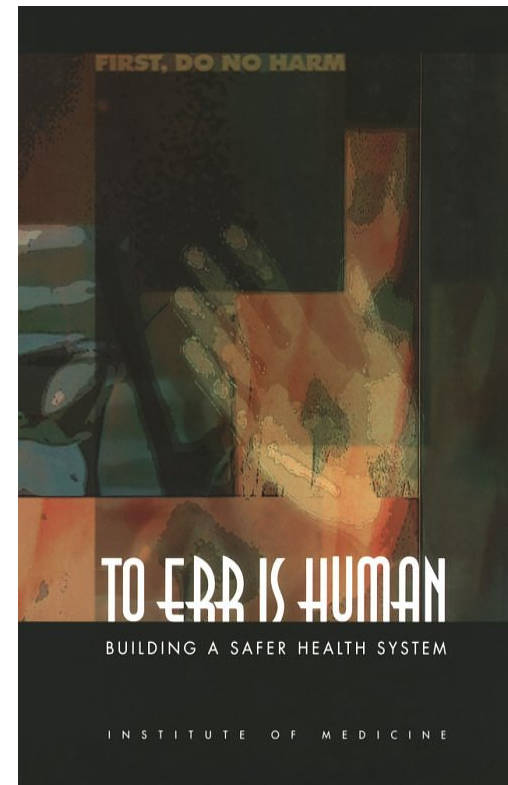
# Background

- Medical errors kill lots of patients & many more have permanent disabilities as a result of these errors
- ~\$300 billion is spent yearly on health care that does not improve patient outcomes

# IOM: 2000

- 3.7% of all hospitalized patients suffer an adverse event (AE)
- 19% of all AE's are related to medications
- 1/3 of all adverse drug events are preventable

→ 48-98,000 preventable deaths per year in the U.S.



# Causes of Death: United States

1. Heart Disease (724,269)
2. Cancer (538,947)
3. Cerebrovascular Dz (158,060)
4. Pulmonary Dz (114,381)
- 5. Medical Errors (98,000 est.)**
6. Pneumonia (94,828)
7. Diabetes (64,574)
- 8. Medical Errors (48,000 est.)**
9. MVA (41,826)
10. Suicide (29,264)
11. Renal Disease (24,295)

What if airlines functioned like this?

One major airline crash every 2 ½ days

Would you fly?

Would you go to a hospital?

# Montgomery County, MD



IPS	PLACE	LIGNE	TEMPS
888	4	4	88:88.88
888	5	5	88:88.88
888	6	6	88:88.88

NOMBRE MAXIMAL 185 BAIGNEURS

# The Culture of Medicine

- Doctor is in charge
- Doctor is infallible if he/she simply maintains vigilance
- Punitive response to errors
- Fear of malpractice

Failure to speak up

Failure to escalate

Failure to report

Failure to change anything

# Challenges Specific to Pediatrics

- Developmental changes in pharmacology
- Weight-based dosing varying over 100-fold in a lifetime
- Use of pounds rather than kg
- Parents may not be present. If they are, they are exhausted
- Children can't tell you that you have the wrong patient or their allergies

# Pediatric EDs

- Crowded, noisy, chaotic
- Frequent workflow interruptions
- Unpredictable surges in volume
- Highly variable case mix
  - Trying to find the needle in the haystack
- 70 minutes to see MD
- Fatigue and shift work
- Outpatient/inpatient interface

# Pediatric EDs

- Complex and tightly coupled
- Teamwork is not formally taught
- Inaccurate history
- Latent errors
  - EMTALA and CMS
  - Reimbursement and staffing
  - PCP referral patterns
- Heuristics and errors

Rm ▲	Age	Sx	Complaint	RN	Rs	Dr	L	X	E	LOS	Comments
C2A	25 y	F	Cold Symptoms	LK					O	1:33	
ED1	9 y	F	Cephalgia	LK	JAG	BAE		☺		2:58	[dn] CT neg
ED2	5 y	F	Assign SCU-3112-A Admitted	LK	MS	TAA		☺	☺	4:58	[nv] OR add on / need admit orders
ED3	1 m	F	Vomiting	LK		BAE		☺		4:37	[nv]
ED4	11 y	M	Back Injury							0:33	[v]
ED5	10 y	M	Lac Lip							0:40	
ED6	9 y	M	Removal Stitches							0:11	[v]
ED7	5 y	M	Hip Injury		MS					1:31	[v]
ED8	9 y	M	*Seizures		JSG	BF		☺		3:21	[v] awaiting labs and PMD fax
ED9	3 y	M	Cough Other		NT	MJH				3:15	[dv] 1 of 2
ED9	6 y	M	Cough Other		NT	MJH				3:15	[dv] 2 of 2
E10A	10 y	M	Wheezing			MJH				2:17	
E10B	13 y	F	*SOB		JAG	BAE				2:07	[v]
E10C	24 m	F	Wheezing			BAE				2:37	round #1
E10D	13 y	M	Wheezing		MS	HTO				1:35	[v]
E10E	32 m	M	*Respiratory distress		JAG					0:41	[v]
ED11	9 y	M	Cephalgia		JSG	MJH	I			6:50	LP in progress
ED12	16 m	F	Fever			BF	I			4:33	[dv] Cbc done
ED13	3 y	F	*Seizures							0:48	
ED14	11 y	F	Assign ncu 4125b Admitted		MS	BF	I	☺		6:33	[n] admit to neuro p tensilon test
ED15	5 d	M	Jaundice							0:37	
ED18	6 m	M	Cough Other		EAD					1:48	
ED17	15 y	F	*Abdominal Pain							1:06	
ED17	14 y	F	Emesis		NT	MJH	I			4:28	[dv]
ED19	8 y	M	Chest Pain		JSG	BAE				3:10	[v]
CN1	12 y	M	Problem Psych	PA	NT	MJH				5:07	[dv] #3
CN2	10 y	F	Problem Psych							2:46	[v] #5
INT	16 y	F	Problem Psych							3:00	obs #4
ESW	12 y	M	Ankle Injury			ALP		☺		2:00	[nv] fracture/ need ortho eval
ESW	28 m	F	Ankle Injury		MS	MJH		☺		3:19	[nv] ortho to see
ESW	11 y	M	Finger Injury		EAD	BF		☺		3:32	[nv] waiting for ortho c/s
ESW	11 y	M	*Seizures			BAE		☺		5:01	[v] MRI @ 1800 ext 2920
EDZ	4 y	M	Cold Symptoms							6:52	[v] where's chart Denise/Kaya
ETU7	7 m	M	Dehydration	JM	BF	ALP	I	☺		24:10	[dnv] check lp, sickle prep
ETU8	8 y	F	Wheezing	JM		ER		☺		22:21	[dn] Q3, reassess 1PM
FT	19 m	M	Emesis							0:35	[v]
FT	4 y	F	Allergic Reaction							0:41	[v]
FT	13 m	M	Emesis							0:46	[v]
FT	12 m	M	Nose Running							0:58	[v]
FT	7 m	F	Ear Pain			YSY				1:10	[v]
FT	8 y	F	Fever			ER				1:16	[v]
	3 y	M	(none)							0:04	[v]

Sign In	Visit Log	Zoom In (+)	All Areas			Total: 42			In Room: 35			WR: 7		
Reserve		Zoom Out (-)	Arr → Room	120	60	Now	Lab Ord → Res	0	0	0	0	60	Now	
			Arr → Dr Sees	3	2	7	Xray Ord → Res	0	0	0	0	0	0	
			Bed Ord → Disp	14	13	11								
				0	0	0								

# Patient “care” in EDs

- 7 major tasks (History, physical, differential, plan, communicate with family, generate discharge instructions, communicate with PCP)
- 37 ancillary tasks (documentation, flow, communication)



# Evidence

- Case reports and case series
- Limited science related to PEDs

# PED Errors

- Reviewed 33 medication errors/5 years
  - 35% incorrect dose
    - incorrect weight
  - 30% incorrect medication
    - failure to consider allergies
    - similar drug names or packaging
- 12% required additional treatment as a result, 1 required admission

# PED Errors

- Review of 1532 ED charts/12 random days Summer 2000
- Prescribing errors in 10%
- Univariate associations with errors:
  - 0400 - 0800 or weekends
  - Severe disease
  - Trainee ordering
  - Higher rates early in academic year

# PED Errors

- 24% of admissions medically unnecessary
- 1.3% return within 48 hours for admission
  - 0.4% have probable or possible medical errors

Chamberlain JM et al. *Acad Emerg Med* 1998  
DePiero AD et al. *Ann Emerg Med* 2002

# System redesign

- Reduce latent errors
- Provide just-in-time information support
- Error checking and forcing functions
- Standardization
- Checklists

# Latent Errors

6/13/00 MSO4 2.0 mg  
P. H. W.

**PRESCRIPTION**

**Name:** PATIENT TEST

**DOB:** 01/01/2000

**Medical Record #:** 000000004

**Account #:** 0110001055

**Sig:** ALBUTEROL NEBULIZER

2.5 mg every 4 hours until PATIENT sees the doctor again.

**Quantity:** 1 (one) box

**Refill:** 5 (five) refills

**Generic replacement allowed.**

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JAMES M. CHAMBERLAIN, MD

DEA: n/a

05/15/2003 17:13



**E. coli resistance**



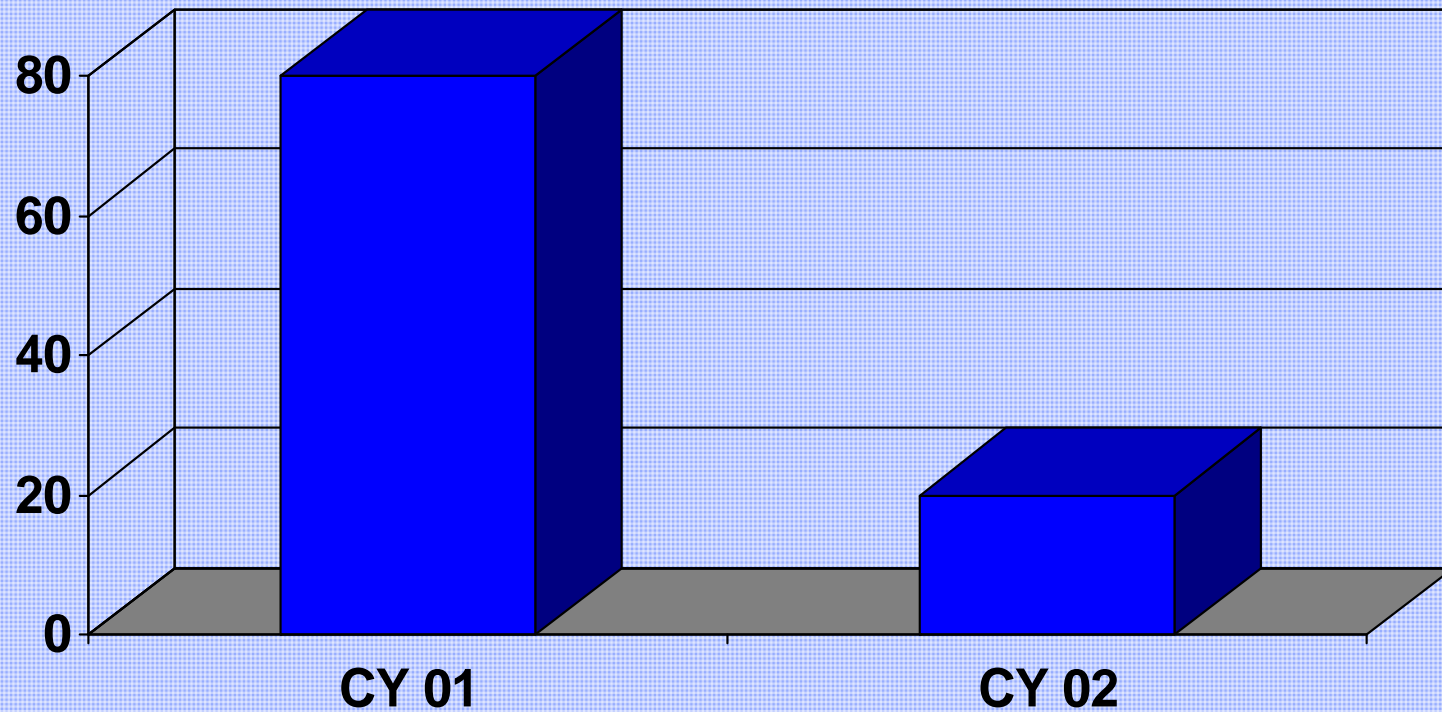
45% of E. Coli at Children's Hospital are resistant to Bactrim. Consider Vantin (cefepodoxime) or Ceftin (cefuroxime).

OK



# Radiology Workstation in ED

## ED Returns for Radiology Re-reads

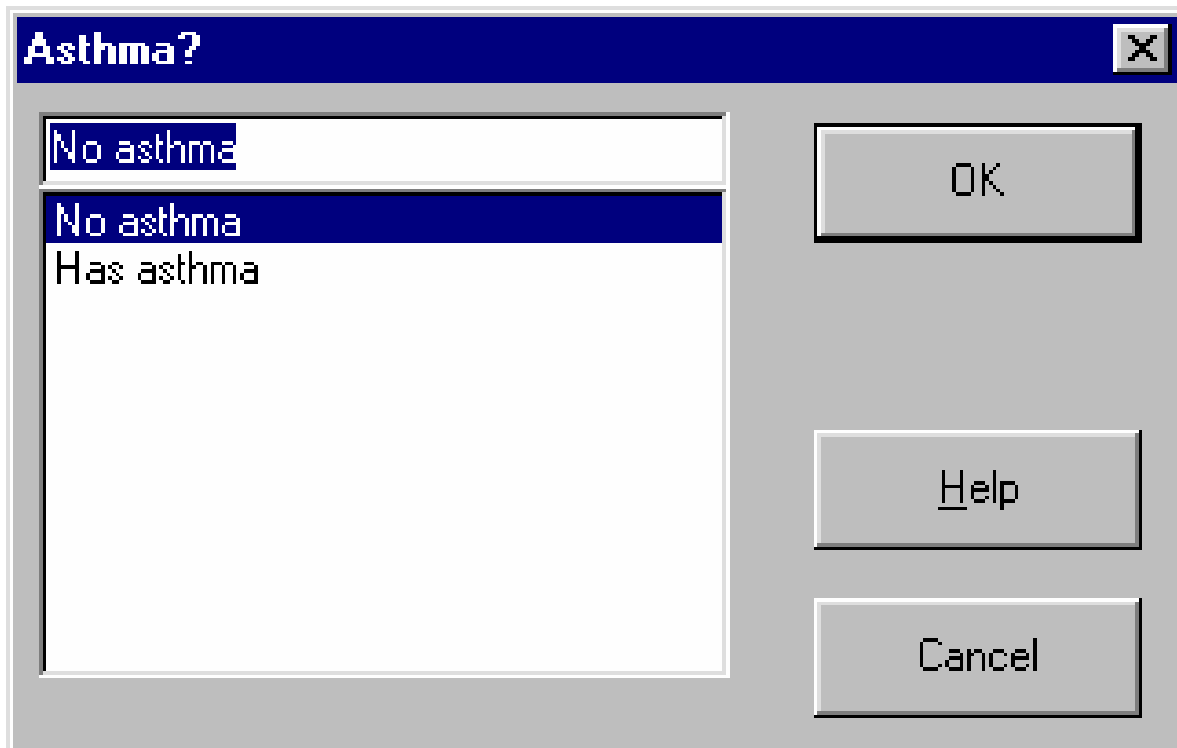


Dose



3 mg/kg/day div TID

OK



# Checklists

- PCP called
- Admissions office called
- Inpatient attending or fellow called
- Inpatient resident called
- All emergent tests and orders initiated in ED  
(including first dose of antibiotics)
- Orders written
- Nursing report communicated

Does it work?

# Checklists Work!

- Has your aircraft ever been grounded for a mechanical failure?
- Reduce cognitive burden
- Team knows what to expect
- Practice makes perfect

# Checklists Work!

- 19-item checklist developed based on WHO.
  - Basic steps for ensuring safe anesthesia
  - Infection prophylaxis
  - Teamwork
  - Other essential steps for successful surgery
- 8 hospitals around the world
- 3733 consecutive patients age 16 or older, non-cardiac surgery
- Mortality 1.5% → 0.8%
- Inpatient complications 11% → 7%

# Checklists Work!

- 103 ICUs in Michigan systems
- 4-part intervention
  - Safety culture
  - Daily goals to improve teamwork
  - Ventilator-associated pneumonia checklist
  - Catheter insertion checklist
- 1981 ICU months, 375,757 catheter-days
- Median of 2.7 infections per 1000 line days → 0 (mean 7.7 → 2.3)

**Where do we go from here?**



# **A Research Agenda**

High-risk areas/patients in EDs

Incidence

Standard terminology and definitions

Attention to generalizability

# **A Research Agenda**

Which methods are most effective?

Which are most cost-effective?

# A Research Agenda

To what extent are the lessons of aviation and other high-risk industries applicable to health care

- standardization
- check lists
- cross checking
- formal teamwork training

# **A Research Agenda**

How useful will prospective risk assessment be and how will we prove it?

# A Research Agenda

How do we change culture?

How do we institute change that we know is beneficial? What about change when we're not sure of the benefit?

# **A Research Agenda**

As we institute changes to reduce errors, how do we ensure that we don't leave the disadvantaged behind?

# TRIGGER EVENTS

## ELECTRONIC TRIGGER YIELD

ELECTRONIC TRIGGER	FREQUENCY	PPV
DIGIBIND	0	0
NALOXONE	16	9(56%)
KAYEXALATE	20	0
PROTAMINE	20	0
FLUMAZENIL	1	0
GLUCOSE	508	101(20%)
POTASSIUM	786	57(7.2%)
TRANSFERS TO ICU	76	36(47%)
Total	1427	203(14%)

# Critical Incident Reporting

- Used in other high-risk industries to identify safety threats
  - Confidentiality
  - An emphasis on improving systems
  - Incentives for reporting
  - A focus on near misses

# Incident Reporting

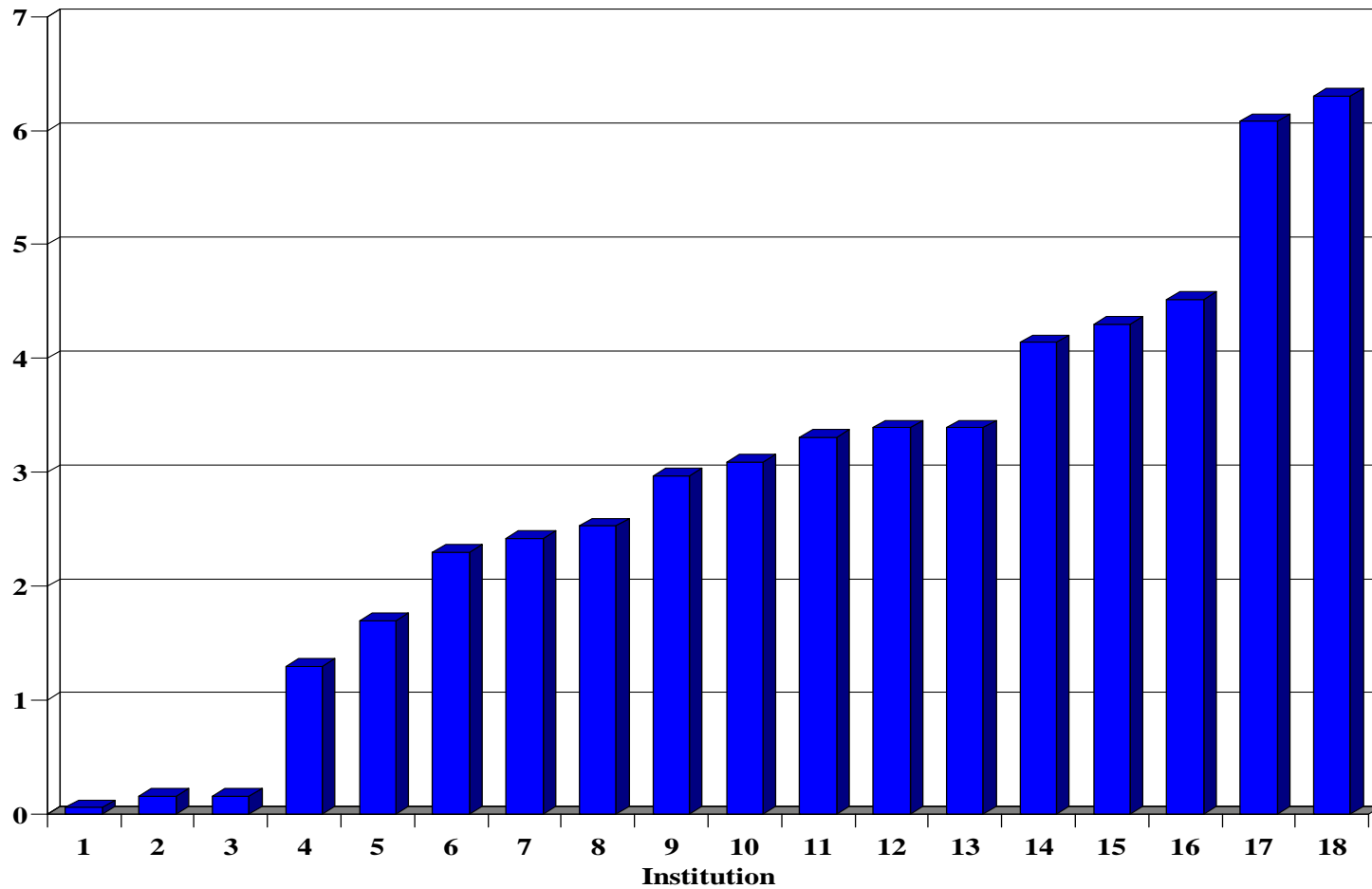
- Used in hospitals
- Estimated 1/20<sup>th</sup> to 1/50<sup>th</sup> of events are captured
- Often punitive
- Results not shared
- Fear of discoverability

# PECARN Incident Reporting

- 18/21 hospitals are sending data
- 2/21 trying to get approval
- 1 has refused
  
- 1258 IRs in first 12 months
  - In 100% could assess type of error
  - In 96% could assess severity
  - In 68% could assess contributing factors

# Wide variation in culture

**Incident Reporting Rate by Institution (Reports per 1000 patients)**



# How to Use the Data

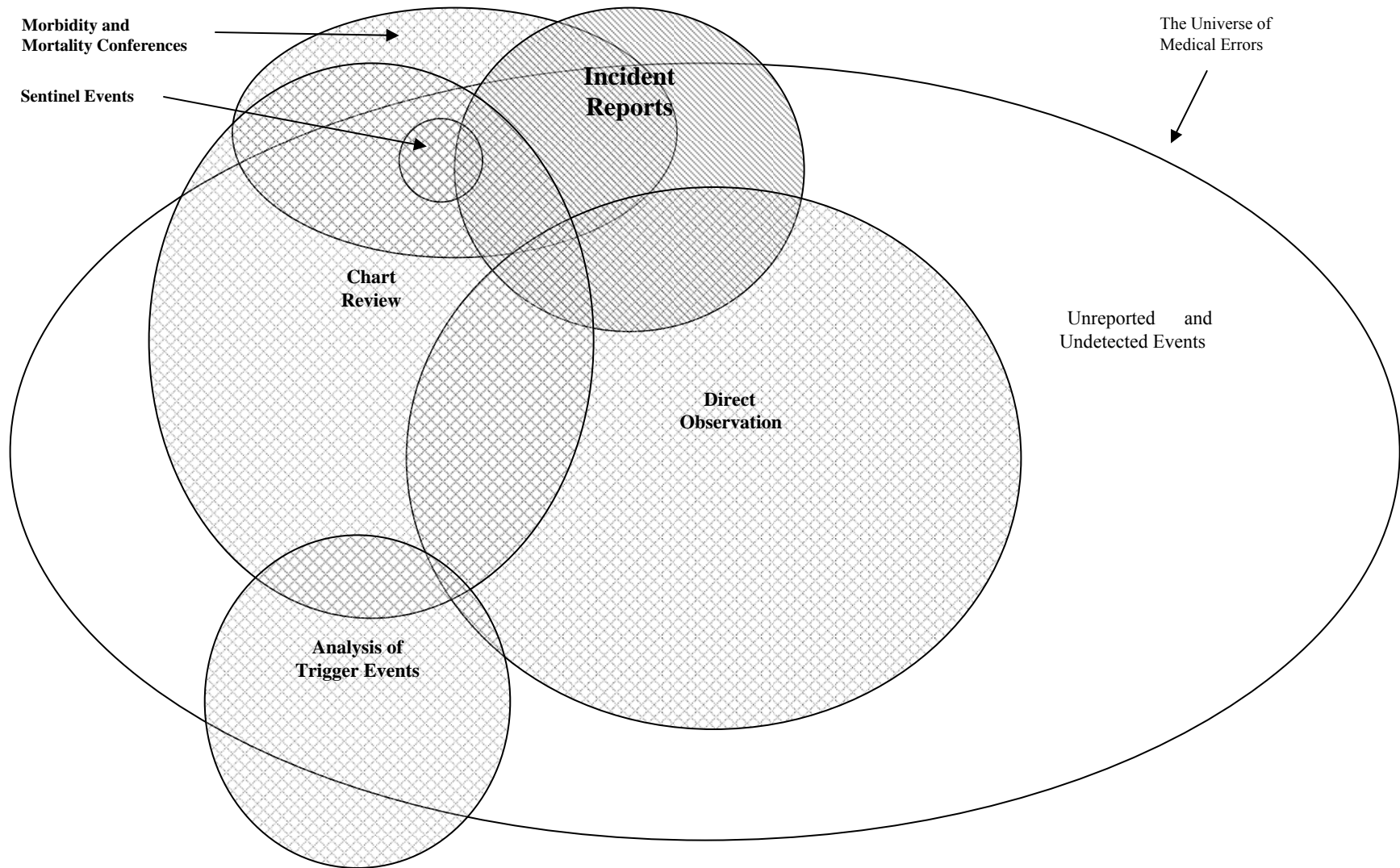
- Feedback to sites
- Newsletters
- Common causes (e.g. pounds versus kg errors)
  - Gather consensus
  - Present to quality groups
    - NQF
    - ABP
    - NACHRI
    - TJC

**→“All pediatric weights should be recorded in kg”**

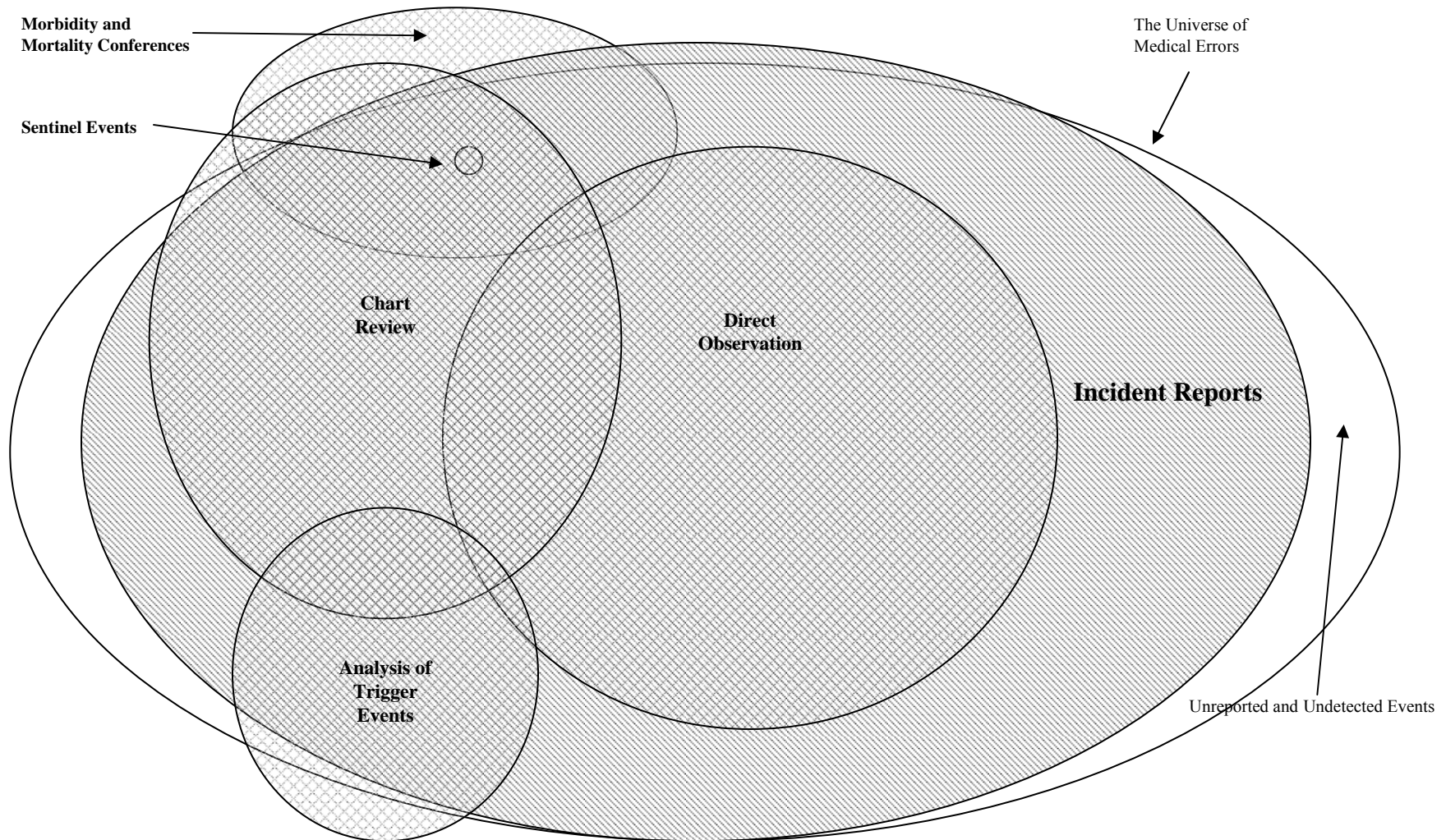
# Other Methods of Reporting

- M&M
- Root cause analysis (sentinel events)
- Telephone to Risk Management
- Resuscitation reviews
- Unreported events

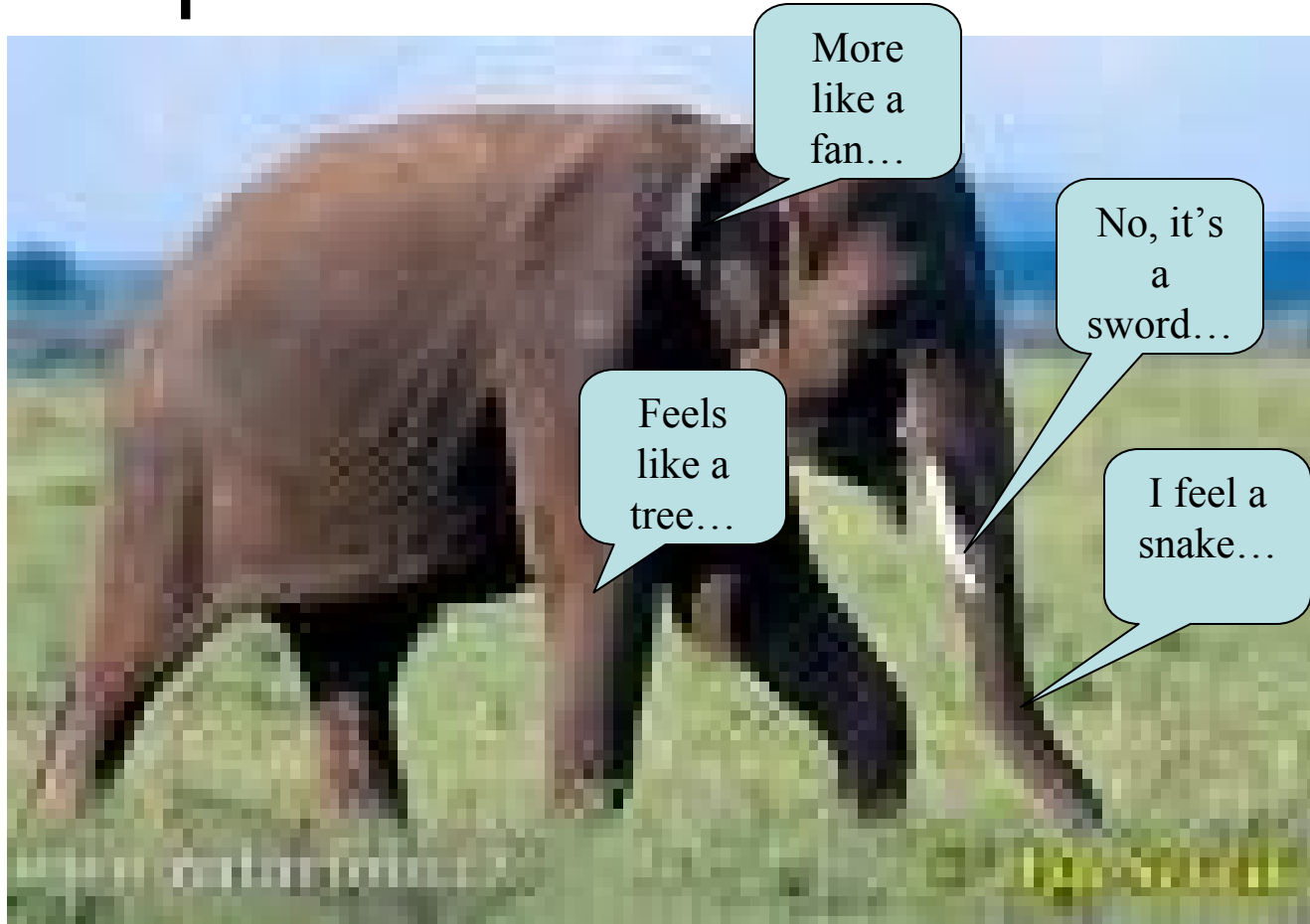
# Safety Events—Current State



# Safety Events—The Future



# It Depends on Where You Look



# Long Term Goals

- Identify best practices for patient safety
- Disseminate these as a safety bundle (checklist)
- Implement and measure effects
- Do it again (and again)

