

The Psychology of Pediatric Resuscitation in the Field



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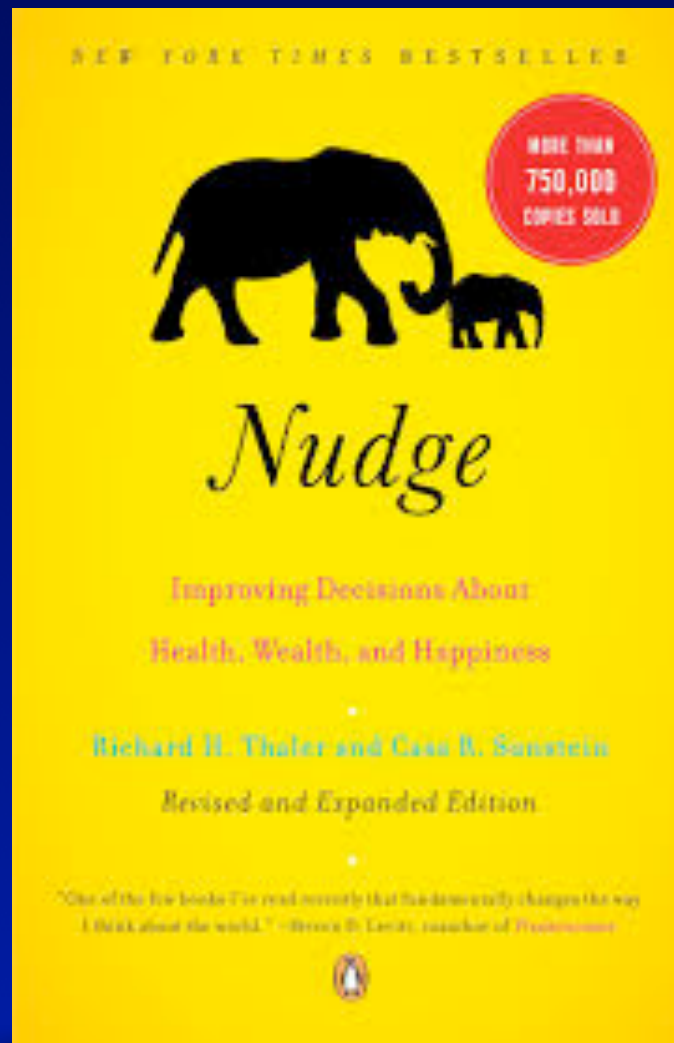
Pediatric Resuscitation

Disclosure

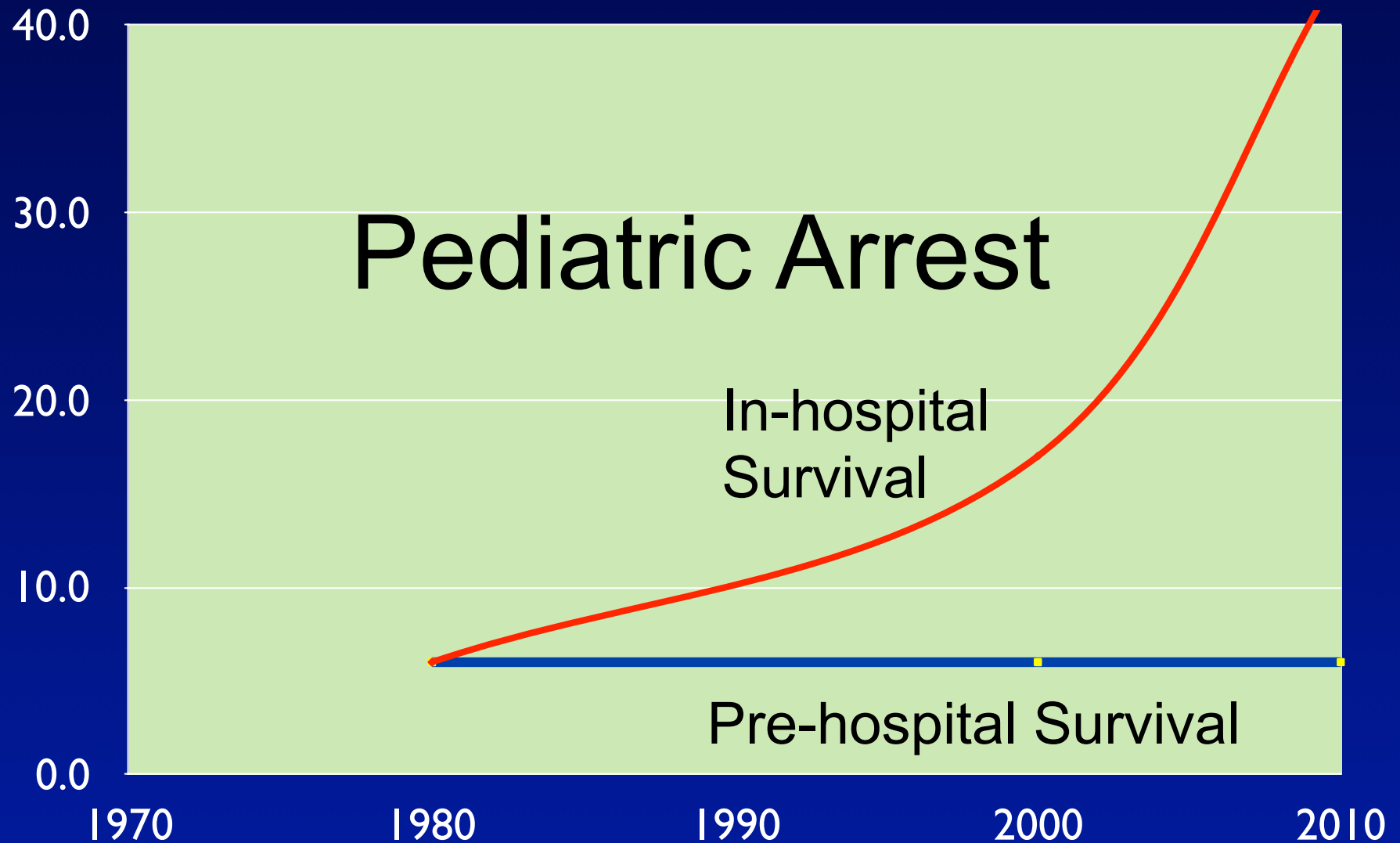
- Pediatric Emergency Standards, Inc.
 - Founder and CMO
 - Consulting
 - Pediatric Resuscitation System



Behavioral Economics



Perspective



Part 14: Pediatric Advanced Life Support: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* 2010;122:S876-S908

Girota, SM et al. Survival Trends in Pediatric In-Hospital Cardiac Arrests: An Analysis from GWTG-Resuscitation. *Circ Cardiovasc Qual Outcomes*. 2013 January 1:6(1): 42-49

Perspective

Pediatric Cardiac Arrest Statistics

Part 12: Pediatric Advanced Life Support

2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

Allan R. de Caen, Chair; Marc D. Berg; Leon Chameides; Cheryl K. Gooden; Robert W. Hickey; Halden F. Scott; Robert M. Sutton; Janice A. Tijssen; Alexis Topjian; Elise W. van der Jagt; Stephen M. Schexnayder; Ricardo A. Samson

Introduction

Over the past 13 years, survival to discharge from pediatric in-hospital cardiac arrest (IHCA) has markedly improved. From 2001 to 2013, rates of return of spontaneous circulation (ROSC) from IHCA increased significantly from 39% to 77%, and survival to hospital discharge improved from 24% to 36% to 43% (Girotra et al¹ and personal communication with Paul Chan, MD, MSc, April 3, 2015). In a single center, implementation of an intensive care unit (ICU)-based interdisciplinary debriefing program improved survival with favorable neurologic outcome from 29% to 50%.² Furthermore, new data show that prolonged cardiopulmonary resuscitation (CPR) is not futile: 12% of patients receiving CPR in IHCA for more than 35 minutes survived to discharge, and 60% of the survivors had a favorable neurologic outcome.³ This improvement in survival rate from IHCA can be attributed to multiple factors, including emphasis on high-quality CPR and advances in post-resuscitation care. Over the past decade, the percent of cardiac arrests occurring in an ICU setting has increased (87% to 91% in 2000 to 2003 to 94% to 96% in 2004 to 2010).⁴ While rates of survival from pulseless electrical activity and asystole have increased, there has been no change in survival rates from in-hospital ventricular

Conversely, survival from out-of-hospital cardiac arrest (OHCA) has not improved as dramatically over the past 5 years. Data from 11 US and Canadian hospital emergency medical service systems (the Resuscitation Outcomes Consortium) during 2005 to 2007 showed age-dependent discharge survival rates of 3.3% for infants (less than 1 year), 9.1% for children (1 to 11 years), and 8.9% for adolescents (12 to 19 years).⁵ More recently published data (through 2012) from this network demonstrate 8.3% survival to hospital discharge across all age groups, with 10.5% survival for children aged 1 to 11 years and 15.8% survival for adolescents aged 12 to 18 years.⁶

Evidence Evaluation Process Informing This Guidelines Update

The American Heart Association (AHA) Emergency Cardiovascular Care (ECC) Committee uses a rigorous process

to review and analyze the peer-reviewed published scientific evidence supporting the AHA Guidelines for CPR and ECC, including this update. In 2000, the AHA began collaborating with other resuscitation councils throughout the world, via the International Liaison Committee on Resuscitation (ILCOR), in a formal international process to evaluate resuscitation science. This process resulted in the publication of the International Consensus on CPR and ECC Science With Treatment Recommendations (CoSTR) in 2005 and 2010.^{7,8} These publications provided the scientific support for AHA Guidelines revisions in those years.

In 2011, the AHA created an online evidence review process, the Scientific Evidence Evaluation and Review System (SEERS), to support ILCOR systematic reviews for 2015 and beyond. This new process includes the use of Grading of Recommendations Assessment, Development, and Evaluation (GRADE) software to create systematic reviews that will be available online and used by resuscitation councils to develop their guidelines for CPR and ECC. The drafts of the online reviews were posted for public comment, and ongoing reviews will be accessible to the public (<https://volunteer.heart.org/apps/pico/Pages/default.aspx>).

The AHA process for identification and management of potential conflicts of interest was used, and potential conflicts for writing group members are listed at the end of each Part of the 2015 AHA Guidelines Update for CPR and ECC. For additional information about this systematic review or management of the potential conflicts of interest, see "Part 2: Evidence Evaluation and Management of Conflicts of Interest" in this supplement and the related article "Part 2: Evidence Evaluation and Management of Conflict of Interest" in the 2015 CoSTR publication.^{9,10}

This update to the 2010 AHA Guidelines for CPR and ECC for pediatric advanced life support (PALS) targets key questions related to pediatric resuscitation. Areas of update were selected by a group of international pediatric resuscitation experts from ILCOR, and the questions encompass resuscitation topics in prearrest care, intra-arrest care, and postresuscitation care. The ILCOR Pediatric Life Support Task Force experts reviewed the topics addressed in the 2010 Guidelines

The American Heart Association requests that this document be cited as follows: de Caen AR, Berg MD, Chameides L, Gooden CK, Hickey RW, Scott HF, Sutton RM, Tijssen JA, Topjian A, van der Jagt E, Schexnayder SM, Samson RA. Part 12: pediatric advanced life support: 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2015;132(suppl 2):S526-S542.

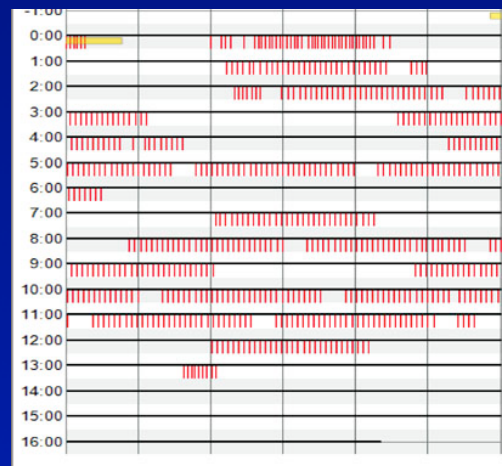
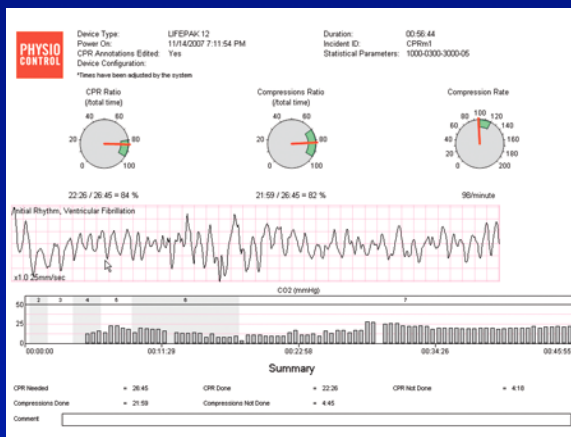
This article has been reprinted in *Pediatrics*. (*Circulation*. 2015;132[suppl 2]:S526-S542. DOI: 10.1161/CIR.000000000000266.)
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Out of Hospital 2015
Infants 3%
Children 10.5%
Adolescents 15.8%

Perspective

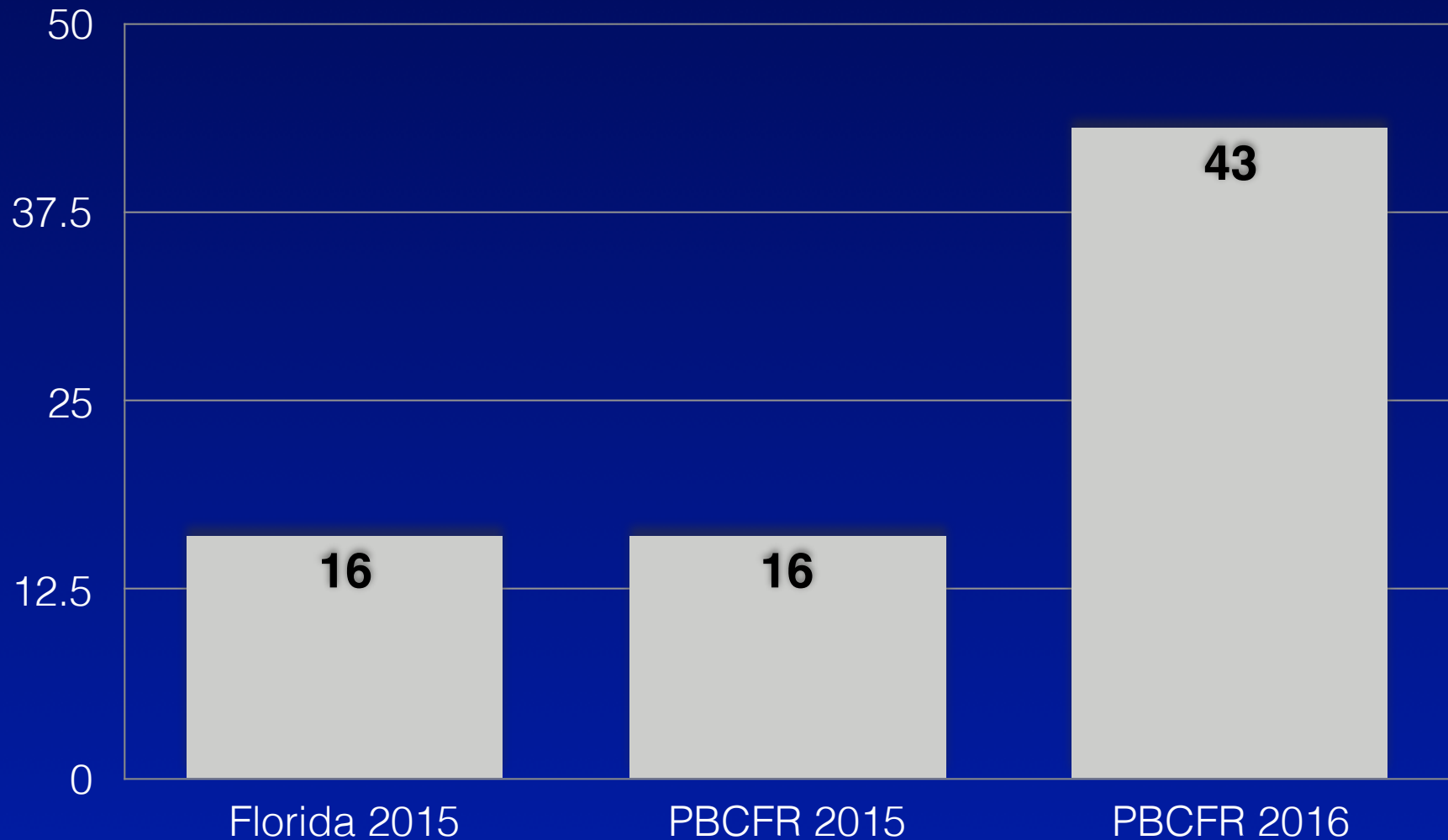
Adult Cardiac Arrest

Recent Advances



Palm Beach County

Adult ROSC Rates



Your Next Call

65 yo female
difficulty breathing

Ate food cooked
in peanut oil



Arrival 6 minutes

Julius Seizure



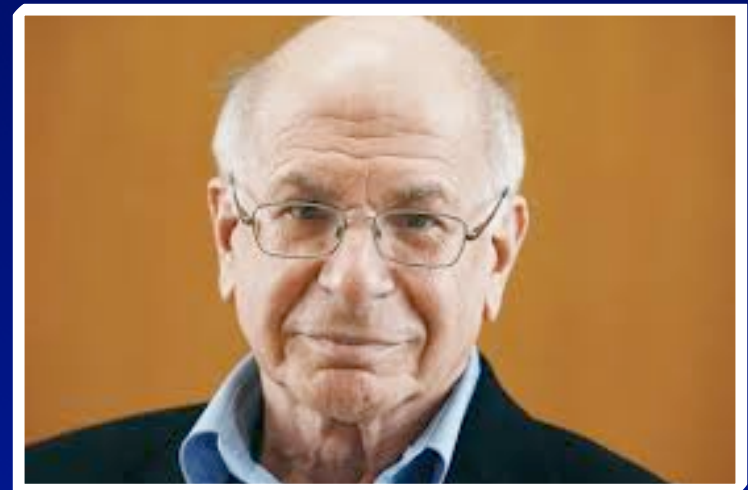
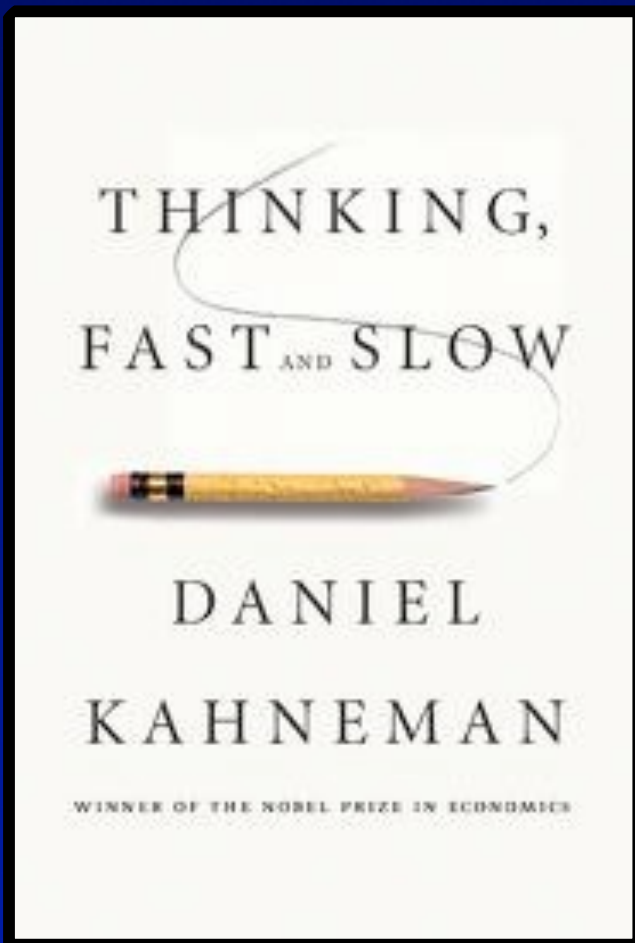
Protocol Calls for Midazolam

Burn 'baby' Burn



61 year old unresponsive

Resuscitation Psychology



Social Psychologist
Nobel Prize Winner

Your Brain

Thinking

Fast

+

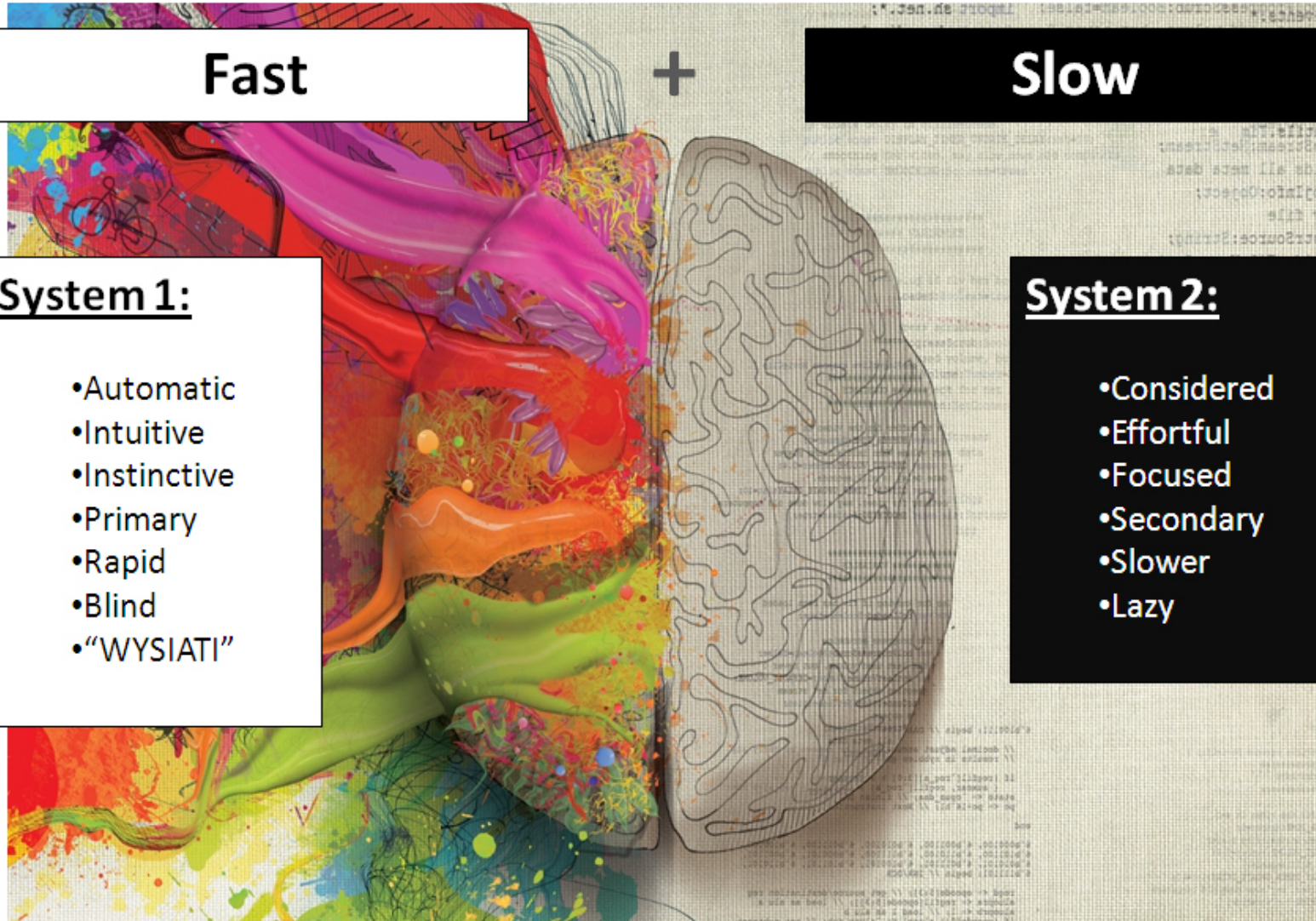
Slow

System 1:

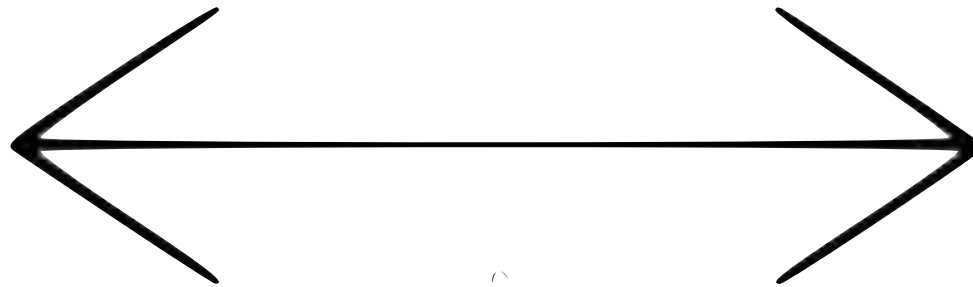
- Automatic
- Intuitive
- Instinctive
- Primary
- Rapid
- Blind
- “WYSIATI”

System 2:

- Considered
- Effortful
- Focused
- Secondary
- Slower
- Lazy



Quiz Question #1



System 1

Rapid Assessment



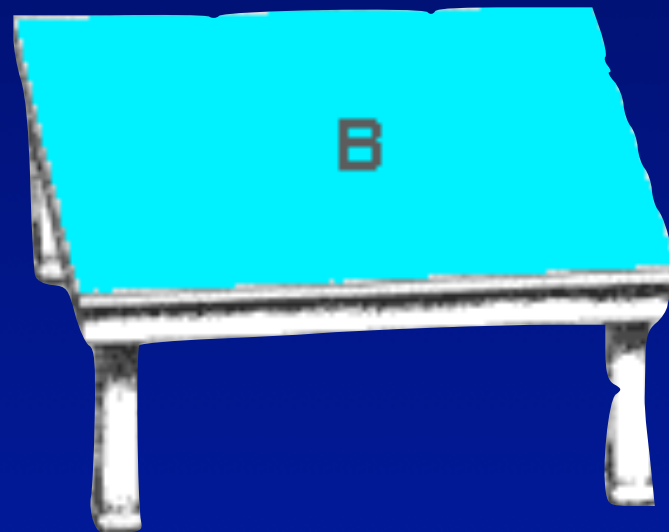
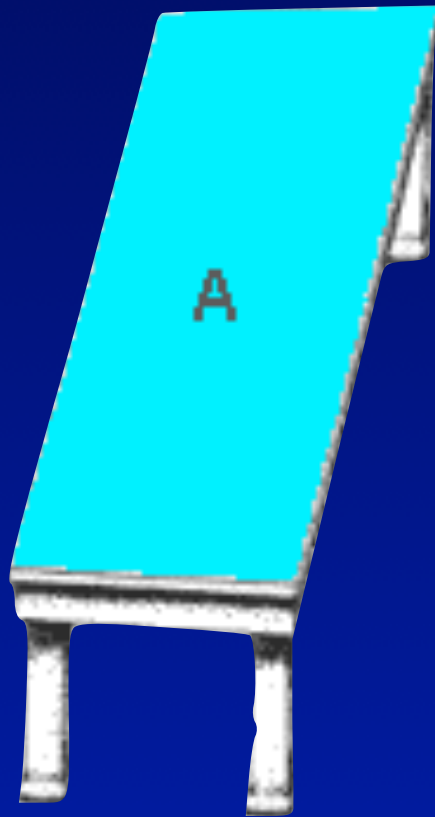
Testing System 1

How many animals of each kind did Moses take on the ark?

Moses Illusion

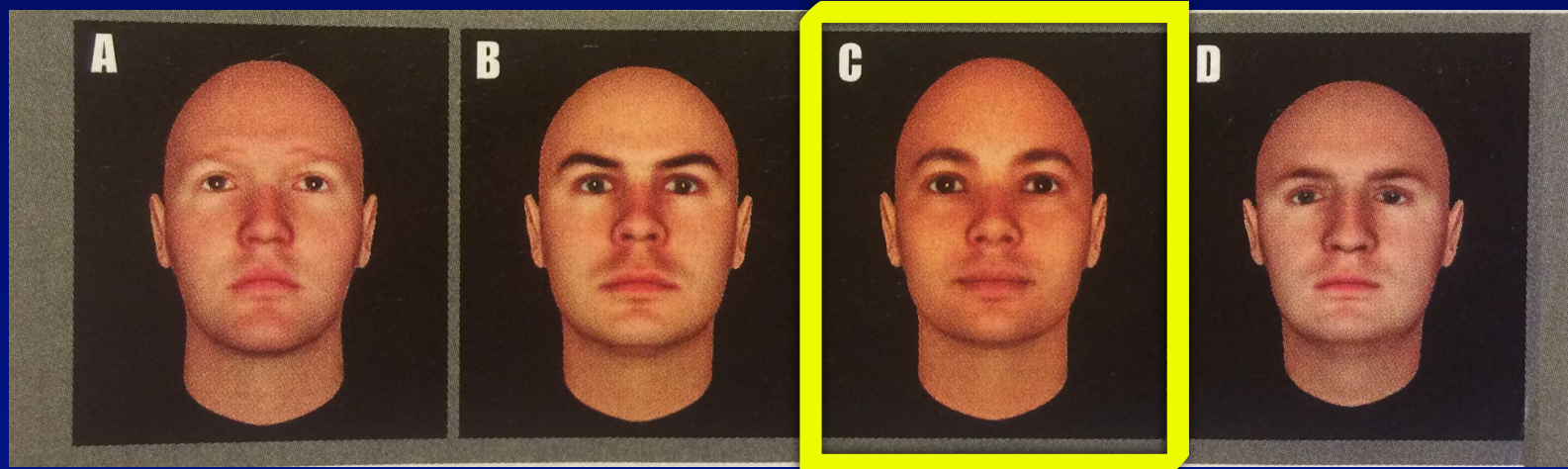
System 1

The Tables Have Turned



System 1

Next President?



80%

1000 Princeton University Students

More System 1

12 B 14

A B C

More System 1

12 B 14

A B C





DOES IT
ADD UP?

1000

1000

1000

30

20

1000

40

1000

10

SURVEY SAYS



?

1000

1000

1000

30

20

1000

40

1000

10

= 5100

Resuscitation Psychology

System 2

National Institute of Health Stroke Scale (NIHSS)		Admit	24 Hrs. Post tPA	Discharge
CATEGORY	DESCRIPTION			
1a. Level of Consciousness (awake, alert)	0 = Alert 1 = Not alert: responds to voice (attention to story, person, request) 2 = Not alert: requires physical stimulation to respond or is disoriented and requires prompting to respond 3 = Responds only with reflex motor or autonomic effects or only a purposeless hand or grasp			
1b. Level of Consciousness (awake, alert)	0 = Answers all 3 questions 1 = Answers 2/3 questions 2 = Answers 1/3 questions 3 = Answers none of questions			
1c. Level of Consciousness (able to follow simple commands, etc.)	0 = Following 2/3 commands 1 = Following 1/3 commands 2 = Following none of commands			
2. Best Gaze (best eye, 0/180°; 1/180°; 2/180°; 3/180°)	0 = Normal 1 = Partial gaze palsy: abnorm. gaze in one or both eyes, 45° lateral deviation 2 = No abnormality			
3. Visual (3/180°; 2/180°; 1/180°; 0/180°)	0 = No abnormality 1 = Partial gaze palsy: abnorm. gaze in one or both eyes, 45° lateral deviation 2 = No abnormality			
4. Facial Palsy (none, mild, moderate, severe)	0 = None 1 = Mild 2 = Moderate 3 = Severe			
5a. Left arm motor (active, 0/5; 1/5; 2/5; 3/5; 4/5; 5/5)	0 = Active, 5/5 1 = Active, 4/5 2 = Active, 3/5 3 = Active, 2/5 4 = Active, 1/5 5 = No abnormality			
5b. Right arm motor (active, 0/5; 1/5; 2/5; 3/5; 4/5; 5/5)	0 = Active, 5/5 1 = Active, 4/5 2 = Active, 3/5 3 = Active, 2/5 4 = Active, 1/5 5 = No abnormality			
5c. Left leg motor (active, 0/5; 1/5; 2/5; 3/5; 4/5; 5/5)	0 = Active, 5/5 1 = Active, 4/5 2 = Active, 3/5 3 = Active, 2/5 4 = Active, 1/5 5 = No abnormality			
5d. Right leg motor (active, 0/5; 1/5; 2/5; 3/5; 4/5; 5/5)	0 = Active, 5/5 1 = Active, 4/5 2 = Active, 3/5 3 = Active, 2/5 4 = Active, 1/5 5 = No abnormality			
7. Limb Ataxia (0/180°; 1/180°; 2/180°; 3/180°)	0 = No abnormality 1 = Mild 2 = Moderate 3 = Severe			
8. Sensory (none, 0/2; 1/2; 2/2)	0 = None 1 = Mild 2 = Moderate 3 = Severe			
9. Best Language (none, 0/3; 1/3; 2/3; 3/3)	0 = None 1 = Mild 2 = Moderate 3 = Severe			
10. Dysarthria (none, 0/2; 1/2; 2/2)	0 = None 1 = Mild 2 = Moderate 3 = Severe			
11. Deletion and Insertion (0/180°; 1/180°; 2/180°; 3/180°)	0 = None 1 = Mild 2 = Moderate 3 = Severe			
TOTAL NIHSS				
INITIALS / DATE / TIME				
MODIFIED RANKIN SCALE		Admit	24 Hrs. Post tPA	Discharge
0 = No symptoms at all				
1 = No significant disability despite symptoms, able to carry out all usual activities				
2 = Moderate disability requiring some help, but able to walk without assistance				
3 = Moderate to severe disability, unable to walk without assistance, unable to attend to own bodily needs without assistance				
4 = Severe disability, unable to walk without assistance and requiring constant nursing care and attention				
5 = Dead				
TOTAL MODIFIED RANKIN SCALE				
INITIALS / DATE / TIME				

Resuscitation Psychology

System 2

2 Year Old
Severe Sepsis



Central Line Size
Norepi Drip
ETT Size
Foley Size
NG Size

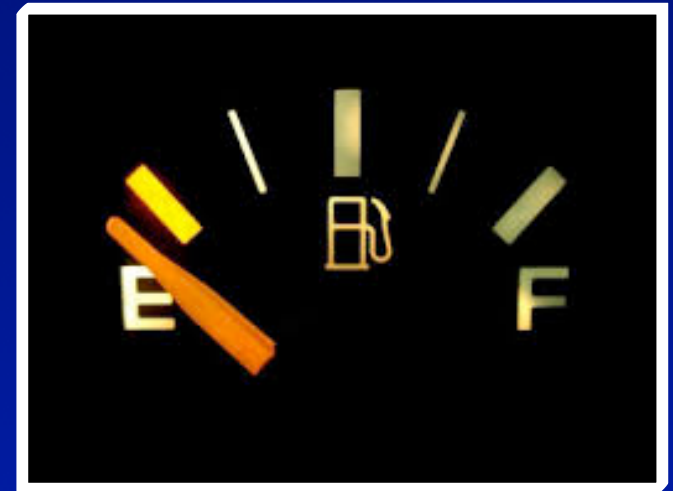
“Pay Attention”

System 2 Has a Cost



Medication Dosages
Mathematical Calculations
Drawing up Medications

System 2



The Dichotomy

Adult v. Peds



60 Year Old Male

- Hypoglycemia



- Asystole



- Allergic Reaction



System 1

5 Year Old Male

- Hypoglycemia



- Asystole



- Allergic Reaction



System 2

Conclusions

	Benefits	Dangers
System 1	Quick Decisions	Error Prone
System 2	Information Resource	Cannot Function During Stress

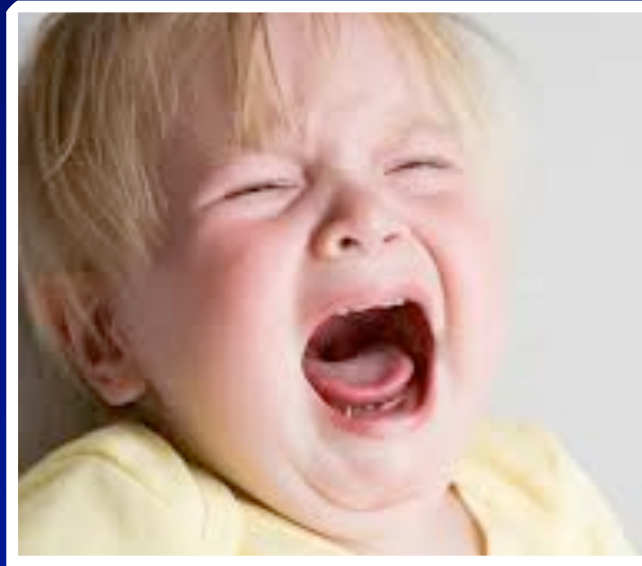
Bread and Butter

Anaphylaxis



Epi 1:1000 IM

Femur Fracture



Fentanyl IN

Seizure



Midazolam IN

What We've Learned

BLUE

RESUSCITATION

Anaphylaxis dose (1/10th strength) not listed

Epinephrine (1:10,000)	0.21 mg (2.1 mL)
Epinephrine ET (1:1,000)	2.1 mg (2.1 mL)
Atropine (0.1 mg/mL)	0.42 mg (4.2 mL)
Atropine ET (0.4 mg/mL)	0.6 mg (1.5 mL)
Sodium Bicarbonate	21 mEq
Lidocaine	20 mg
Lidocaine ET	40-60 mgs
Defibrillation	
1st/2nd Dose (may repeat)	40J/80J
Cardioversion	
1st/2nd Dose	20J/40J
Adenosine	
1st Dose	2.1 mg
2nd Dose If Needed	4.2 mg
Amiodarone	105 mg
Calcium Chloride	420 mg
Magnesium Sulfate	1050 mg

RAPID SEQUENCE INTUBATION

PREMEDICATIONS

Atropine	0.42 mg
Pan/Vecuronium (Defasciculating Agent)	0.21 mg
Lidocaine	32 mg
Fentanyl <small>6 fold higher dose</small>	63 mcg

INDUCTION AGENTS

Etomidate	6.3 mg
Ketamine	42 mg
Midazolam <small>3 fold higher dose</small>	6.3 mg
Propofol	63 mg

PARALYTIC AGENTS

Succinylcholine (give atropine prior)	40 mg
Pancuronium	4.2 mg
Vecuronium	4.2 mg
Rocuronium	21 mg

MAINTENANCE

Pancuronium/Vecuronium	2.1 mg
Lorazepam	1 mg

19 KG

20 KG

22 KG

10X

3X

3X



A Comparison of Medications in 38 Pediatric EMS Protocols to Those Listed on the Broselow™ Length-Based Tape

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Joe DiMaggio Children's Hospital, Hollywood, FL, Nova Southeastern University, Davie, FL



DISCLOSURE

Conflict of Interest / Disclosure Statement
Peter Antevy MD is the Founder & CMO of Pediatric Emergency Standards, Inc. and developer of a pediatric resuscitation system.

BACKGROUND

- Pediatric medication errors are common.¹
- PALS 2015 recommends the use of a length based tape with precalculated doses.²
- This study seeks to compare pediatric drug dosages from large and small EMS agencies to those listed on the Broselow LBT and determine discordance rates.

METHODS

- Determine the percentage of medications on the Broselow LBT found at incongruent dosages compared to the EMS protocols.
- Determine the total number of medications from each EMS protocol that were not present on the Broselow LBT.
- For each EMS agency, the discordance rate was determined.
- Calculation of the frequency of each of the medications in each EMS protocol that were missing from the Broselow LBT, as well as those that were listed at incongruent doses.

RESULTS

38 EMS Agencies

Population 294 to 2.4 million
Urban – Suburban – Rural

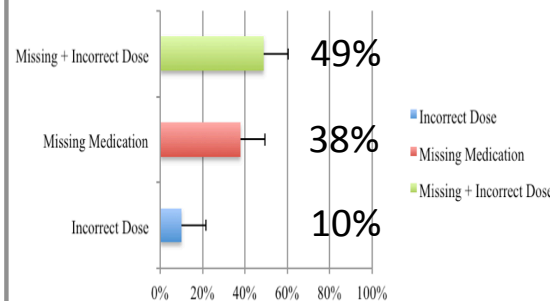
49% Discordance

Pediatric ALS Protocols Compared to Broselow LBT

Table 1. Missing and Incorrect Dosages

	M	SD	Min	Max
Incorrect Dose	10%	6%	0%	20%
Missing Medications	38%	7%	23%	50%
Missing Medication + Incorrect Dose	49%	8%	32%	63%

Average Discordance



Missing Medications*

Ondansetron
Diphenhydramine
Morphine
Albuterol

*Represents 62% of all missing medications

Incorrect Dosing*

Epinephrine IM
Midazolam
Fentanyl
Diazepam

*Represents largest percentage of incorrectly dosed medications

CONCLUSION

A significant discrepancy exists between the pediatric drug dosages found in 38 EMS protocols and those listed on the Broselow LBT.

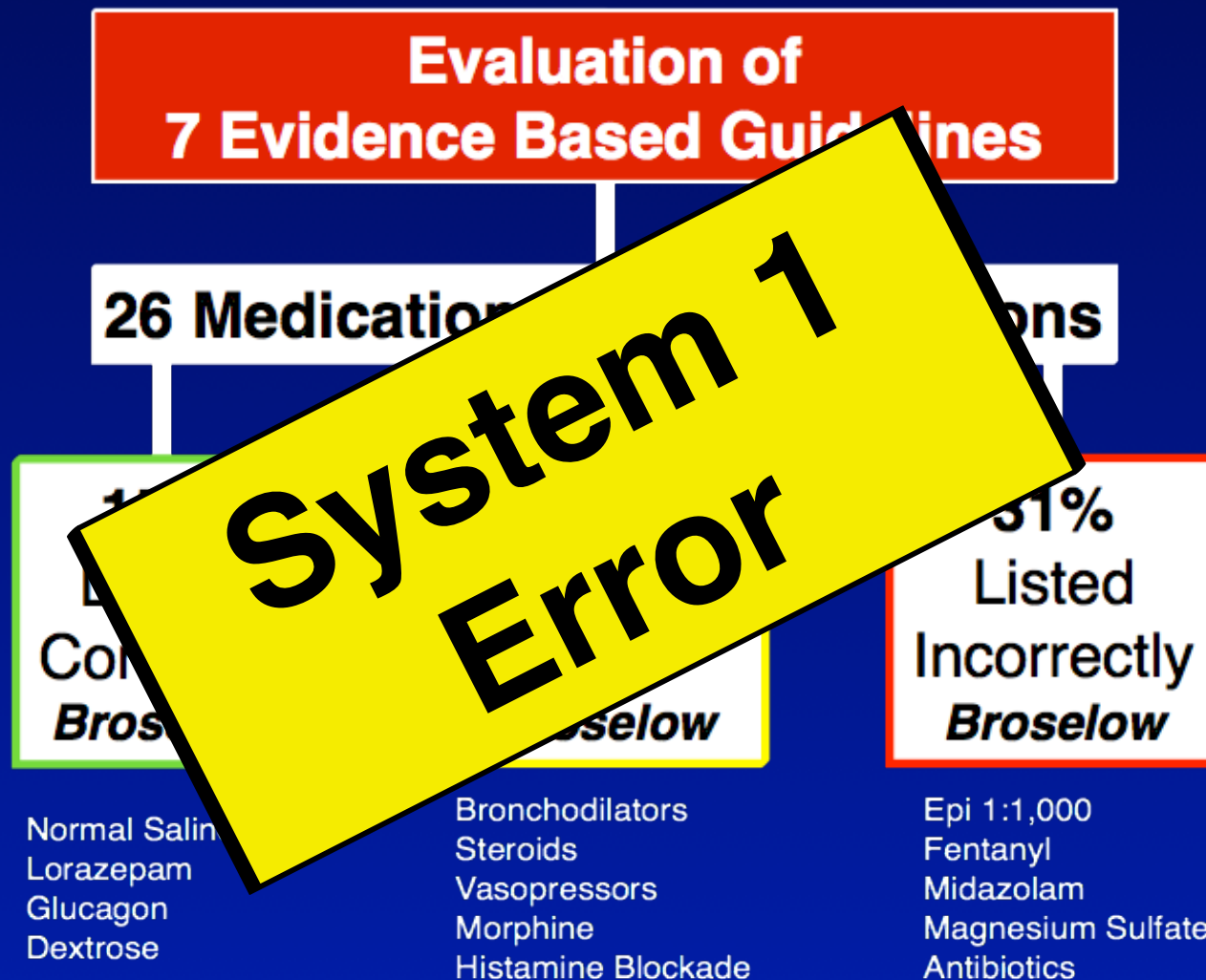
REFERENCES

1. Hoyle Jr JD, Davis AT, Putman KK, Trytko JA, Fales WD. Medication dosing errors in pediatric patients treated by emergency medical services. *Prehospital Emergency Care.* 2011; 16(1): 59-66.
2. American Heart Association. 2015 American Heart Association Guidelines Update for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. 2015; 132(18): S356.

Utilizing the Broselow™ Pediatric Emergency Tape for Prehospital Management of Children According to Evidence-Based Guidelines

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Presented at AAP Section on Emergency Medicine, October 23, 2015





Prehospital Emergency Care

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Impact of High-Fidelity Pediatric Simulation on Paramedic Seizure Management

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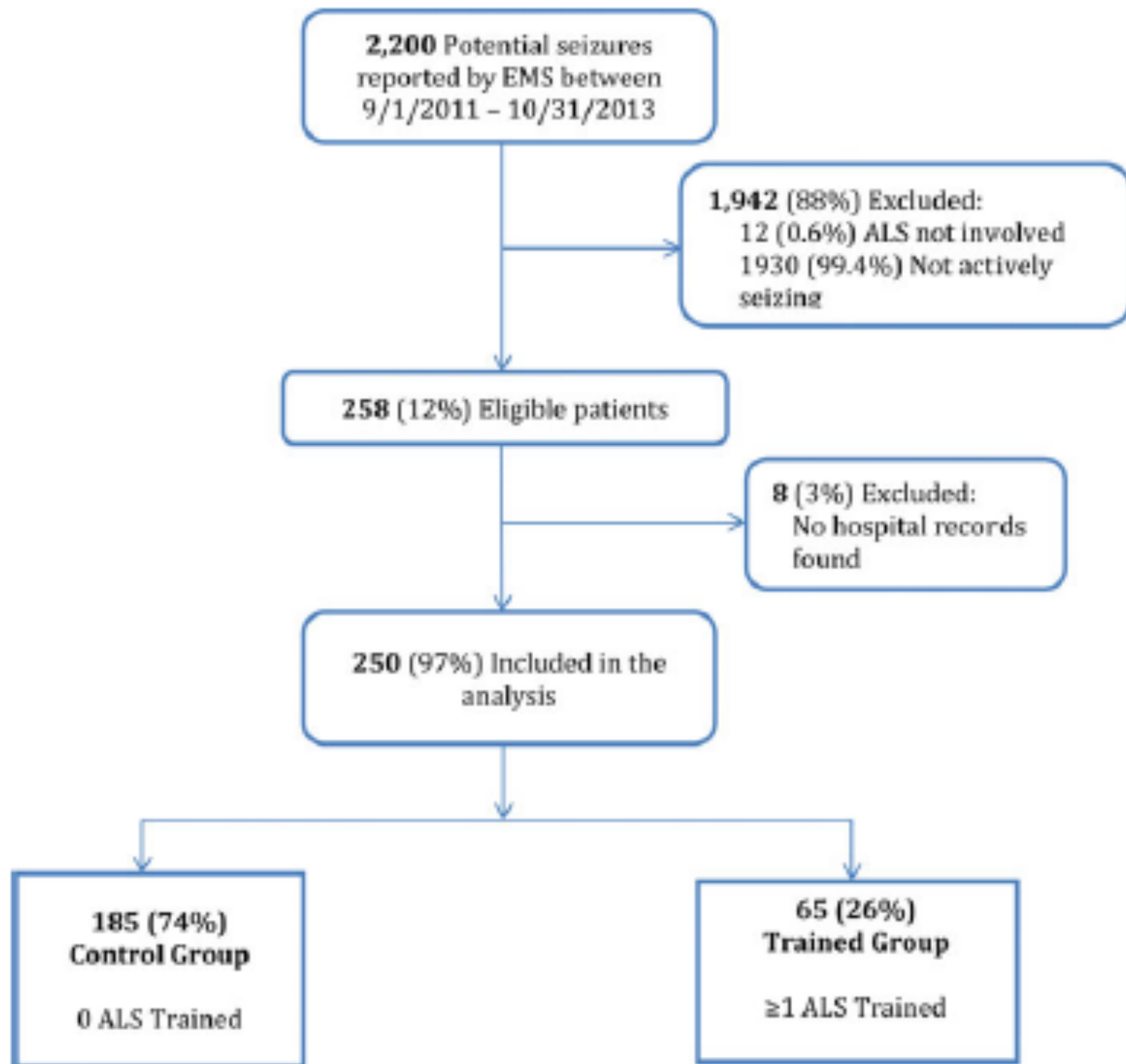
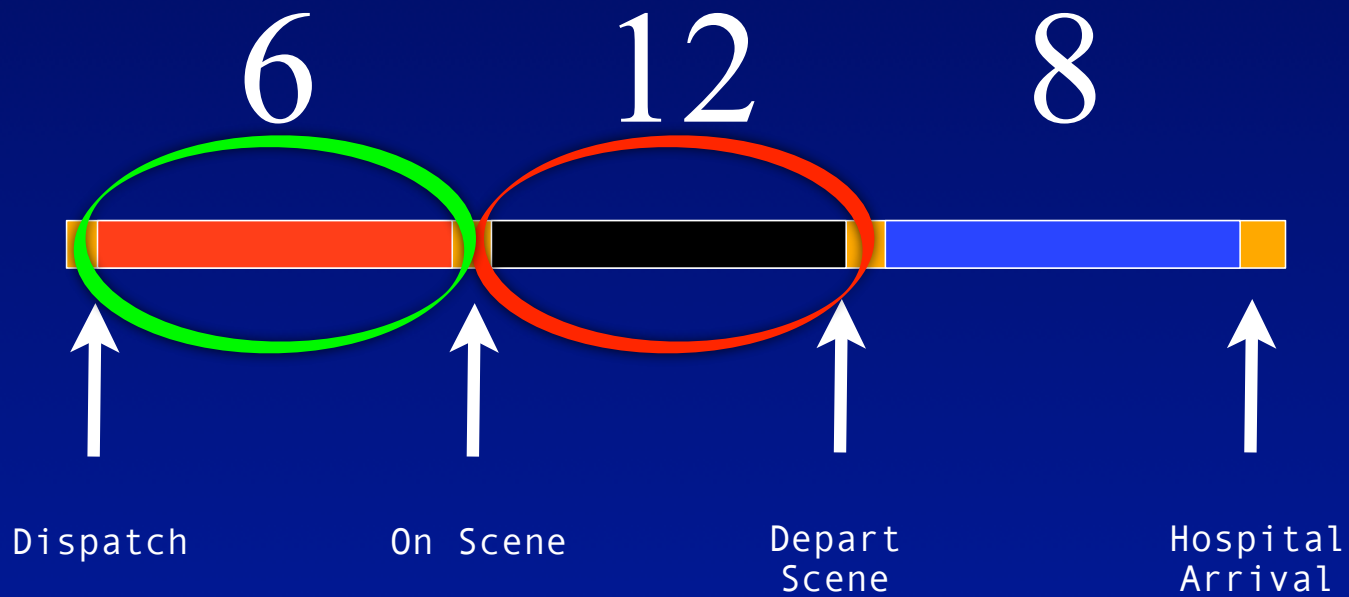


TABLE 4. Prehospital secondary outcomes

	Total (n = 250)	Non-trained paramedics (n = 185)	PediSTEPPs trained paramedics (n = 65)	p value
Received 1 st midazolam dose	144 (58%)	103 (56%)	41 (63%)	0.30
Route, 1 st dose of midazolam				0.23
IV	98 (68%)	67 (65%)	31 (76%)	
PR	17 (12%)	16 (16%)	1 (2%)	
IM	16 (11%)	12 (12%)	4 (10%)	
IN	11 (8%)	7 (7%)	4 (10%)	
IO	2 (1%)	1 (1%)	1 (2%)	
Received 2 nd midazolam dose	19 (8%)	13 (7%)	6 (9%)	0.75
Route, 2 nd dose of midazolam				0.31
IV	10 (53%)	6 (46%)	4 (67%)	
IM	5 (26%)	3 (23%)	2 (33%)	
PR	4 (21%)	4 (31%)	0 (0%)	
IN	0 (0%)	0 (0%)	0 (0%)	
IO	0 (0%)	0 (0%)	0 (0%)	
Correct dose given* (midazolam)	82/161 (51%)	58/114 (51%)	24/47 (51%)	0.98
Correct dose given* (dextrose)	1/2 (50%)	0/1 (0%)	1/1 (100%)	1.00
Respiratory failure	25 (10%)	21 (11%)	4 (6%)	0.34
IV line attempted	200 (80%)	144 (78%)	56 (86%)	0.15
Seizure recurrence	54 (22%)	40 (22%)	14 (22%)	0.99
Median time on-scene (IQR) (minutes)	34 (27, 41)	34 (27–41)	35 (27.5–42)	0.66
Median time to 1 st treatment (IQR) (minutes)	14 (7, 20)	14 (7–22)	14 (6.5–19.5)	0.56

EMS Timeline





ELSEVIER

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation



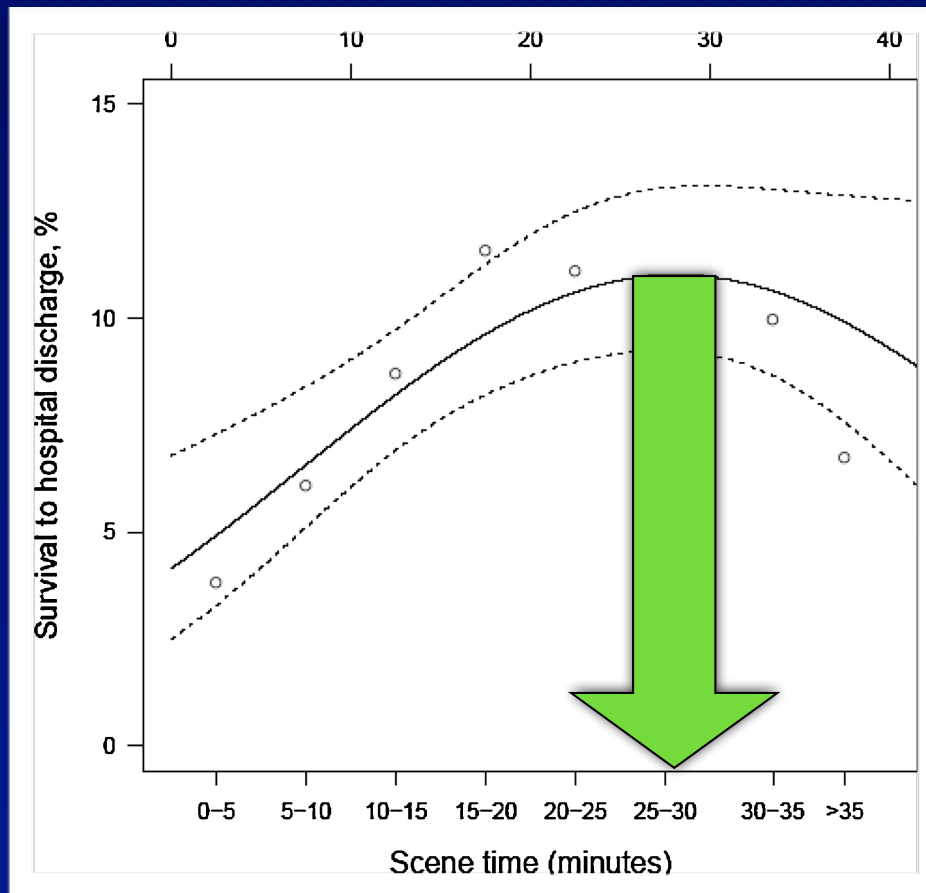
EUROPEAN
RESUSCITATION
COUNCIL

Clinical paper

Time on the scene and interventions are associated with improved survival in pediatric out-of-hospital cardiac arrest[☆]



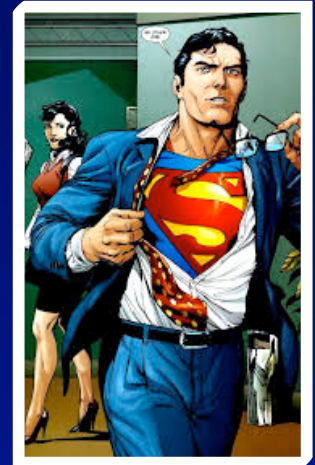
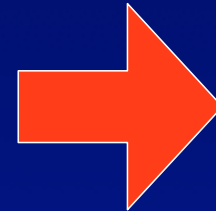
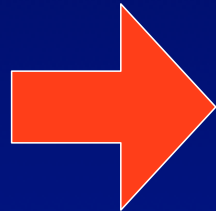
Janice A. Tijssen^{a,b,*}, David K. Prince^c, Laurie J. Morrison^{d,e}, Dianne L. Atkins^f,



25-30
Minutes
On Scene

Highest Survival
to Discharge

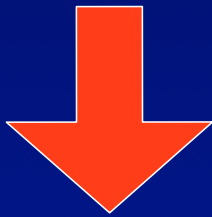
Transformation



Remove System 2

Pediatrics

System 2

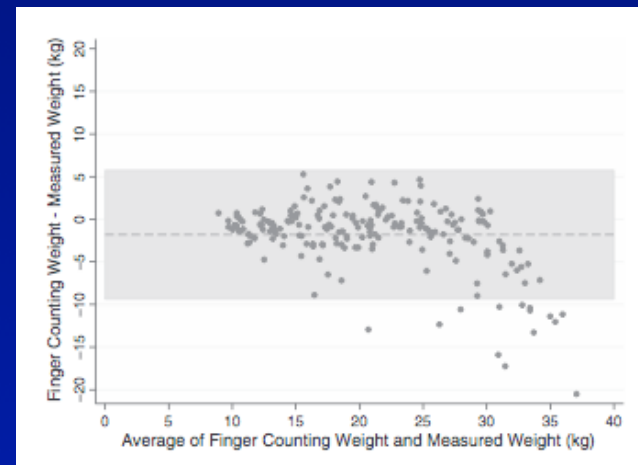
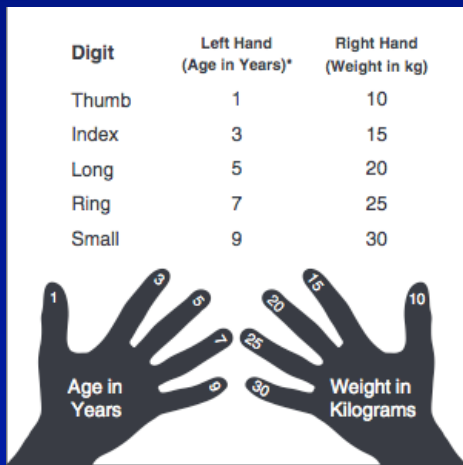


System 1

1. Start with Age
2. No Math
3. Equipment predetermined
4. Practice Medication administration

Age Vs. Length?

Method	Proportion within 10% (95% CI)	Proportion within 20% (95% CI)	
Finger counting	59% (52%-65%)	87% (81%-91%)	AGE
Broselow tape	56% (49%-63%)	81% (75%-86%)	
Parental estimate	54% (47%-61%)	79% (73%-84%)	
Luscombe formula	52% (45%-59%)	84% (78%-89%)	
APLS formula	33% (27%-40%)	72% (66%-78%)	

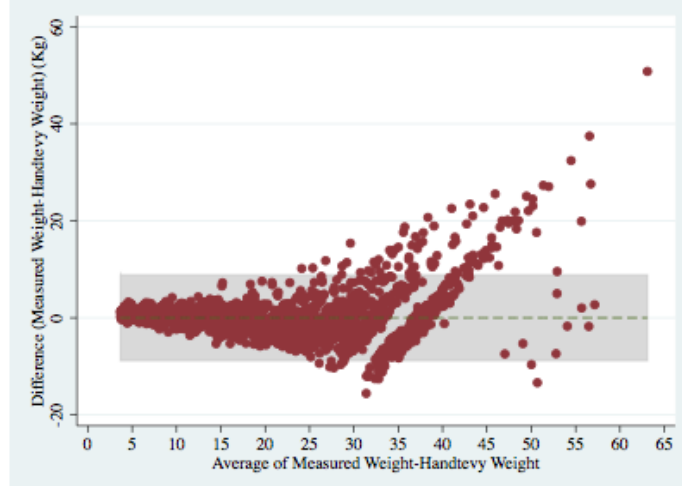


Age Vs. Length?

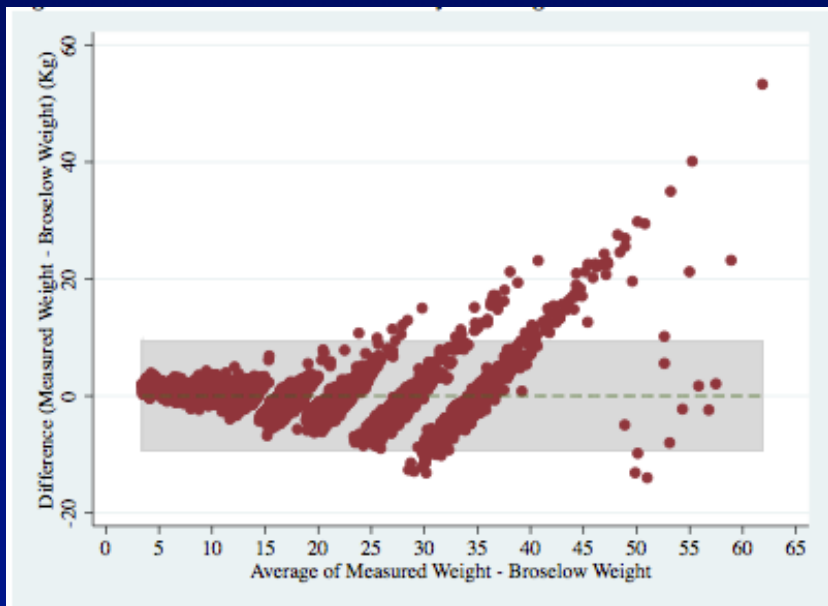
Age

Length

Figure 5. Bland-Altman Plot for Handtevy 0 through 10 years of Age



=



Poster Presentation

- Clincon 2014
- ACEP 2014
- NAEMSP 2015

Restart The Heart

Before You Depart

A RRIVE

B VM

C OMPRESS

D RILL

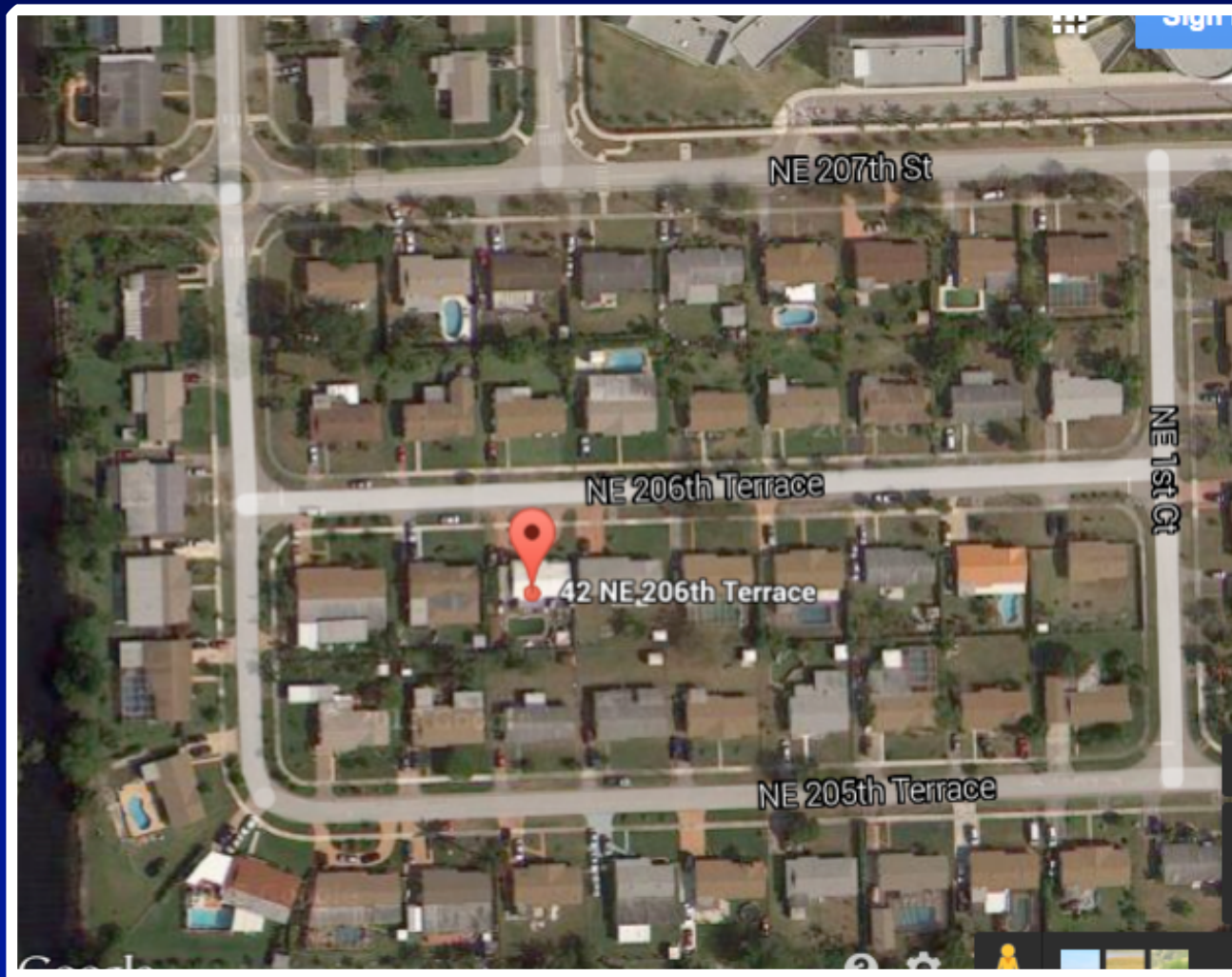
E PINEPHRINE

On Scene

5 STEPS

2 Minutes

Miami-Dade Fire Rescue



Alejandro





Drowning Case #2



Run Report #2

Sequence Chart				
Date	Time	Event	By	Description
03-09-2013	13:56:00	Received		
03-09-2013	13:57:51	Dispatched		
03-09-2013	13:58:13	Enroute		
03-09-2013	14:01:21	On Location		
03-09-2013	14:02:00	Patient Contact		
03-09-2013	14:02:45	IV/IO	RT	A IO was attempted in the Tibia Right IO by Torres, Raphael with success. NS 500cc Bag run at WO with a 10 gtt. Blood was not drawn. The Patient's condition was Unchanged.
03-09-2013	14:03:00	Drug Administration	RT	0.20MG Epi 1:10,000 administered Intraosseous by Torres, Raphael per Protocol (Standing Order). The Patient's condition was Unchanged.
03-09-2013	14:03:10	Drug Administration	RT	350.00ML Normal Saline administered Intraosseous by Torres, Raphael. The Patient's condition was Unchanged.
03-09-2013	14:04:00	EKG	KF	Paddles A Other ekg was obtained by Frie, Kelly. Asystole.
03-09-2013	14:04:00	CPR Stop	JP	
03-09-2013	14:04:01	Vitals	JP	Pulse 0, Respirations 0 taken by Posner, Justin.
03-09-2013	14:04:05	CPR	JP	
03-09-2013	14:04:10	Oxygen	KF	BVM 15.00 LPM via Other/miscellaneous per Protocol (Standing Order). The Patient's condition was Unchanged.
03-09-2013	14:04:20	Airway	KF	OPA
03-09-2013	14:06:00	Drug Administration	RT	0.20MG Epi 1:10,000 administered Intraosseous by Torres, Raphael per Protocol (Standing Order). The Patient's condition was Unchanged.
03-09-2013	14:06:00	CPR Stop	JP	
03-09-2013	14:06:01	EKG	RT	A 4 lead ekg was obtained by Torres, Raphael. Asystole.
03-09-2013	14:06:06	CPR	JP	
03-09-2013	14:07:30	Drug Administration	RT	0.20MG Epi 1:10,000 administered Intraosseous by Torres, Raphael per Protocol (Standing Order). The Patient's condition was Unchanged.
03-09-2013	14:07:51	Departed Location		
03-09-2013	14:08:00	CPR Stop	JP	
03-09-2013	14:08:07	EKG	RT	A 4 lead ekg was obtained by Torres, Raphael. Asystole.
03-09-2013	14:08:09	CPR	JP	

Polk County Fire Rescue Pediatric Arrest Data

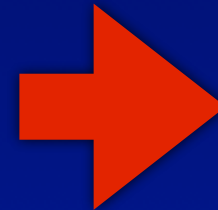
	2012	2013	2014	2015
Total Patients	20	18	21	31
ROSC	0%	11%	33%	29%
Survival To Discharge	0 Survivors 0%		12 Survivors 71%	
	0%	0%	78%	78%

Denver Paramedics Data

- Comparison of Before and After Implementation

Fentanyl IN - 116% Increase

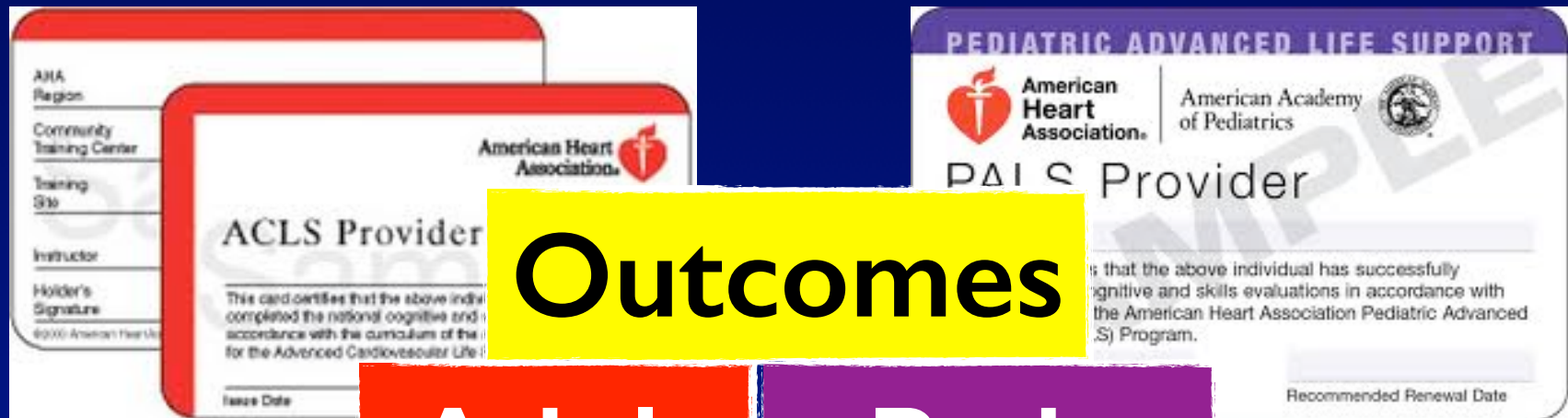
Versed IN - 197% Increase



**Improved
Care**

Children Under Age 6
4x higher rate of Fentanyl use

ACLS vs. PALS



Outcomes

Adult

Peds

Algorithms

Advanced Life Support

The Psychology of Pediatric Resuscitation in the Field



Peter Antevy MD

Davie Fire Rescue, Medical Director
Coral Springs Fire Department, Medical Director
American Ambulance, Medical Director
SW Ranches Fire Rescue, Medical Director
Broward College EMS, Medical Director
Palm Beach County Fire Rescue, Asst. Medical Director
JDCH, Pediatric Emergency Medicine

