

# Color Coding Every Kid Every Time in Washington State

---

*Mary King, MD MPH*

*Medical Director Trauma Pediatric Intensive Care Unit*

*UW Medicine Harborview Medical Center*

*Assistant Professor, Pediatric Critical Care Medicine*

*University of Washington*



**NORTHWEST HEALTHCARE  
Response Network**

Development of these materials paid for by NWHRN member contributions. © 2015, Northwest Healthcare Response Network. Copying and adaptations permitted for non-commercial, educational use only.



# Overview

---

- Why color-code kids?
- Decrease your cognitive load and error
- Harborview: every kid every time
- King County, WA: regional implementation
- Disaster preparedness
- Practical tools



# Pediatric case

---

- 2 year old falls from 2nd story window
- GCS 3, HR 70, BP 80/40
- Femur deformity
- Blown pupil



# Example of Cognitive Load

---

- What is the correct **ETT size**?
- Is the child **mainstem intubated**?
- How **fast** should I bag?
- What is the **dose** of mannitol?
- Is that **heart rate** appropriate?
- How much **fluid** do I bolus?
- How much **blood** should I order?
- What is the correct epi **dose**?
- How much **radiation** dose do we use for CT?

# Pediatric resuscitations

---

- High stress
- Low frequency
- Low familiarity
- High “Cognitive Load”



# Cognitive Load

---

- Affects executive control of working memory
- Amount of data and interactions that must be processed simultaneously
  
- Depends on:
  - Degree of uncertainty
  - Number of non-automatic decisions
  
- Increased cognitive load = **increased error**

# Cognitive Load

---

- Lack of familiarity = **uncertainty**
- Size-related variables = **non-automatic**
  
- Increased cognitive load during pediatric resuscitation
  
- Increased error and time to intervention

# Pediatric Medication Errors

---

- 1999 IOM Report: *To Err is Human: Building a Safer Health System*
  - 44-98K patients (adults) die annually from ME
- What is the Pediatric ME rate?
  - Jama 2001: 5.7-6.1 error per 100 orders
  - Trigger tool (i.e. not dependent on self-reporting): 11.1 error per 100 orders
  - 2006-2007 USP (US Pharmacopeia) Medmarx database: 2.5% of PME led to patient harm

# What Kind of Mistakes?

---

- MEDMARX, Joint Commission, AAP:
- Leading cause of Pediatric Medication Error:
- Dosing Error

# Why?

---

- Children are more prone to ME because:
  - Most medications are formulated and packaged primarily for adults
  - Most health care settings are primarily build around the needs of adults. Therefore staff are not oriented to pediatric care and do not have pediatric safeguards
  - Children are less able to physiologically tolerate ME.

*Joint Commission: Sentinel Event Alert: Preventing Pediatric Medication Errors, Issue 39, April 11, 2008*

# Recommendations: Joint Commissions and AAP

---

- Provide a dosage calculation sheet for each pediatric patient including both emergency and commonly used medications
- All patients should be weighed in kg
- Develop an educational program for calculating, prescribing, preparing and administering medications for children.

# Cognitive Load & Error

---

- Estimate age
- Estimate weight
- Remember pediatrics drug dose (mg/kg)
- Be aware of min & max dose
- Calculate dose in mg
- Calculate volume
- Draw up volume and deliver

**Multiple opportunities for error**



# What about multiple kids at once?



Multiple chances for  
ERROR!

# Harborview Medical Center (HMC)

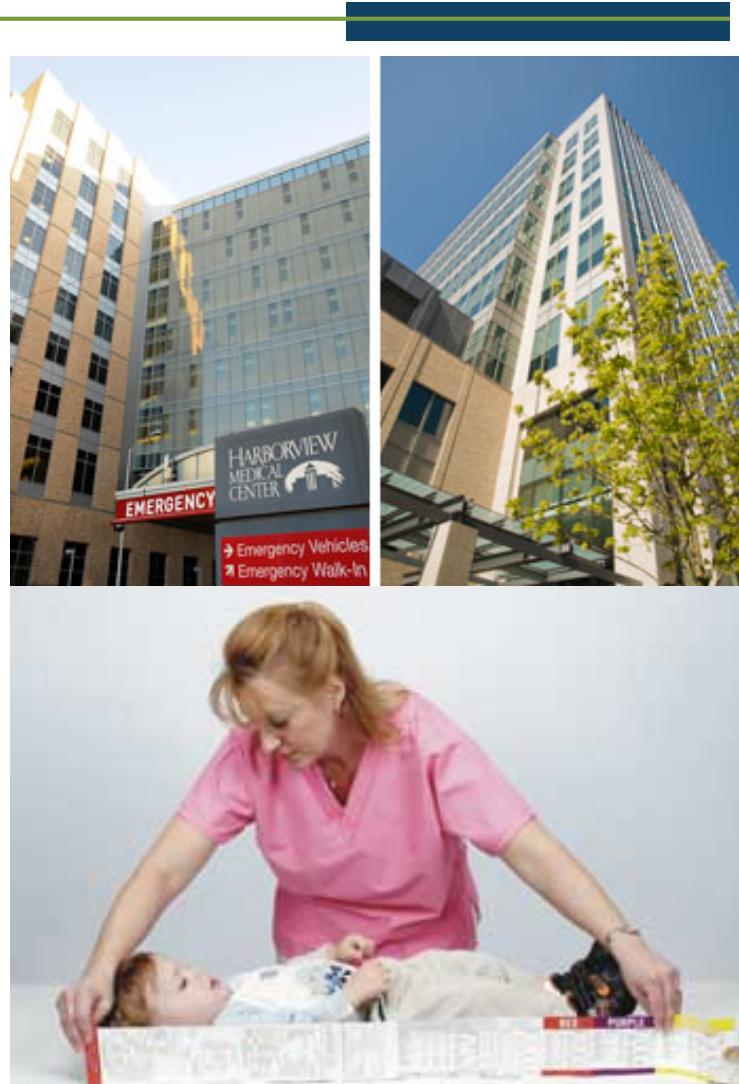
---

- Level I Trauma
- Regional Center
- Adult and Peds
- Mainly adult providers
- Less familiar with peds dosing
- Risk of peds MCI



# HMC: Color code Every kid, Every time

- New peds vital sign
- Every kid color-coded upon triage
- Used for:
  - Supplies
  - Code meds
  - CT radiation dose



# HMC: Color-coded carts

- Equipment by color
- Includes everything EXCEPT respiratory equipment
- Located in:
  - ED
  - PICU
  - Floor
  - Clinic



# HMC: Color-coded resuscitation bags

- Every peds admit gets one in ED
- Follows kid throughout hospital
- Has all equip for a peds resp arrest
- Put at head of bed



# HMC: Color-coded bag stockpiles

- Bags stockpiled at HMC
- Multiple bags of all colors
- Could handle:
  - many kids of same age
  - many kids of different ages
  - don't need to look for equipment



# Broselow and obesity

---

- **The recent 2010 PALS guidelines**<sup>[7]</sup> **comment on this issue:** There are no data regarding the safety or efficacy of adjusting the doses of resuscitation medications in obese patients. Therefore, regardless of the patient's habitus, use the actual body weight for calculating initial resuscitation drug doses or use a body length tape with pre-calculated doses. (Class IIb, LOE C)

# Broselow and obesity

---

- Most resuscitation medications are distributed in lean body mass (e.g., epinephrine, sodium bicarbonate, calcium, magnesium, etc.) so that IBW as accurately predicted by length, not the actual body weight, would appear preferable for dosing.

# Broselow and obesity

---

■ The following is the manufacturer recommendation for how to use of the Broselow tape. Utilizing clinical judgment applied to each situation:

1. Measure child to identify weight/color zone.
2. If a child appears overweight consider utilizing one zone higher for dosing only.
3. Always use the tape measured length zone for equipment selection regardless of body habitus.

# Weight-based: too much time

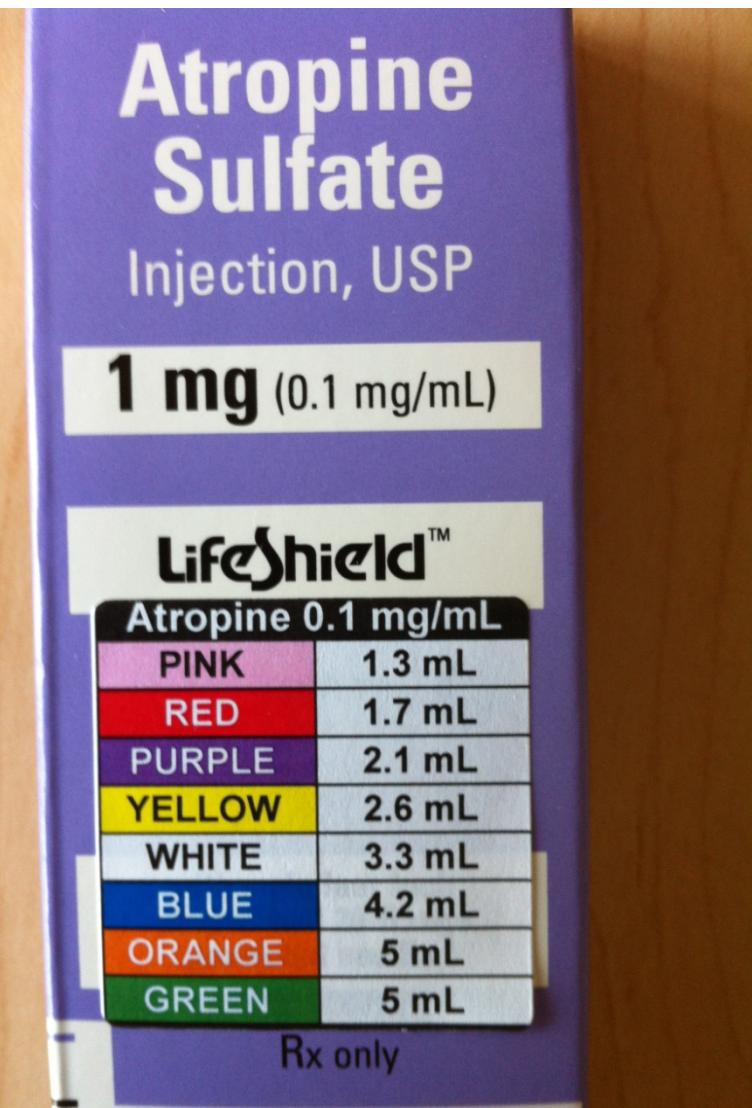
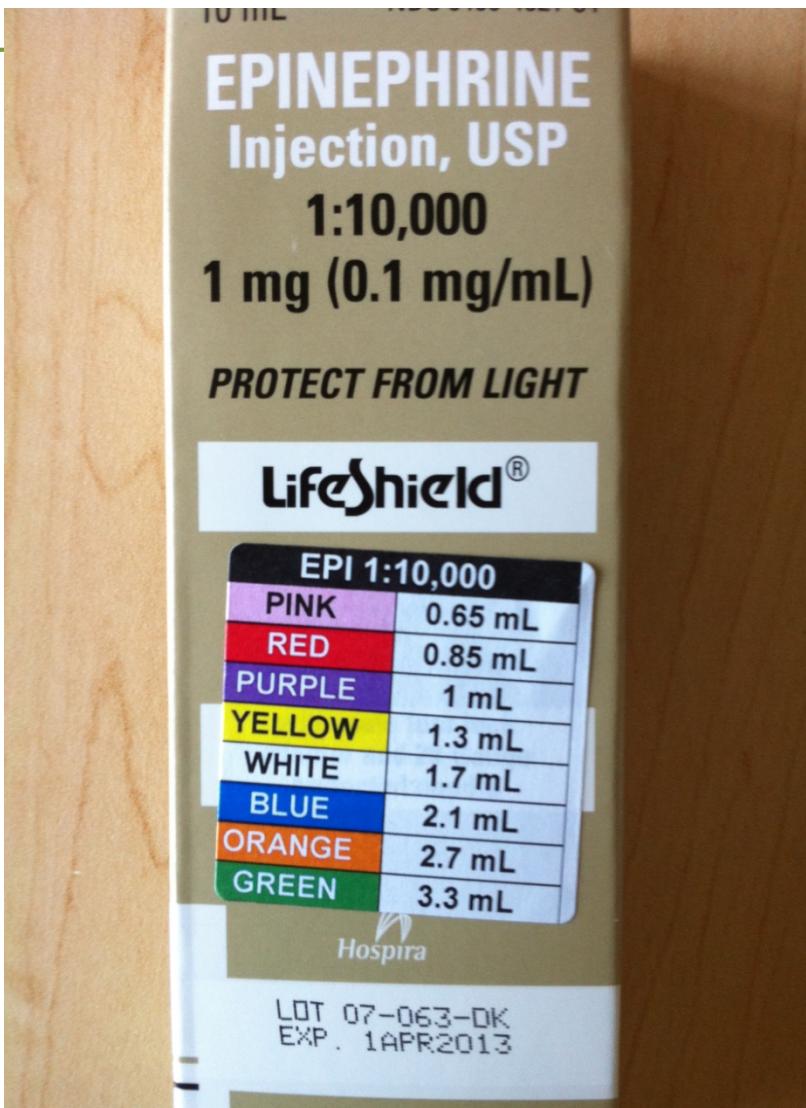
---

**3 minutes \***



\* Assessed during pediatric mock code simulation at HMC

# HMC: Color code all peds code meds



# Case: decrease cognitive load

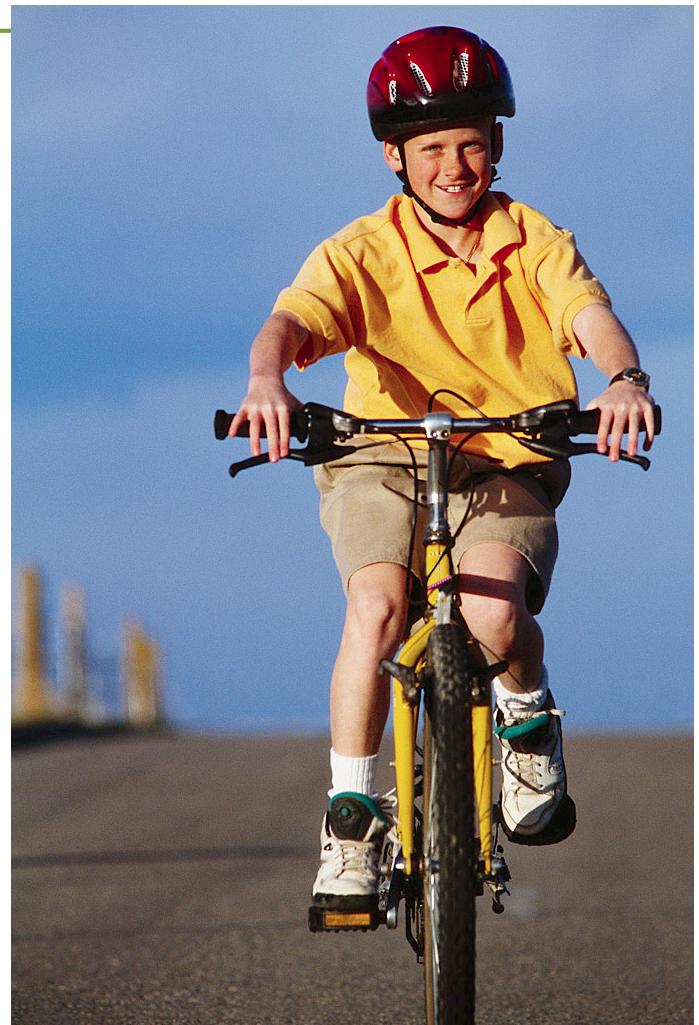
---

- What is the correct **ETT size**? **PURPLE ETT**
- Is the child **mainstem intubated**? Check **PURPLE depth**
- How **fast** should I bag? **PURPLE RR**
- What is the **dose** of mannitol? **PURPLE mannitol dose**
- Is that **heart rate** appropriate? Check **PURPLE normals**
- How much **fluid** do I bolus? **PURPLE bolus**
- How much **blood** should I order? **PURPLE transfusion**
- What is the correct **epi dose**? **PURPLE epi dose**
- How much **radiation** dose for CT? **PURPLE settings**

# Day-to-day preparedness

---

- Color coding should:
  - start in the field
  - cross the continuum
- Include in Medic, Airlift, ED, ICU, Acute care, OR, PACU, Clinic
- Entered in the electronic medical record
- Integrate into Hospital Disaster Management Plan



# Color coded wristbands

## KangaBand™ Wristbands

NEW!

for use with the Broselow® Pediatric Resuscitation System

Positive identification is mission critical when it comes to pediatric identification. When resuscitation is imminent, every second counts. The color coded KangaBand wristbands are specially designed to help quickly and accurately identify size and weight categories of pediatric patients. They coordinate with the Broselow Pediatric Resuscitation System, which provides a quick reference for accurate medication administration and proper equipment usage. KangaBand is ultra-soft, flexible, and comfortable for patients, even those with the most delicate, fragile skin.

The Broselow system is an easy-to-use, color-coded information and reference kit that provides doctors and nurses with the proper equipment sizes, pre-calculated medication dosages, and infusion rates needed to perform resuscitation on a child according to weight.

### Product Features:

- Available in 9 colors that coordinate with the Broselow System
- Write-on style wristbands feature a designated area to write in patient's weight (in Kg)
- Color-coded for quick, visual identification. Color name is also spelled out for additional reinforcement
- One size fits all. Fully adjustable
- Playful kangaroo design for pediatric patients
- Features patented SecurSnap™, tamperproof closure for added security
- Latex-free, phthalate-free



Contact Us Today for more information, samples, or a quote!

Call 800.435.4242  
or visit [www.pdcorp.com/healthcare](http://www.pdcorp.com/healthcare)

## KangaBand™ Wristbands

NEW!

for use with the Broselow® Pediatric Resuscitation System

### Ordering Information:

- Write-on style wristbands feature a designated area to write in patient's weight (in Kg)
- 250 wristbands per box
- Overall wristband length 10-1/4"

Color	Kg Range	Wristband	Part Number
Gray	3-5 kg		KG470SGY-11-PDJ
Pink	6-7 kg		KG470SPK-11-PDJ
Red	8-9 kg		KG470SRD-11-PDJ
Purple	10-11 kg		KG470SPU-11-PDJ
Yellow	12-14 kg		KG470SYL-11-PDJ
White	15-18 kg		KG470SWH-11-PDJ
Blue	19-23 kg		KG470SBL-11-PDJ
Orange	24-29 kg		KG470SOR-11-PDJ
Green	30-36 kg		KG470SGR-11-PDJ

Contact Us Today for more information, samples, or a quote!  
Call 800.435.4242 or visit [www.pdcorp.com/healthcare](http://www.pdcorp.com/healthcare)



Valencia, California  
25167 Anza Drive | Valencia, CA 91355  
Tel 800.435.4242 or 661.257.0233  
Fax 800.321.4409  
Email [cs@stjohninc.com](mailto:cs@stjohninc.com)  
[www.stjohninc.com](http://www.stjohninc.com)

San Fernando, California  
19880 Del Sur Street | San Fernando, CA 91340  
Tel 800.772.1122 or 818.897.1111  
Fax 818.686.9314  
Email [info@pdcorp.com](mailto:info@pdcorp.com)  
[www.pdcorp.com](http://www.pdcorp.com)



KangaBand™ and PermaPrint™ are registered trademarks of Precision Dynamics Corporation. Broselow® is a registered trademark of Vital Signs, Inc.

HC-185-022

Valencia, California  
25167 Anza Drive | Valencia, CA 91355  
Tel 800.435.4242 or 661.257.0233  
Fax 800.321.4409  
Email [cs@stjohninc.com](mailto:cs@stjohninc.com)  
[www.pdcorp.com](http://www.pdcorp.com)

San Fernando, California  
19880 Del Sur Street | San Fernando, CA 91340  
Tel 800.772.1122 or 818.897.1111  
Fax 818.686.9314  
Email [info@pdcorp.com](mailto:info@pdcorp.com)  
[www.pdcorp.com](http://www.pdcorp.com)

# Code Sheets

## Pediatric Color Zone YELLOW 13 kg

Approximate Weight (kg)	13
Approximate Age	2yr
Heart Rate	90-150
Respiratory Rate	24-40
Minimum SBP	70
ETT [uncuffed /*cuffed > 1 y/o]	4.5/4.0
NG / Foley	10 Fr
Chest Tube	20-24 Fr
Central Venous Line	3-4 Fr
Vent Settings - VT (mL)	104-156
Vent Settings - Rate (BPM)	15-25
C-Collar (Jerome Sizing)	P-1
Fluid Bolus (20 mL/kg)	260
Maintenance Fluids (mL/hr)	45
PRBC (mL) [unit = 350 mL]	130-195
Atropine IV (0.02 mg/kg)	0.26
Epinephrine IV (0.01 mg/kg)	0.13
Fentanyl IV (2 mcg/kg)	26
Fosphenytoin IV load (20 mg/kg PE eq)	260
Glucose IV (1 mL/kg of D <sub>50</sub> W)	13
Mannitol IV (1 gm/kg)	13
Midazolam IV (0.05 mg/kg)	0.65
Morphine IV (0.1 mg/kg)	1.3
Naloxone IV (1mcg/kg) partial	13
Phenobarbital IV load (20 mg/kg)	260
Sodium Bicarbonate IV (1mEq/kg)	13
Reference Ranges	
Dopamine 2-20 mcg/kg/min	Phenylephrine 0.05-1 mcg/kg/min
Dobutamine 2-20 mcg/kg/min	Propofol 25-50 mcg/kg/min
Epinephrine 0.1-4 mcg/kg/min	Rocuronium 10 mcg/kg/min
Norepinephrine 0.05-1 mcg/kg/min	Vecuronium 0.1-0.3 mg/kg/hr (bolus 0.1mg/kg)

This is not to be included as part of the medical record. HMC October 2010

<b>MEDIC ONE Pediatric Card: PINK 6 kg</b>				
Approximate Age	4 months	ETT (cuffed)	3.0	
Heart Rate	100 to 180	ETT depth	11 cm	
Respiratory Rate	30 to 60	Suction Catheter	8 Fr	
Minimum SBP	70 mm Hg			
Fluid bolus (20 mL/kg)	120 mL			
<b>DOSE route IV/IO unless stated</b>				
RAPID SEQUENCE INTUBATION	Dose	Amt	Vol *	
Premed: Atropine	0.02 mg/kg	0.12 mg	1.2 mL	
Induction: Etomidate	0.2 mg/kg	1.2 mg	0.6 mL	
Paralysis: Succinylcholine	2 mg/kg	12 mg	0.6 mL	
	Rocuronium	1 mg/kg	6 mg	0.6 mL
Sedation: Midazolam (5mg/mL)	0.1 mg/kg	0.6 mg	0.1 mL	
Pain: Morphine (10mg/mL)	0.1 mg/kg	0.6 mg	0.1 mL	
<b>CARDIAC</b>				
Epinephrine (0.1mg/mL)	0.01 mg/kg	0.06 mg	0.6 mL	
Atropine	0.02 mg/kg	0.12 mg	1.2 mL	
Lidocaine	1 mg/kg	6 mg	0.3 mL	
Adenosine	1st 0.1 mg/kg	0.6 mg	0.2 mL	
	2nd 0.2 mg/kg	1.2 mg	0.4 mL	
Magnesium sulfate	50 mg/kg	300 mg	0.6 mL	
<b>SHOCK ENERGY</b>				
Defibrillation	1st 2 J/kg		10 J	
	2nd 4 J/kg		20 J	
Cardioversion	1st 1 J/kg		6 J	
	2nd 2 J/kg		10 J	
<b>ANAPHYLAXIS</b>				
Epinephrine (1mg/mL) IM	standard dose	0.15 mg	0.15 mL	
Diphenhydramine	1 mg/kg	6 mg	0.1 mL	
<b>CRUPO</b>				
Epinephrine (1mg/mL) NEB	0.5 mg/kg	3 mg	3 mL	
<b>SEIZURE</b>				
No IV: Midazolam (5mg/mL) IN/IM	0.2 mg/kg	1.2 mg	0.2 mL	
Midazolam (5mg/mL)	0.1 mg/kg	0.6 mg	0.1 mL	
Lorazepam (2mg/mL)	0.1 mg/kg	0.6 mg	0.3 mL	
Phenobarbital (130mg/mL)	20 mg/kg	120 mg	0.9 mL	
<b>NEURO OTHER</b>				
Dextrose 10%	5 mL/kg		30 mL	
(12.5 gm (1/2 amp) D50 to 250 mL D5W)				
Naloxone (0.4 mg/mL)	0.1 mg/kg	0.6 mg	1.5 mL	
      				

\* Volumes based on concentrations carried by Medic One agencies located in King County WA 5/2016

<b>MEDIC ONE Pediatric Card: BLUE 20 kg</b>				
Approximate Age	6 years	ETT (cuffed)	5.0	
Heart Rate	70 to 130	ETT depth	15 cm	
Respiratory Rate	20 to 30	Suction Catheter	10 Fr	
Minimum SBP	82 mm Hg			
Fluid bolus (20 mL/kg)	400 mL			
<b>DOSE route IV/IO unless stated</b>				
RAPID SEQUENCE INTUBATION	Dose	Amt	Vol *	
Induction: Etomidate	0.2 mg/kg	4 mg	2 mL	
Paralysis: Succinylcholine	2 mg/kg	40 mg	2 mL	
	Rocuronium	1 mg/kg	20 mg	2 mL
Sedation: Midazolam (5mg/mL)	0.1 mg/kg	2 mg	0.4 mL	
Pain: Morphine (10mg/mL)	0.1 mg/kg	2 mg	0.2 mL	
<b>CARDIAC</b>				
Epinephrine (0.1mg/mL)	0.01 mg/kg	0.2 mg	2 mL	
Atropine	0.02 mg/kg	0.4 mg	4 mL	
Lidocaine	1 mg/kg	20 mg	1 mL	
Adenosine	1st 0.1 mg/kg	2 mg	0.7 mL	
	2nd 0.2 mg/kg	4 mg	1.3 mL	
Magnesium sulfate	50 mg/kg	1000 mg	2 mL	
<b>SHOCK ENERGY</b>				
Defibrillation	1st 2 J/kg		50 J	
	2nd 4 J/kg		100 J	
Cardioversion	1st 1 J/kg		20 J	
	2nd 2 J/kg		50 J	
<b>ANAPHYLAXIS</b>				
Epinephrine (1mg/mL) IM	standard dose	0.15 mg	0.15 mL	
Diphenhydramine	1 mg/kg	20 mg	0.4 mL	
<b>CRUPO</b>				
Epinephrine (1mg/mL) NEB	standard dose	5 mg	5 mL	
<b>SEIZURE</b>				
No IV: Midazolam (5mg/mL) IN/MM	0.2 mg/kg	4 mg	0.8 mL	
Midazolam (5mg/mL)	0.1 mg/kg	2 mg	0.4 mL	
Lorazepam (2mg/mL)	0.1 mg/kg	2 mg	1.0 mL	
Phenobarbital	20 mg/kg	400 mg	3.1 mL	
<b>NEURO OTHER</b>				
Dextrose 10%	5 mL/kg		100 mL	
(12.5 gm (1/2 amp) D50 to 250 mL D5W)				
Naloxone (0.4mg/mL)	0.1 mg/kg	2 mg	5 mL	
      				

\* Volumes based on concentrations carried by Medic One agencies located in King County WA 5/2016

# CT Radiation Dosing

TECHNICAL INNOVATION COLOR CODING FOR KIDS – PEDIATRIC IMAGING

Color-Coded CT Protocols Help Reduce Dose for Pediatrics



# Other Interventions to Reduce Pediatric ME

---

- CPOE: 21-88%
- Preprinted Order Sheets: 27-88%
- Education: 8-87%
- Pharmacist participation: 17-50%

# Protect against Errors

---

- Software programs
- Apps
- Tapes and preprinted sheets
- Practice, practice, practice....

# Recap: Every Kid, Every Time

---

- Standard care for 1 or 100 kids
- No reliance on specific provider type
- Efficient use of time, supplies, meds
- Medical stores to maintain cache of color coded equipment
- Decreases time to intervention
- Decreases error
- Increases number of kids that can receive care
- Could easily be adapted to disaster team planning

# Recap: Color-coding tools

---

- Length-based tapes
- Wrist bands
- Resuscitation Carts
- Respiratory bags
- Code sheets
- Code med stickers
- CT scanner radiation protocols

# Are You Ready ??????

