JUNE 11, 2024

Pediatric Disaster Preparedness

How to plan for when the worst happens to the smallest….

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A very bad day

- A school bus crashes into a liquid transport semi-truck on I-70 at the US 50 junction
- It was fully loaded with school kids on their way to school.
- You get a call from dispatch – passersby have called in that there are many cars involved and at least 1 school bus
- You will be the first rig on scene.....

You have 5 minutes until you arrive

What is your plan?

HURRICANE KATRINA

- The wealthiest nation in the world is hit with a predicted hurricane
- Poor planning and lack of evacuation lead to chaos and horrific conditions
- 5000 children were separated from their families. It took 6 months to reunite the last child

BOSTON MARATHON BOMBING

- 30 red-tagged patients, all transported within 60 minutes
- 264 injured patients required hospital treatment
- 16 patients with traumatic amputations of at least one limb
- 3 deaths at the scene. None at hospitals

- **A preparedness success**

LAS VEGAS – ROUTE 91 FESTIVAL OCTOBER 1, 2017

- > 851 injured
- 58 fatalities
- > 200 responding ambulances, 13 responding agencies, 3 separate ambulance companies
- >400 people transported to 13 hospitals
- No safe evacuation zone until 2 hours after start of incident
- EMS responded anyway.

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THE SCOPE OF THE PROBLEM

- We don't know where or when the next MCI will occur – but it will occur
- 27% of the population is under 18 years old
- Planning for children has historically been under "special populations" and ignored as being too hard
- No one likes to think about mass casualties of children.

OKAY, NOW WHAT….

Why kids are different

How to plan for kids in a disaster

Adding kids to your disaster plan

Kids are at high risk of injury from:

Hazardous material exposure

Bioterrorism

Chemical warfare

Mass casualty incidents

Natural disasters

Mass shootings

Warfare

Because they:

Are short

Can’t travel\

Are small (with fragile torsos)

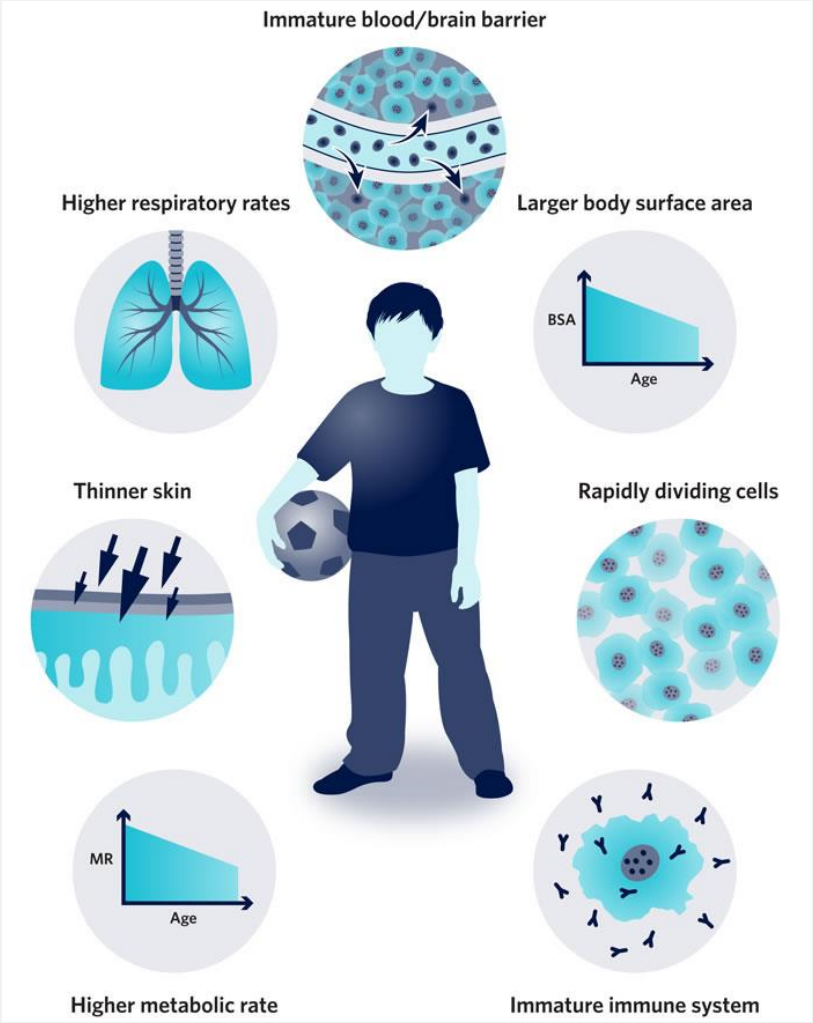
Are thin skinned

Breathe more

Use more energy

Are closer to the ground

Are found in groups



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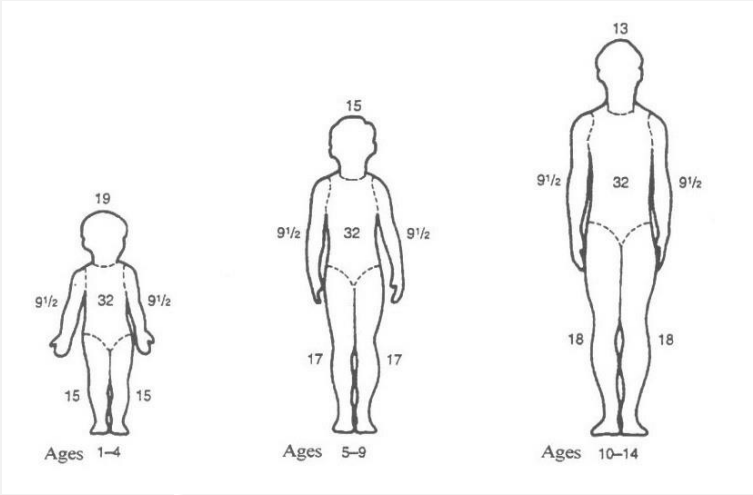
Kids are short (with big heads)

- They are more prone to serious head injuries in both blunt and penetrating trauma
- Toxic gases tend to be heavier than air and accumulate at toddler height
- Small children pickup more particulate matter from the ground (radioactive or hazmat)
- More prone to multi-system trauma in explosions / gunfire due to small size



Kids can't travel (developmental stages matter)

- Infants and toddlers – may be completely dependent on adults to move them from danger
- Pre-schoolers / toddlers – can't localize danger or move appropriately from it
- Older children – may have inappropriate response to danger
- Teenagers – can move but may still be very poorly equipped to deal with the psychological trauma

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Kids are small

Increased body surface area for weight – lose heat, water quickly

Increased compliance of the chest wall makes injury to the lung (and abdominal organs) more likely

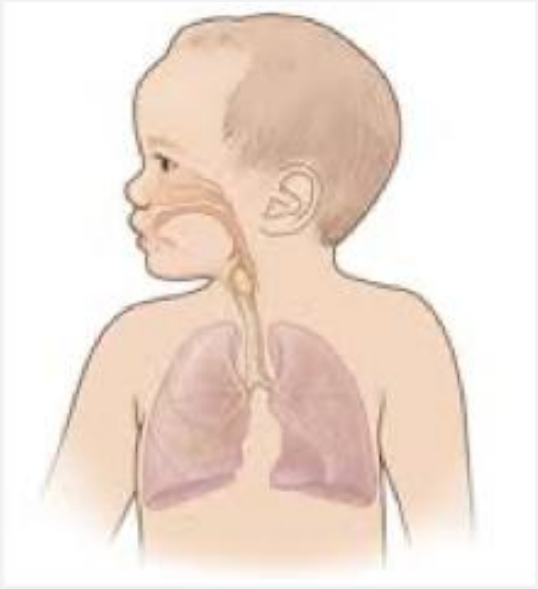
Abdominal organs are close together and less protected by the rib cage

Hypovolemia occurs quickly – less blood volume

Kids are small

- Hazardous material exposure
  - Increased dose/ weight absorbed through the skin or lungs
  - Small dose of toxin is more dangerous (a little goes a long way)
  - Dosing antidotes is tricky
- Trauma
  - Less protection provided by the chest and abdominal wall
  - Increased multi-organ trauma
  - Increased abdominal / thoracic trauma
- Burns - Dehydration and hypovolemia occur fast

Kids breathe more (and faster)

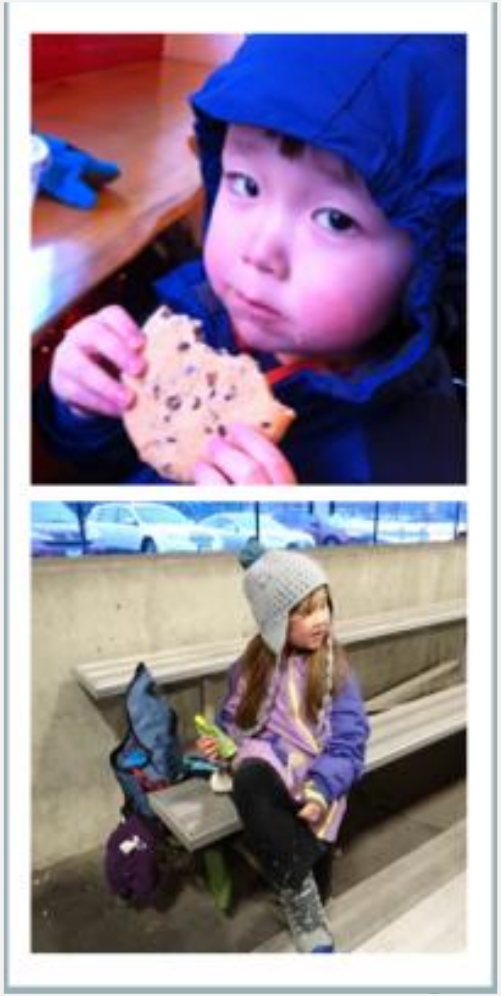


- Increased respiratory rate
  - Increased dose of aerosolized or vaporized materials
  - More quickly affected by asphyxiants
- Smaller airways
  - Increase caustic effects on respiratory mucosa
  - Edema or secretions cause obstruction quickly
- Difficult to determine a child with “SLUDGE” induced salivation / lacrimation from crying toddler with runny nose

Kids use more energy

- Higher metabolic rates – increased respiratory rate, higher heart rates
- Asphyxiants cause damage faster
- May cause more potent changes with toxins
- Hypovolemia can be missed in early stages

"Is her heart rate 150 because she is crying or is she hypovolemic?"



Kids are found in groups

- Kids are at their most vulnerable (ie away from parents / guardians) when they are clustered:
  - Schools
  - Daycare
  - Buses
  - Museums
  - Water parks
  - Parks

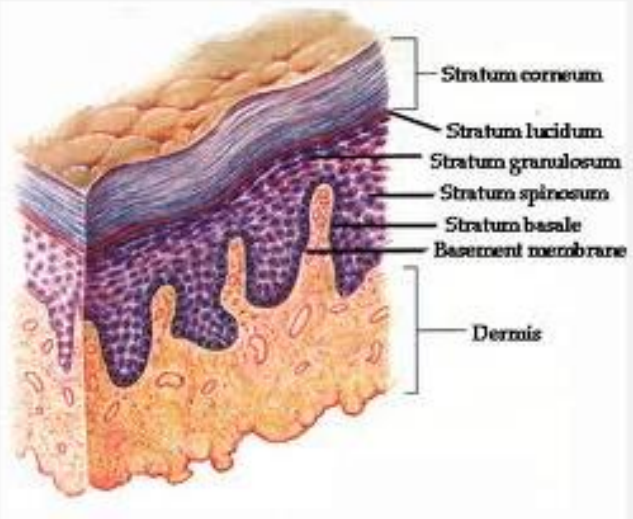
KIDS AND VITAL SIGNS

- Smaller kids have higher HR and RR at baseline
- BP will be normal until close to CV collapse
- Bradycardia is ominous

Age	HR	BP	RR
Premature	120-170	55-75/35-45	40-70
0-3mo	100-160	65-85/45-55	35-55
3-6mo	90-150	70-90/50-65	30-45
6-12mo	80-130	80-100/55-65	25-40
1-3 yr	70-125	90-105/55-70	20-30
3-6yr	65-115	90-110/60-50	20-25
6-12 yr	60-100	90-120/60-75	14-22
12-21 yr	55-100	95-120/65-85	12-18

Kids are thin skinned

- Increased toxin absorption through the skin
- Increased heat loss due to burns, decontamination, exposure
- Caustic agents may cause more damage



PLANNING FOR PEDIATRIC DISASTERS

It's a lot like planning for adult disasters

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IN A DISASTER KIDS NEED:

- To be with their family (or caregiver)
- To be warm
- To be kept safe from further harm
- To have their injuries treated appropriately
- To be fed (and then poop)
- To return to normal as soon as possible

KEEP CHILDREN WITH THEIR FAMILIES

- Keeping kids with family/parent/caregiver
  - Makes physical exam and treatment easier
  - Decreases risk of secondary injury due to inadequate supervision
  - Minimizes secondary psychological trauma
  - Decreases anxiety and pain
  - Prevents need for re-unification
- If separation must occur – document and / or tag kid / caregiver together to allow easy re-unification!

KIDS NEED TO BE WARM

- On scene – look for hypothermia and treat (even if the adults are ok)
- Decontamination poses huge risk of hypothermia
  - Use warm water and heaters if possible
  - Dry off quickly and wrap in warm blankets
- Evaluate for presenting hypothermia (or heat illness in hot weather) – they may have had prolonged environmental exposure prior to arrival
- While waiting for evacuation – provide passive warming / blankets (or cooling measures if hot temperatures)

Cold + Trauma = Bad outcomes

KIDS NEED TO BE KEPT SAFE

- The incident scene likely isn't safe for kids
  - Remove them from the scene quickly
  - Find a safe place for them to wait (if green triage)
- Keep them with an approved adult supervisor (pre-screen if at all possible)
  - Prevent secondary injury
  - Keep them from wandering off
- Prevent abduction / exploitation
  - All adults aren't safe adults
  - Kids are very vulnerable in disasters

KIDS NEED INJURIES IDENTIFIED

- Use a triage system with pediatric indications (SALT / JumpSTART)
- Use the Pediatric Assessment Triangle
- Look for intrathoracic and abdominal trauma
- Don't be fooled by a stable blood pressure – look for shock if high HR
- Ominous signs:
  - Bradycardia in an injured patient
  - Lower respiratory rate than expected
  - Poor cap refill or skin perfusion
- Assume kids DO feel pain just as you would – they might not show it

KIDS NEED INJURIES TREATED

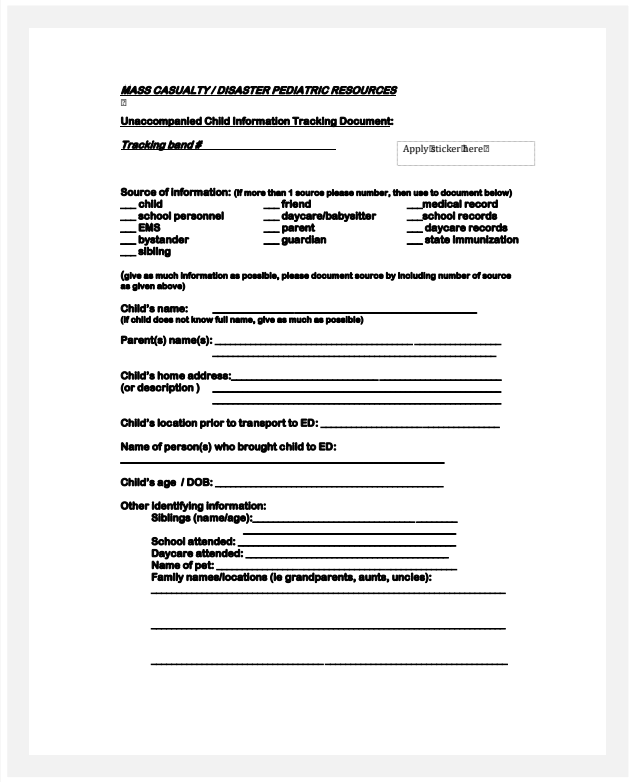
- Airway – position the airway to keep open (remember to raise the torso)
- Breathing – Give O2 if appears ill or injured
- Circulation –
  - Give fluids if shock exists – 20 cc/kg bolus (if blood is available – 10cc/kg pRBC)
  - Tourniquet /pack/ pressure if needed
  - Tachycardia is your early warning for hemorrhage and shock
- Treat pain (IN Fentanyl)
- Use Broselow / HandTevy / standardized weight estimate tool
- C-spine stabilization
- Splint obvious fractures
- Place dry clean sheet over burns

KEEP KIDS FED, RESTED AND CLEAN

- Plan for supplies needed for children and infants
  - Diapers / wipes, etc
  - Formula / clean water
  - Kid friendly foods (no grapes, no hot dogs)
- Provide areas / supplies for safe care
  - Cribs
  - Low cots
  - Safe bedding

KIDS NEED TO RETURN TO "NORMAL"

- Reunification plans must be in place if separated from caregivers
- Plan to identify children who can't speak - ensure this is documented
- As soon as possible after a disaster:
  - Start school / lessons
  - Schedules, structure and rules should be re-started
  - Allow kids to play and provide comfort
  - "Adults should be back in charge"
- Avoid secondary medical trauma if possible



MASS CASUALTY / DISASTER PEDIATRIC RESOURCES

Unaccompanied Child Information Tracking Document:

Tracking band # _____ Apply Sticker Here

Source of information: (If more than 1 source please number, then use to document below)

___ child	___ friend	___medical record
___ school personnel	___ daycare/babysitter	___school records
___ EMS	___ parent	___ daycare records
___ bystander	___ guardian	___ state immunization
___ sibling		

(give as much information as possible, please document source by including number of source as given above)

Child's name: _____
(If child does not know full name, give as much as possible)

Parent(s) name(s): _____ _____
_____

Child's home address: _____
(or description) _____
_____

Child's location prior to transport to ED: _____

Name of person(s) who brought child to ED:
_____

Child's age / DOB: _____

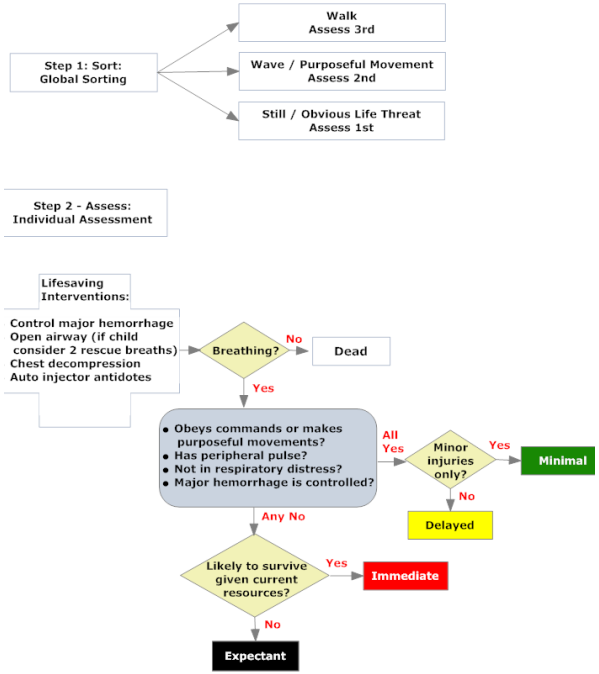
Other identifying information:
Siblings (name/age): _____ _____
_____
School attended: _____
Daycare attended: _____
Name of pet: _____
Family names/locations (ie grandparents, aunts, uncles):
_____
_____
_____

UNIDENTIFIED / UNACCOMPANIED KIDS

- Record all possible information – be creative
  - Location they were found
  - People with the child when found
  - Who transported the child to hospital
  - All other information – siblings, pets, descriptions of home or toys
- Designate an adult to care for each unaccompanied child
- Create a safe area to house unaccompanied / unidentified kids until transport to hospital
- Use matched triage tags to identify caregiver / child pairs

MCI TRIAGE & KIDS

RED - Emergent	YELLOW - Urgent	GREEN - Wait	EXPECTANT
• Seriously injured, likely to survive with immediate attention	• Injured - requires urgent treatment but will live with some delay in treatment	• Minor injuries - will require treatment but can wait	• Seriously injured but unlikely to survive even with immediate treatment or requires resources not available



SALT TRIAGE

- Pediatric key points
  - All non-ambulatory kids are YELLOW
  - Kids get 2 rescue breaths before declared dead
  - Respiratory distress can be harder to identifiy

BACK TO YOUR BAD DAY….

- You pull out the MCI Plan for your department – and find the pediatric annex
- You looked at the MCI plan last month so remember most of it
- You drilled an MCI 6 months ago and think back to how the local scout troups participated to ensure that kids were included and that the pediatric plans would be as seamless as the adult plan

- You feel that this is going to be a really bad day – but you are prepared for what to do next…

BLACKER CLOUD

- You are just about to get to the scene and notice a large cloud of smoke near the area
- As you pull up Fire and Police are all coughing and seem to have watering eyes

- You and your partner need to decide what to do next…..

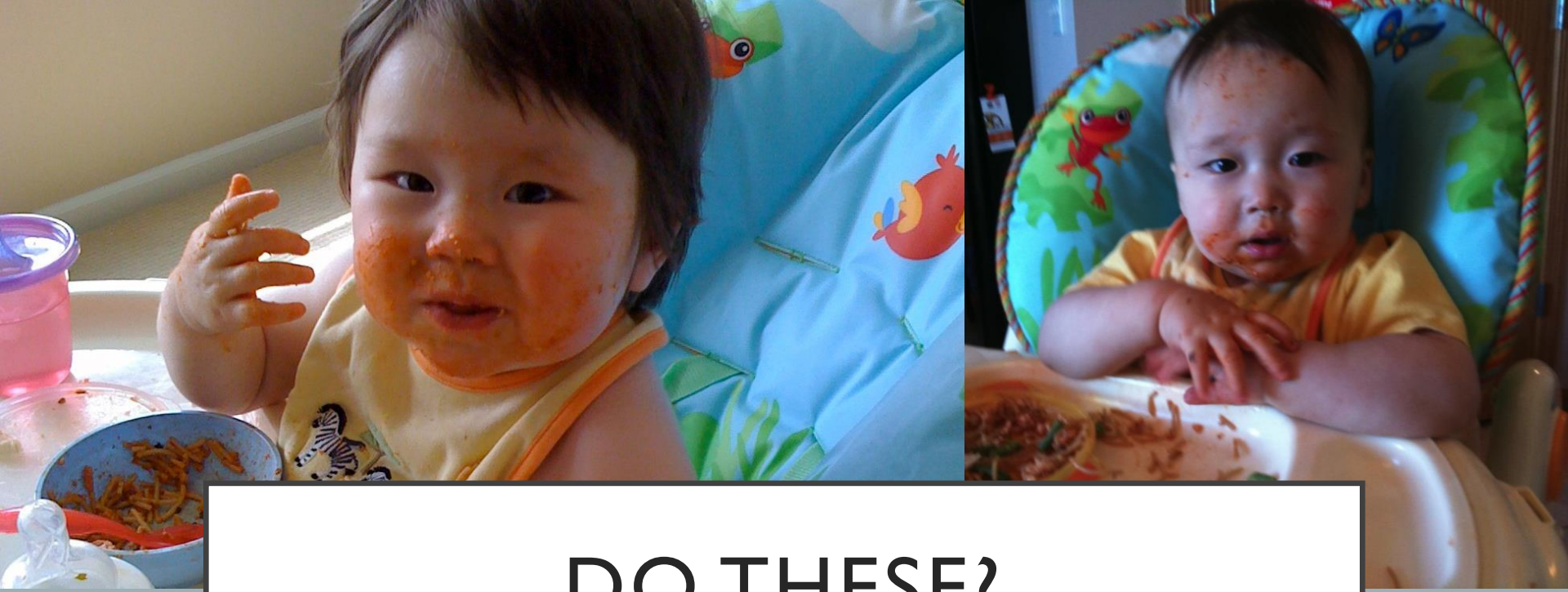
CHEMICAL / HAZMAT AND KIDS

- Basic principles still apply
  - Use toxidromes to suspect / identify exposure
  - Consider the need for decontamination
  - Use PPE appropriately to protect yourself and your teams (and the other patients!)
- Keep children with their families during evaluation, decontamination and treatment if at all possible

SUSPECT HAZMAT?

- Respiratory distress – cough, wheezing, tachypnea
- Irritated mucous membranes – burning nose, eyes, mouth, tears
- SLUDGE signs (cholinergic) – Salivation, Lacrimation, Urination, Diarrhea, GI, Emesis
  - 2 PAM (20mg/kg) + Atropine (0.05mg/kg and keep it coming)
- Skin irritation – pain, vesicles
- CNS effects – AMS, seizures, fasiculations
- Likely signs – known risks (fire, transport tank, odors, lots of affected people)
- Remember – GASOLINE (and other hydrocarbons) are hazardous materials and require decontamination too!

DOES THIS PATIENT NEED DECONTAMINATION?



DO THESE?

DOES THIS PATIENT NEED DECONTAMINATION?

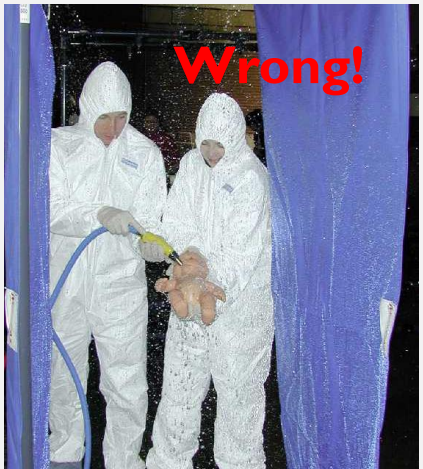
- 3 questions:
  - Was there a hazmat exposure?
  - Does it pose a risk to the patient?
  - Does it pose a risk to others?

If all 3 = Yes

then decontamination is the FIRST priority

DECONTAMINATION AND KIDS

- Keep kids with their families – but the grownups might need help
- Use warm water, low pressure & high volume
- Babies and toddlers are slippery – use a laundry basket to hold them
- Baby shampoo works great
- Get them warm after decontamination
- Respect older kids' modesty



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BACK TO THE BAD DAY

- You quickly recognize that there may have been a hazmat substance in the tanker truck and. don your PPE
- You use SALT triage to identify patients who can self decontaminate and those who will need help
- You arrange with the fire department to set up mass decontamination stations
- You pull out the handy laundry baskets you have ready for any infants
- You keep kids with their families and prevent further harm

You go do the amazing work you were trained to do because you've already practiced this…

3 THINGS TO REMEMBER IN AN MCI WITH KIDS

- Keep kids with their grownups
- Kids have different injury patterns from adults and might not show injuries immediately
- Hypotension and / or bradycardia are ominous signs – don't wait for these to occur to act

THANK YOU

Kristin.kim@childrenscolorado.org

- EMSC Colorado / COPPER website:
  - https://www.emsccolorado.com
  - lots of resources – will have a pediatric MCI template available soon (email Kristin for the advance draft if you'd like)