



Minnesota Pediatric Surge Primer

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PEDIATRIC SURGE PRIMER

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Introduction

In 2014, children¹ comprise 23.1% of the U.S. population. Approximately one-third of all children are under the age of six.² Over 69% of children requiring emergency care report to an Emergency Department (ED) that sees fewer than 15 pediatric patients a day.³ Therefore, all hospitals must be prepared to stabilize pediatric patients and have pre-determined their referral patterns, regardless of the hospital mission in the community. The magnitude of a surge event may overwhelm either the usual resources of the hospital, or the transport resources available, or both. Hospitals must be prepared to receive and continue care for pediatric patients in a surge event. The emphasis on keeping families together during an event increases the chances that children will be taken to non-pediatric facilities for care along with their adult family members.

How to Use this Primer and Toolkit

This primer is directed at health care facilities that do not usually provide pediatric trauma or inpatient services (pediatric specialty centers must have a more comprehensive and integrated approach to pediatric disaster response).

It is a part of the Pediatric Surge Toolkit available on the Minnesota Department of Health's website. The Toolkit include a range of materials including:

- Assessment Tools
- Planning Tools and Templates
- Education and Training Tools
- Exercise Tools and Templates
- Response Tools

The Primer is categorized as a Planning Tool and makes several references to other planning tools and templates available in the Pediatric Surge Toolkit.

Background

Children have unique physical and behavioral characteristics that make them particularly or uniquely vulnerable in a disaster. These characteristics also present the caregiver with significant challenges (Table 1).

¹ For the purposes of this publication "child" and "children" reference a person ages 0-17 years old.

² Child Trends Data Bank. Number of Children: Indicators of Child and Youth Well-Being. November 2015. https://www.childtrends.org/wp-content/uploads/2015/12/53_Number_of_Children.pdf

³ American College of Emergency Physicians. Pediatric Readiness in the Emergency Department June 2018.

Table 1: Unique Consequences in Children During a Disaster⁴

Characteristic	Cause	Consequences
Larger head for a given body weight	Higher center of gravity	More likely to suffer head injuries and falls
Greater skin surface for body weight	Evaporative heat and water losses	Hypothermia and dehydration
Small blood vessels	Relative size with younger age	Difficult venous access, more difficult fluid and medication delivery
Closer proximity of solid organs with less bony protection	Relative size with younger age	Greater chance of multi-organ injuries
Wide range of normal vital signs	Large differences in size, weight, and normal values	Difficult to determine normal values for a given individual, particularly for clinicians more accustomed to caring for adult patients
Rapid heart and respiratory rate	Normal physiologic variables based on age and weight	Faster intake of airborne agents and dissemination to tissues
Wide range of weight across pediatric age range	Normal physiologic variables based on age and weight	Greater likelihood of medication errors
Shorter height	Closer to the ground	Greater exposure to chemical and biologic toxins that settle near the ground due to higher density
Often found in groups	Daycare and school	More likely to see multiple casualties
Immature cognitive and coping skills	Age and experience, psychological development	Less likely to flee from danger, inability to cope, inability to care for themselves, find sustenance, and avoid danger

Guidelines for hospitals to start their planning for a pediatric surge are found below (Table 2). Baseline numbers were developed according to risk of a school bus crash, day care center incident, and similar incidents involving larger groups of children present in any community. Green patients are listed mainly to assure that planning for supervision, safe areas, and family support centers accounts for a reasonable expected volume of patients from a school or transport related incident. Note that 'Red' or critical patient numbers reflect only those < 8 years (as older children can be managed with adult equipment) and will be admitted/transferred. Yellow/green patients do not require as many size-critical resources but do require supervision and general medical care.

Table 2: Baseline Numbers for Hospital Pediatric Surge Planning

	Critically injured (Red) ⁵		Non-critical - Age < 18	
MN Trauma System Designation	< 8 years old	< 1 year	Yellow patients	Green patients
Level 4	2	1	5	10
Level 3	4	2	10	15
Level 2	6	3	15	20
Level 1	8	4	20	30

⁴ Branson, R. (2011). Disaster planning for pediatrics. Respiratory Care, 56(9), 1457-1465. DOI: 10.4187

⁵ Assume will require airway management, IV access at minimum

This Primer includes steps for facilities and regional health care coalitions (HCC) to consider in their pediatric planning. The steps are supported by discussion organized around the CO-S-TR framework (Command, Control, Communications and Coordination, Staff, Stuff, Space, and Special considerations, Triage, Treatment, Transport, and Tracking).⁶

The most important step in the planning process is for each facility to identify a champion of pediatric preparedness that can provide expertise, time, and leadership to implement these steps. In turn, these champions can provide the support needed to enhance HCC regional discussions, planning, and preparedness activities.

Command, Control, Communications, and Coordination

The health care facility emergency operations plan follows the all-hazards process and includes the use of the Hospital Incident Command system (HICS) as well as other incident management techniques. It is essential that the facilities Command Center address the specific issues related to a pediatric incident. These issues include:

- Access controls should be implemented early in the incident, as there is likely to be tremendous media and parental pressure on the facility, which should be directed through appropriate venues/entrances
- Traffic control may be an issue
- Specific pediatric personnel may have to be notified during a pediatric incident—this may occur through designated callback procedures or be automated—though it still will require a request to activate the callback
- Phone systems/switchboards are likely to be jammed
- Media interest will be higher than in a ‘usual’ mass casualty event which may place severe demands on the Public Information Officer
- Accurate patient tracking and coordination of information with schools, family assistance centers in the community, and other entities requires specific early attention by the Liaison Officer
- Coordination with the Regional Healthcare Preparedness Coordinator and/or receiving hospitals and transport agencies may be required early in the event. The Liaison Officer and/or the Pediatric Technical Specialist or Pediatric Services Supervisor may be tasked by the Incident Commander (or designee) to address these issues—specific prompts should be built into the Job Action sheets for these positions.

⁶ Further information on the CO-S-TR framework see http://www.dmph.org/cgi/content/full/2/Supplement_1/S51

Logistics—Surge Capacity

Space/Structure

Prior to the event, spaces conducive to pediatric care should be identified:

- Triage areas
- Ambulatory care
- Emergency/Resuscitation care
- Inpatient care (including PICU if applicable)
- Pediatric Safe Area (PSA) (a supervised/monitored area for discharged pediatric patients awaiting a caregiver, children that cannot be supervised by caregivers who are undergoing treatment, and/or children of facility staff responding to work that did not have other options for child care)

Spaces should be listed as:

- **Conventional spaces:** Areas where such care is normally provided
- **Contingency spaces:** Areas where care could be provided at a level functionally equivalent to usual care
- **Crisis spaces:** Areas where sufficient care could be provided when usual resources are overwhelmed (this might involve non-pediatric providers supervising inpatient care, temporary intensive care/ventilator support for patients who cannot be moved, etc.)

Usually, conventional spaces will be used first and contingency and crisis spaces activated according to incident demands. The table below provides samples of what might be included in a facility assessment.

Table 3: Space Surge Examples

Space Needed	Conventional	Contingency	Crisis
Triage	Emergency	Emergency lobby	Parking lot
Emergency Dept.	Emergency	GI procedure area	Same day surgery
Ambulatory	Clinic	Meeting room	Cafeteria
Inpatient (Floor and ICU-level)	None	Floor beds	Floor beds, ICU care in PACU
Pediatric Safe Area	Family room	Small meeting room	Secure large meeting/dining area

At the time of an incident, an assessment should be made about the currently available beds and spaces (including operating rooms, post-anesthesia care unit (PACU), ICU, ventilators, etc.) The assessment could include the possibility of patient relocation or discharging of inpatients. Pediatric patients should be placed on units that are secure, and ideally cohorted on the same units to simplify staffing and support. Unaccompanied patients should share rooms with other unaccompanied patients if possible. Unaccompanied children **MUST** have supervision at all times regardless of location.

Staff and Training

Staff working in the Emergency Department or who usually provide pediatric care may already have baseline training expectations for their positions. Additional staff, who would not normally be involved in emergency care and have had pediatric training, should be identified.

Sources of staff with potential pediatric expertise may include:

- Emergency medicine, pediatrics, family medicine
- Anesthesia, ENT, pediatric surgery, trauma surgery, general surgery, orthopedics, urology, neurosurgery, thoracic surgery
- Nurses, physician assistants, nurse practitioners from OR, PACU, ICUs, inpatient units and outpatient clinics
- Pharmacy, respiratory therapy, and other support staff

Additionally, staff in other categories/areas may have experience with pediatric care that provides them with a level of comfort and expertise allowing them to assist in care during a disaster—these staff should be identified via survey or other means and their contact information tracked. They should be encouraged to keep current with pediatric topics and enroll in available courses and offered trainings to maintain their skills and confidence.

There is also a need for pediatric-specific expertise in clinical support services such as respiratory therapy and pharmacy. Clinical pharmacists and respiratory therapists are core personnel in a hospital disaster response, and their abilities and need for training should be assessed so that they are able to meet the pediatric-specific challenges (such as medication preparation/administration and ventilator or other respiratory care management).

Support staff for the pediatric safe area and escorts for patients could be drawn from a number of sources including licensed day care centers, schools, and other facilities. These arrangements should be documented in the facility plan and those listed facilities/staff should understand their roles and ideally have participated in a prior exercise. Hospital personnel should always provide supervision of the Safe Area regardless of outside assistance being provided.

A process for contacting these staff should be identified in the facility Pediatric Surge Annex, as well as the expectations for where they should report. Credentialing and training expectations for these staff should be addressed, if required, prior to an event.

Training falls into two basic categories:

1. Formal classes (for example Advanced Trauma Life Support - ATLS, Advanced Pediatric Life Support - APLS, Pediatric Advanced Life Support - PALS) that are:
 - Expected as part of job description/job class
 - This would likely apply to physicians and nurses working in certain areas (ATLS for physicians staffing the Emergency Department for example)
 - These should be documented in the planning process
 - Encouraged as supplemental education/enrichment of staff that might participate in a mass casualty response
 - Personnel taking these classes should be documented
2. Facility education:
 - Pediatric Surge Annex components (space, staff, stuff)

- Equipment (location and use)
- Simulation sessions
- Exercises
- Decontamination team education about pediatric-specific issues

Call-back/notification procedures for staff with relevant pediatric skills should be documented in the Pediatric Annex as required (for example, if all providers are trained to the same level, there is no basis for a separate notification list. However, if specific key providers have a higher level of expertise these providers should be notified preferentially).

Create key pediatric positions for response in a disaster event; refine Job Action Sheets and add to your hospital's Emergency Operations Plan Pediatric Surge annex (see [Template: Facility Pediatric Surge Plan](#)).

- Pediatric Technical Expert
- Pediatric Safe Area Unit Leader
- Pediatric Services Supervisor

Assure that line staff have appropriate Standard Operating Procedures or job aids immediately available to initiate response in their work areas.

Stuff (Equipment Recommendations, Pharmacy Considerations)

Basic Patient Care

Storage of disaster supplies is often difficult in hospitals due to space and maintenance issues. However, there is no substitute for appropriate hospital beds and clinical monitoring equipment.

Pediatric-sized beds are not normal inventory in hospitals that do not provide dedicated pediatric services. If adult beds must be used for pediatric patients, side protection may have to be improved to prevent falls. Additionally, beds may need to be unplugged for certain age groups to prevent them from being raised too high or otherwise being placed in positions that may cause injury.

Hospitals should consider having at least 5 portable cribs available for small children who may be patients or may be in the PSA. Larger hospitals, especially those providing pediatric inpatient services, should consider additional resources. Cots may be suitable for older children in the Safe Area or for crisis/shelter care but should be supplemented with egg-crate or other mattresses for use beyond a few hours.

Adequate monitoring equipment must be available including appropriately sized blood pressure cuffs, oximetry probes, and ECG leads.

Hospitals should be familiar with the pediatric capabilities of ventilators used at their facility and pediatric considerations (including dead space volumes, need for pediatric circuits, etc.).

Emergency Care

Each institution must have a system to assure that the appropriate medication dosing and sizes of equipment are used for pediatric patients. Some institutions use a color-based equipment

scheme correlated to a measuring tape (Broselow system, up to 36 kilograms). Others may elect to use age-correlated weight/actual weight-based drug and equipment guides. Regardless, each institution must have a system to assure appropriate dosing and sizes of equipment are used for pediatric patients.

Equipment must be organized and easily accessible. Personnel *must* be familiar with the pediatric equipment and have opportunities to practice with it; otherwise this will contribute to the potential for errors in a stressful mass casualty environment. Additionally, necessary procedures may not be performed due to a reluctance to ‘break the seal’ on emergency equipment.

It is assumed the emergency department has the usual emergency medications, basic intravenous (IV) fluids (including normal saline, dextrose-containing ½ normal saline, ¼ normal saline, etc.), intravenous micro-drip tubing, adult size IV cannulas, usual needles, syringes, connecting tubing, and electronic patient monitoring equipment and diagnostic equipment (thermometer, cardiac monitor, oximetry, etc.).

Providers and planners should assess their supplies relative to their institutional preparedness goal. *Goals should be established by looking at the table above (Table 2) and adjusting as needed based on the community and institutional role.* Keep in mind, during a surge event, lower level trauma designated hospitals (Levels III and IV) should at minimum be able to stabilize and treat a pediatric patient for at least 6 hours before a transfer to definitive care can occur. Basic planning goals are for patients less than 8 years old as older children can be managed using adult equipment.

In general, the equipment list below should be used *per critical patient* so that a facility planning for 4 critically injured patients should have four times the recommended disposable supplies below that will be needed for each patient—these may be packaged in kits to aid response, especially the airway and vascular access equipment which may be needed emergently. A separate infant kit is recommended; Providers may wish to confine the smallest tube, mask, and blade sizes to the infant kits only (<1 year).

Reasonable supply planning may assume that:

- **Airway:** All Red (critical) patients require airway management (back-up airway equipment including supraglottic and surgical airway supplies must be available, though only one set per facility is needed)
- **Breathing:** One of every two Red patients’ needs a chest tube (minimum two per facility), all Red and Yellow patients require supplemental oxygen by mask
- **Circulation:** All Red and Yellow patients and one third of Green patients require intravenous (IV) access (some of these may require intra-osseous (IO) access) which includes cannulas, arm boards, fluids, drip sets, etc.
- **Disability/Neuro:** All Red and Yellow patients require a cervical collar. One third of all patients require a splint (SAM, cardboard/arm board, plaster, etc.)

Pediatric ED Equipment and Supplies Guidelines

Minnesota hospitals are required to stock supplies in accordance with their designated trauma level. Level I and Level II verified trauma centers are required to follow the American College of

Surgeons (ACS) equipment requirements while Level III and Level IV designated trauma centers need to follow the Minnesota requirements.

Additionally, the American College of Emergency Physicians (ACEP) recently updated their policy statement for *Pediatric Readiness in the Emergency Department*. These guidelines are intended for **all** EDs that provide care for children open 24 hours a day, 7 days a week, including freestanding and critical access hospital EDs. Appendix 1 (pg 23-24) is a complete list of general and specialized equipment for pediatric patients.

Medications

Pediatric surge management rarely involves medications. However, use of oral or nasal analgesia (e.g. fentanyl via mucosal atomizer device (MAD) or oral oxycodone elixir) may provide for more rapid symptom control with less provider effort and are strongly encouraged.

Dosing errors in pediatric patients are often 10x the actual dose needed due to multiplication and decimal point errors. This can lead to complications, and even death. Height or weight-based references **MUST** be available, and drug doses must be carefully checked prior to administration (including a ‘common sense’ check comparing the dose to an adult dose and relating that to the patient weight—e.g. 15 kg child should get one fourth of the adult dose of most medications). Optimally, an emergency dosing card should be generated for every patient based on weight that outlines usual drug dose by mg AND by mL of supplied solution as this is a common source of medication error. Clinical pharmacists that can provide support in the Emergency Department can be invaluable in assisting with appropriate dosing if adequate staff is available.

Providers must be careful not to push fluids and medications too aggressively through small intravenous catheters. Constant pressure from a pump or pressure bag is required to keep intra-osseous lines patent, and intra-osseous lidocaine may be needed for patient comfort in the awake patient. Certain fluids (such as hypertonic saline) are not compatible with IO administration. Providers may wish to review usual resuscitation drugs for compatibility and error potential and conduct education or develop procedures that reduce the chance of errors.

Consider stocking a 72-96 hour supply (given usual use and planning goals as outlined above) of medications such as:^{7,8}

- **Resuscitation:** Adenosine, amiodarone, atropine, calcium chloride and/or calcium gluconate, epinephrine (1 mg/mL IM and 0.1 mg/mL IV solutions), lidocaine, procainamide, sodium bicarbonate (4.2%), vasopressor agents (e.g. dopamine, epinephrine, norepinephrine)
- **Analgesia:** Narcotics, ibuprofen, ketamine (oral, intranasal, parenteral)
- **Anesthetics:** Including EMLA (eutectic mixture of local anesthetics), lidocaine 2.5% and prilocaine 2.5%, LET (lidocaine, epinephrine, and tetracaine), L.M.X. 4 (4% lidocaine)

⁷ Note that there are very few pediatric-specific medications – however, pharmacy should assure that safety mechanisms are in place to accurately dose and dispense medications. Stocks of liquid or other forms of medication may have to be evaluated to assure adequate stocks for pediatric use. This process should be part of an all-hazards drug and dosing preparedness strategy rather than a pediatric-specific strategy.

⁸ American College of Emergency Physicians. *Pediatric Readiness in the Emergency Department* June 2018.

- **Antibiotics:** Including intravenous (narrow and broad-spectrum, for example cefazolin, ceftriaxone, and expanded spectrum penicillins such as piperacillin/tazobactam), palatable oral antibiotics such as amoxicillin (consider stocking flavored syrups to enhance palatability) and topical bacitracin (for burns)
- **Anticonvulsants:** Levetiracetam, Valproate, carbamazepine, fosphenytoin, phenobarbital
- **Antidotes:** Common antidotes should be accessible in the ED (Consider: naloxone hydrochloride, hydroxocobalamin for cyanide poisoning, post-exposure prophylaxis for biologic agents for pediatric use (e.g. amoxicillin for anthrax), ocular drugs such as proparacaine and topical antibiotics)
- **Antiemetics:** Ondansetron, others - injectable and oral
- **Antihypertensives:** Labetolol, nicardipine, sodium nitroprusside
- **Antipsychotics:** olanzapine, haloperidol
- **Antipyretics:** acetaminophen, ibuprofen
- **Benzodiazepines:** midazolam, lorazepam
- **Bronchodilators:** Including appropriate nebulizer masks, metered dose inhalers, and spacers (albuterol, ipratropium bromide)
- **Corticosteroids:** dexamethasone, methylprednisolone, hydrocortisone
- **Dextrose** (D₁₀W, D₂₅W)
- **Diphenhydramine** (injectable and oral)
- **Furosemide**
- **Glucagon**
- **Insulin**
- **Lidocaine**
- **Magnesium sulfate**
- **Mannitol**
- **Neuromuscular blockers** (e.g. rocuronium, succinylcholine)
- **Oral glucose or sucrose solutions** (for pain control in infants)
- **Sedation medications:** Ketamine, etomidate
- **Vaccines** (tetanus)
- **3% Hypertonic saline** (3% which can be given via peripheral IV)

The facility may wish to consider a disaster ‘pull list’ for the pharmacy that results in certain medications (especially narcotics, sedation, and intubation medications) being automatically pulled and sent to the Emergency Department when a mass casualty event occurs.

Special Considerations

Mental Health

Early psychological support for children affected by disaster can facilitate their initial and subsequent care and potentially reduce longer-term mental health issues. Initially, an escort, ideally one trained in psychological first aid, should be assigned to unaccompanied pediatric patients to provide companionship and support through the initial medical treatment process. A focus on pain relief, comfort measures, and providing a quiet and secure environment contribute greatly to reducing fear and advancing feelings of well-being. Every effort should be made to keep families together, and when this is not possible, to re-unite them as quickly as

possible. The Pediatric Surge Toolkit contains hand-outs and reference tools that may be of value in the initial support of children's mental health needs.

The use of the Minnesota Behavioral Health Medical Reserve Corp is recommended in order to provide additional trained mental health support to a hospital and/or community that has experienced a disaster event. This is especially important when the event involves children. The staffing, mission, activation, and operations of such teams or personnel should be detailed in advance of an incident. While awaiting such teams, the hospital should have a plan to bring in facility staff/volunteers or other community based volunteers if there are a number of unaccompanied pediatric patients that require escort/support. It is essential that these individuals be pre-screened and have background checks completed prior to having them work with the pediatric population. The use of Psychological Simple Triage and Rapid Assessment (PsySTART) or other psychological assessment and screening is recommended as early as possible once the child is medically stabilized, and those at risk should have more formal assessment by professional providers.

Hospital Support Center

Families need to be provided with the most up to date information available in a supportive and safe environment. This includes having resources and a designated area at the hospital to provide these services for families of patients, the size of which depends on the event.

Recently, the American Academy of Pediatrics published the *Family Reunification Following Disasters: A Planning Tool for Health Care Facilities* which provides planning assistance in regards to support services necessary during a disaster response. Below you will find an outline of considerations for the Hospital Support Center (HSC).

Upon arrival to the HSC, families should be logged in either via an electronic database or sign-in book. Registered families are updated periodically with information coming into the HSC and may be referred to community locations/resources if their child is not at the hospital or expected there. A social worker, or other support staff, should be assigned to families that are identified as exhibiting overt psychological upset or need to be given bad news. Family reunification may be coordinated by public agencies at a site away from the hospital (e.g.: Family Assistance Center set up at a school or other location).

Primary Functions

1. Provide accurate information to family members through statements issued by the hospital's Public Information Officer to:
 - a. Facilitate family access to community Family Assistance Center (FAC's)
 - b. Coordinate communication with local law enforcement and FAC
2. Provide psychological first aid to families and refer, as needed, to disaster behavioral health services and professional mental health providers
3. Provide temporary childcare in the Pediatric Safe Area for well children awaiting reunification
4. Assist with patient location and reunification of family within the hospital
5. Assist in contacting family members to facilitate re-unification

6. Assist making shelter or community placement arrangements for children that do not have a safe place to be or a family member who can care for them
7. Provide communications resources for families that need them (phones, e-mail)
8. Protect families from intrusion by media or others
9. Assist in determining location of patients/family at other facilities

Ideal set-up of HSC

- Large reception area with conveniently located restroom facilities, but also with areas of relative privacy—the area should not have other functions
- Appropriate security and access controls
- A system in place to identify the family members—such as ID wristbands—thereby eliminating the risk of a non-family member having access to the hospital support center
- Area for group briefings as well as private areas
- Comfortable chairs and waiting areas
- Information desk with message center and phone (including long-distance calling), and internet connections (including the ability to access email websites which may normally be blocked by hospital information technology)
- Outlet power strips for cell phone and other electronics charging needs
- Photograph/identification room with limited access (close relatives only)
- Private consultation rooms with table, chairs, telephone, tissues, trash can (may be same room as photograph/identification room)
- Pediatric Safe Area nearby if possible
- Ability to provide light refreshments and drinks
- Visually isolated from media, triage, and treatment areas

Identification of identified or unidentified victims/family members

- Personal details and pictures of patients are sent to the HSC electronically (MNTrac, email, other methods as agreed upon by community plan) or via runners from the Hospital Command Center
- Information is included on all unaccompanied children, both the uninjured and those receiving medical treatment
- Information on deceased victims should be sent to the response Family Assistance Center and medical examiner. Policies should be in place on how death notifications are carried out as well as how viewing and other issues will be handled
- Adults coming to the hospital to claim children must show I.D.; ideally, they should bring a picture that includes the adult with the child, such as a family photograph. Policies should define in advance what threshold of proof is required to release a child to a parent, guardian, or other individual. This may vary with the age of the child and ability to interview the child
- Adult family members of victims not listed as patients at the hospital should be referred to the response Family Assistance Center (FAC) for more information though an attempt can be made to determine family member location on MNTrac if more than one hospital is receiving patients (and/or contact information can be kept if the patient arrives later)

Recommended HSC staffing

- Unit Leader
- Public Information Officer (or designee)
- Liaison to community Family Assistance Center (FAC)
- Runners
- Trained and pre-screened support volunteers
- Security
- Translators as needed
- Professional staff (spiritual care, social services, psychology/psychiatry)

Pediatric Safe Area

The purpose of a pediatric safe area (PSA) is to establish a supervised area for unaccompanied children during a pediatric surge incident or disaster. They are designed as a holding area for uninjured children awaiting parents, caregivers or guardians to claim them. Every PSA should be adequately staffed according to MN Rule 9503.0040, which states the following acceptable staff-to-child ratios.

Age Category	Minimum Staff : Child Ratio
Infant	1:4
Toddler	1:7
Preschooler	1:10
School-age child	1:15

See the Template: Facility Pediatric Surge Plan for more information about the PSA Supervisor role and Job Action Sheet that should be established during an incident. See the PSA Checklist, Registration and Registry forms for more response materials.

Infectious Disease

The facility infectious disease plan should account for pediatric-specific issues. Though it is beyond the scope of this document to go into detail about infection control and epidemic management, a few issues worthy of addressing are:

- Expectations of parents for compliance with Personal Protective Equipment (PPE) restrictions when their children are hospitalized and considered highly contagious
- Issues with children being able to comply with PPE use
- Infection control issues in play areas
- Visiting restrictions and sibling visiting restrictions during infectious disease outbreaks
- PPE supplies for children (simple masks, hand hygiene, etc.)
- Cohorting plans for pediatric surge during an epidemic—how and where will cohorting occur if the pathogen is transmissible by the airborne route? What units will pediatric care expand to if children are disproportionately affected?
- Are there medication issues to address? (availability or compounding of palatable liquid forms of certain medications, adequate stocks of anti-viral medications and antibiotics, etc.)

- Are there plans for contingency staffing if pediatric staff are disproportionately absent due to infection or ill family members?

Decontamination

Children may be more susceptible to injury from hazardous materials due to:

- Failure to recognize a hazardous material or situation
- Failure to recognize signs of exposure or formulate an escape plan
- High surface area relative to mass (allows more skin contact)
- Higher minute ventilation (allows more inhalation exposure)
- Lower height may result in more concentrated exposure to gases with higher vapor densities

Decontamination for children requires planning and training that must be incorporated into the facility decontamination plan. A few considerations are:

- Use of dry decontamination when indicated
- Families should be kept together and assist each other (though teen aged children may wish to have privacy from the other family members)
- Children will be intimidated by chemical PPE of providers and may resist the decontamination process
- Children will require assistance and escort through the decontamination process, increasing workload for the decontamination team
- Handheld or low showerheads are required for adequate bathing
- Temperature control of the water is more critical for children—assure warm water is provided (ideally, have an in-line temperature monitor on the water supply lines)
- Hypothermia is a significant concern—children should be undressed for brief periods of time and re-dressed as soon as possible—warm blankets should be available
- Re-dress kits and gowns in appropriate sizes should be available for use
- Baby shampoo should be available to avoid eye irritation
- Heavy-duty laundry baskets may be helpful to carry very small children
- Parents should not carry their children through the decontamination process as slip and drop risk is high
- Instructions using pictures on laminated cards to help non-English speaking and illiterate patients

Operations – Patient Care

Triage

Pediatric patients can be difficult to triage. Pediatric patients with obvious external bleeding or soft tissue wounds and those who are crying uncontrollably are often assigned triage categories higher than justified. There is increased risk of resources being provided to these patients and, as a result, not having necessary resources available for more seriously injured children. There is also the phenomenon of ‘upside down’ triage by which less injured patients arrive first, and

those with more serious injuries that require extrication or EMS interventions arrive around 30 minutes later, when resources have already been devoted to the lesser injured.

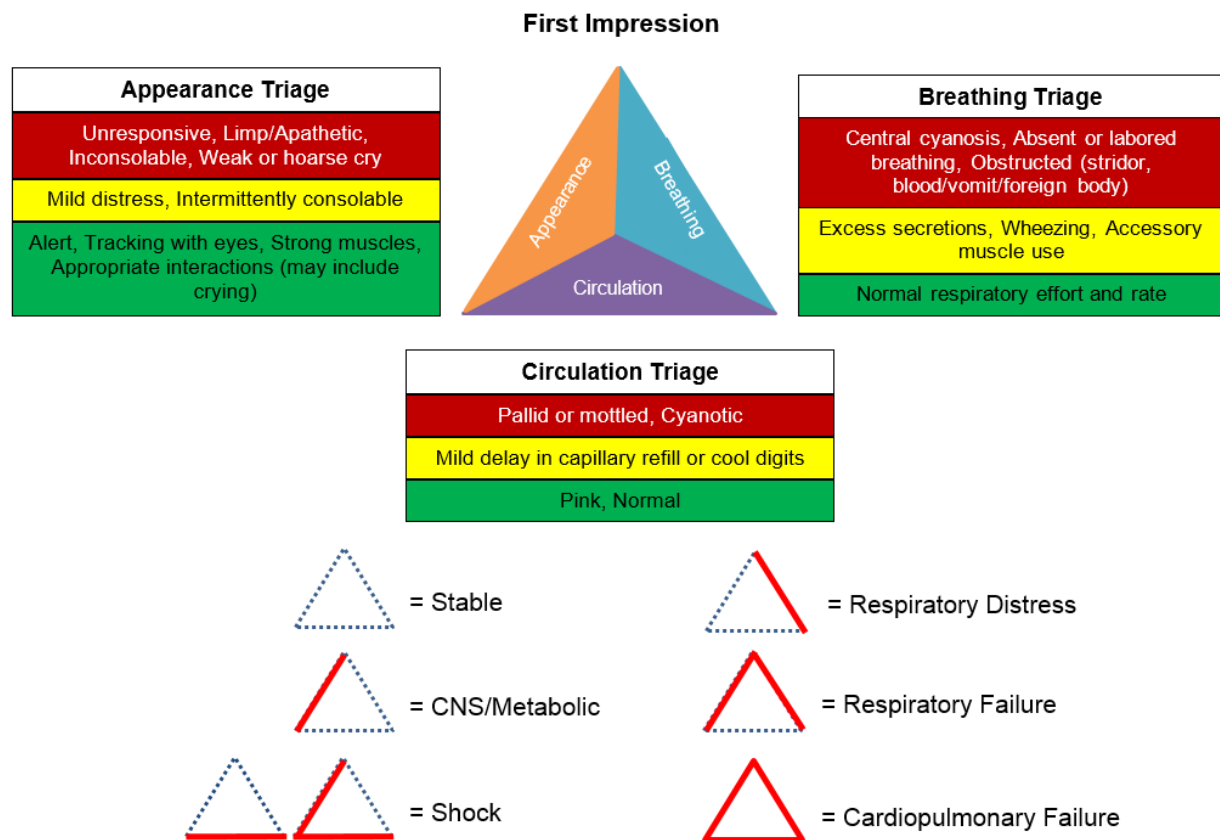
Additionally, a high percentage of patients will not be transported by EMS and may arrive by family vehicles or police. Health care facilities need to be ready to triage patients as they arrive. Triage tags need to be available and the emergency department divided up into areas of Red, Yellow and Green. When there is a large volume of pediatric patients, JumpSTART, SMART and SALT are 3 methods of triage. Information can be found at:

<https://emscimprovement.center/resources/cme-training/pediatric-disaster-triage-doing-the-most-good-for-the-most-patients-in-the-least-time>.

Children with the following signs and symptoms should be triaged as 'Red' or the highest priority, and be cared for by the most experienced providers in the resuscitation area of the emergency department:

- Altered mental status
- Respiratory distress
- Signs of shock

Advanced Pediatric Life Support (APLS) uses the Pediatric Assessment Triangle (PAT) (Figure 1), for a quick initial assessment of the pediatric patient. The only threat not addressed by the PAT is a finding of penetrating injury to the chest or abdomen, which should categorize the patient as 'Red' or critical—these may be subtle and should be looked for carefully in the setting of any explosion.

Figure 1: Pediatric Assessment Triangle

Vital signs can be of some help in determining priority, however the normal ranges, by age, are wide, and thus, clinical correlation to the injuries/symptoms is required. Persistent tachycardia or tachypnea exceeding the ranges below, after appropriate analgesia, should prompt a careful evaluation for severe illness/injury.

Table 4: Vital Signs Normal Ranges by Age

Respiratory Rate and Heart Rate Range by Age	Respiration Rate (per minute)	Heart Rate (per minute)
Birth to 1 year (infant)	30 – 60	100 – 160
1 to 3 years (toddler)	24 – 40	90 – 150
3 to 6 years (pre-school)	22 – 34	80 – 140
6 to 12 years	18 – 30	70 – 120

Early assessment should consider the need for decontamination if the patient was exposed to hazardous chemicals. It is important to note that those patients exposed to irritant gases do *not* require specific decontamination. Exposure to liquid or solid irritants or those exhibiting cholinergic syndrome symptoms (small pupils, excess secretions) does require specific decontamination.

Mass psychogenic illness is a syndrome that should also be given consideration; it is usually mistaken for a hazardous materials release⁹. It occurs when a stimulus (such as an odor) triggers one person (usually a school-aged child) to have shortness of breath or nausea and vomiting. The occurrence of these symptoms triggers others in the group to have similar symptoms. Communication with fire services, at the scene of the event, is critical to determine if there are any dangerous chemicals involved, but usually the symptoms are limited to the sensation of shortness of breath, headaches, and nausea and vomiting without evident cause or other findings. Symptomatic treatment is recommended and these patients should **not** be cohorted together at risk of exacerbating symptoms. This is differentiated from Medically Unexplained Physical Symptoms (MUPS) which usually presents on a *delayed* basis after a suspected exposure and may involve multiple symptoms and presentations that cannot be explained by a specific injury, toxin, or syndrome.

Treatment

Emergency Department Care

Red-tagged patients (critical/unstable)

- Place in the most acute (e.g.: resuscitation) beds of the pediatric or, as necessary, adult areas of the ED
- Management: ED attending physicians; transfer to PICU or pediatric ward attending physicians, if available (or arrange consultation with referral center)
- Alert surgery (pediatric, when available) or Trauma Team
- Place all other surgical specialties on standby as required/available

Yellow-tagged patients (moderately injured or ill/potentially unstable)

- Place in acute care beds in ED if possible—consider overflow to procedure areas and other locations per surge capacity plan
- Reevaluate frequently and assign disposition in a timely manner
- Ideally, providers assigned to patients should stay with that patient through the emergency department course if resources allow
- When enough clinical staff are not available, an escort should be assigned to each unaccompanied child to maintain continuity and safety—unsupervised children should always be avoided

Green-tagged patients (minor or non-injured/stable)

- Triage to secured waiting room, other large waiting area or clinic (if available) *with* supervision to ensure safety of unaccompanied children
- Reevaluate frequently - discharge after care is completed to an appropriately identified adult

⁹ For example, and discussion – a case report of 99 persons presenting to an ED on day one after an unusual odor (no hazardous materials found) in a school and 71 more the day the school reopened – Jones TF. N Engl J Med 2000;342:96-100

Placement

Table 5: Emergency Department Placement

Color	Red	Yellow	Green
Category	Immediate life threat	Potential life threat (within hours)	No immediate life threat
Clinical	Altered mental status, respiratory distress, signs of shock, truncal penetrating injury	Generally non-ambulatory with an injury or injuries that may become life-threatening if untreated	Generally ambulatory with isolated injuries that should not be life or limb-threatening
Placement	Resuscitation area	Acute treatment and re-triage area	Waiting area/clinic/urgent care area ¹⁰

Emergency evaluation and treatment of pediatric patients follows the general ‘ABCDE’ approach of trauma triage. Providers should refer to the MDH Pediatric Priorities poster for additional clinical tips. Early analgesia should be provided including appropriate doses of narcotic analgesia where needed—this may be given via intranasal and other non-invasive routes. Intra-osseous lines may be needed when IV access is difficult and adequate supplies of needles, drivers, and connections sets should be available.

Comprehensive information about pediatric medical care is beyond the scope of this document, though ten key differences in caring for pediatric patients are:

1. In pre-school children, the cricoid ring is the narrowest portion of the airway—so an endotracheal tube may pass the cords but hang up below them and require a smaller tube—cricothyrotomy is contraindicated below school age. Consider airway adjuncts like laryngeal mask airways (LMAs) or other supraglottic airways if intubation is not feasible.
2. Endotracheal tube position is more tenuous the smaller the child. Any change in neck position may result in right mainstem intubation (flexion) or extubation (extension). Head immobilization is recommended in addition to careful securing of the tube. Continuous end-tidal CO₂ monitoring can protect against an unrecognized dislodged tube.
3. Respiratory distress often leads to gastric distension from air-swallowing. All intubated children should have a orogastric tube placed (nasogastric tubes should be avoided in trauma).
4. Compensation for shock is much better than in adults, but when shock occurs it is often precipitous—sustained high heart rates after appropriate analgesia should indicate compensated shock until proven otherwise.
5. Pre-school children and infants are likely to have hypoglycemia when severely injured or ill—point of care glucose should be checked on all pediatric patients.
6. Hypothermia occurs quickly due to higher body surface area relative to mass—protect early against loss of body heat.
7. In cases of shock, give 20mL/kg normal saline, if clearly hemorrhagic shock considers early replacement of 10mL/kg packed RBCs.
8. Maintenance fluid rate
 - a. 4mL/kg/hr first 10kg (40mL/hr)

¹⁰ Until thoroughly evaluated, Green patients should not be taken to a remote area of the facility or to an off-site facility as they will need to be re-triaged if subtle or evolving injuries are present. Yellow patients will also need re-evaluation and re-triage after initial assessment and treatment.

- b. 2mL/kg/hr second 10kg (20+40=60mL/hr)
- c. 1mL/kg/hr each kg >20 kg (60 + x mL/hr)
- 9. Fluids—starting maintenance
 - a. Neonate D10 ½ NS
 - b. 1-5 years D5NS
 - c. > 5 years D5NS
- 10. Drug dosing in pediatric patients is subject to errors, which can arise from:
 - a. Inaccurate weight estimation (use actual weight when possible, length-based correlate to weight—such as Broselow tape—as secondary method, age-based as last resort)
 - b. Inaccurate dose calculation
 - c. Inaccurate conversion of dose to volume (mg to mL of drug for example)

Providers should refer to course materials for Advanced Pediatric Life Support or textbooks such as Fleischer’s Textbook of Pediatric Emergency Medicine for more definitive information.

Inpatient Care

For hospitals **with** PICUs:

- Admit the most critical cases and/or youngest victims to PICU
- Manage overflow patients in monitored beds on ward or adult medical or surgical ICUs.
- Expand ICU care to PACU, back to ED, or to monitored beds on pediatric unit with pediatric RNs

If PICU services are unavailable or resources are exceeded, staff physicians will have to manage critical patients pending transport (in consultation with outside pediatric experts—telephone or telemedicine, or with internal ED, anesthesia and/or adult critical care staff as needed, see Appendix 1) in the above areas. Providers with expertise in this area should be determined prior to the incident.

For hospitals **with** pediatric inpatient services:

- Admit moderately injured or ill patients (and especially those < 8 years of age) to pediatric ward.
- Room patients of similar age together whenever possible
- As more space is needed, add 1 bed per room, if possible
- Consider cohorting older pediatric patients on adult wards but pediatric patients should *not* room share with a non-parent adult

For hospitals **without** pediatric inpatient services:

- Arrange transfer to appropriate referral center
- If transportation is delayed, provide care in consultation with outside technical experts at pediatric specialty center and involve community pediatric specialist input as possible
- Consider providing ongoing care on adult unit appropriate for acuity
 - Children should not share rooms with non-parent adults. Rooms should be easily observed and secured.

Transportation

Within the Hospital

Equipment:

- Children > 8 years old—adult stretchers may be appropriate
- Smaller children—crib or additional personnel with padded adult stretcher—stretcher rails may allow entrapment/falls if not careful, height may cause significant injury if child falls

Personnel:

- Parents or adult caregivers should stay with children
- If no parent is available, appropriate personnel must be identified to supervise pediatric patients
 - Children < 8 years—continuous 1:1 supervision, unless in crib
 - Children ≥ 8 years—assess ability to follow safety rules while on stretcher
 - A child separated from other children requires 1:1 observation

From Hospital to Other Facilities

Patients requiring ICU care who cannot be accommodated at the facility should be transferred to referral centers (Appendix 1). Priority should be given to those with the most critical injuries and those < 8 years of age. Rotor-wing (helicopter) transfer to an appropriate referral center should be considered depending on distance and road conditions. Parents should accompany the child whenever possible.

Neonatal transport should be arranged with the receiving specialty center and an appropriate rotor-wing, fixed wing, or ground transport team should be arranged. There are few circumstances where an ill neonate should be transported without the services of such teams—if the team is delayed by weather, specialty consultation should be obtained to advise on interim care measures.

Close coordination with EMS in the affected community and with the receiving region is important to assure appropriate and timely arrival of transportation. It may be more effective to have units from the receiving community come to the affected area depending on local EMS capacity.

Hospitals should consider alternatives to ambulances for safe pediatric transfers in a disaster situation.

Stable patients

Arrange for the following:

- Car seats (see options in Table 6 below).
 - Donations
 - Purchases
 - Identify local sources as needed

- Conduct just-in-time survey of employees re: available car seats
- Transport vehicles
 - Cars, vans, city or private buses with car seats, as indicated
 - School buses for children ≥ 5 years who can sit up
 - Driver must have cell phone or radio to communicate with hospital
 - Appropriate medical personnel must accompany patients
 - Mental health or social service personnel should ideally accompany the patients

Unstable or Potentially Unstable Patients

Appropriate transport vehicles—arrange in consultation with pediatric expertise and EMS

1. BLS/ALS ambulance with:
 - a. Accompanying physician, CRNA, or other staff skilled in pediatric airway and resuscitation
 - b. Equipment appropriate for age and acuity of patient
2. ALS/BLS ambulance with normal EMS staff for less critical patients
3. Specialty pediatric transport teams from referral pediatric institutions
4. Rotor-wing (helicopter) or fixed wing (airplane) ambulance

Table 6: Appropriate Use and Type of Car Seats¹¹

Age Group	Type of Seat	General Guidelines
Infants/toddlers	Rear facing only seats and rear facing convertible seats	All infants and toddlers should ride in a Rear-Facing Car Seat until they are 2 years of age or until they reach the highest weight or height allowed by their car safety seat's manufacturer.
Toddlers/preschoolers	Convertible seats and forward-facing seats with harness	All children 2 years or older, or those younger than 2 years who have outgrown the rear-facing weight or height limit for their car seat, should use a Forward-Facing Car Seat with a harness for as long as possible, up to the highest weight or height allowed their car seat's manufacturer.
School Aged Children	Booster Seats	All children whose weight or height is above the forward-facing limit for their car seat should use a Belt-Positioning Booster Seat until the vehicle seat belt fits properly, typically when they have reached 4 feet 9 inches in height and are between 8 and 12 years of age.
Older Children	Seat Belts	When children are old enough and large enough to use the vehicle seat belt alone, they should always use Lap and Shoulder Seat Belts for optimal protection. All children younger than 13 years should be restrained in the rear seats of vehicles for optimal protection

Patient Tracking

Early registration and tracking of pediatric patients is very important for family re-unification as well as clinical operations. Because younger children cannot participate verbally in their care there may be difficulty assigning names—thus pictures of all unaccompanied children should be taken and a numeric system used until identity can be confirmed. A template for information collection for unaccompanied children can be found in Appendix 13. ALL unaccompanied children < 18 and all children checked into the Pediatric Safe Area should have this sheet filled

¹¹ American Academy of Pediatrics

out, and, unless they are an emancipated minor, they must await a parent or guardian prior to being discharged.

A colored band system should be used to help identify the child's status—a suggested system is:

- **Purple** bands signify the child is *with* a parent/guardian
- **White** bands signify a child *without* a parent/guardian
- A child with a patient band has/is receiving medical care at the facility—a white or purple band may accompany the patient band to show the child's status
- **Blue** bands may be used to identify the children that *belong* to staff members who required childcare in order to respond to the emergency

If the child is referred to another institution, a tracking sheet should note the transporting crew, the destination hospital (and ideally unit and receiving staff), time of departure, and any belongings and/or parents or caregivers accompanying the child. (See Appendix 13)

A child who is a patient and unaccompanied should be discharged to the Pediatric Safe Area after medical care is complete—the discharge should reflect the destination to assure that parents/caregivers can find the child in the PSA.

Appendix 1: Pediatric Referral Resources

Region	Facility Name	Trauma Level	PICU Services	NICU Services	Contact
Metro	Children's Minnesota, Minneapolis Campus	Level I	Yes	Yes	866-755-2121
	Hennepin County Medical Children's Hospital	Level I	Yes	Yes	800-424-4262
	Regions Hospital/Gillette Children's Specialty Healthcare	Level I	Yes	Yes	888-588-9855
	North Memorial Medical Center	Level II	Yes	Yes	800-230-2413
	University of Minnesota Masonic Children's Hospital	Level III	Yes	Yes	888-543-7866
	Children's Minnesota, St. Paul Campus	Level IV	Yes	Yes	888-543-7866
Northwest	Altru Hospital Grand Forks, North Dakota	Level II	No	Yes	855-425-8781
	Sanford Medical Center Fargo Fargo, North Dakota	Level II	Yes	Yes	877-647-1225
	Essentia Health—Fargo Fargo, North Dakota	Level II	No	Yes	800-437-4054
Northeast	St. Luke's Hospital	Level II	No	No	218-249-7870
	Essentia Health—St. Mary's Medical Center	Level II	Yes	Yes	218-786-7777
West Central	St. Cloud Hospital	Level II	Yes	Yes	888-387-2862
	Sanford Medical Center Fargo Fargo, North Dakota	Level II	Yes	Yes	877-647-1225
	Essentia Health—Fargo Fargo, North Dakota	Level II	No	Yes	800-437-4054
Central	St. Cloud Hospital	Level II	Yes	Yes	888-387-2862
Southwest	Sanford Children's Hospital Sioux Falls, South Dakota	Level II	Yes	Yes	605-333-1000
South Central	Mayo Clinic Health System—Mankato	Level III	No	No	877-225-5475
Southeast	Mayo Clinic Hospital Eugenio Litta Children's Hospital	Level I	Yes	Yes	800-533-1564

References

Emergency Medical Services for Children Innovation and Improvement Center. Pediatric Disaster Preparedness Toolbox.

<https://emscimprovement.center/resources/toolboxes/pediatric-disaster-preparedness-toolbox/>

King County Healthcare Coalition. Hospital Guidelines for Management of pediatric Patients in Disasters. March 2010. <https://nwhrn.org/wp-content/uploads/2017/08/King-Co-Pediatric-Toolkit-2010.pdf>

New York City Department of Health and Mental Hygiene. Pediatric Disaster Toolkit. 2006. https://www.omh.ny.gov/omhweb/disaster_resources/pandemic_influenza/hospitals/bhpp_focus_ped_toolkit.pdf