

Universal Level Designations for Hospitalized Pediatric Patients in Evacuation

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ABSTRACT

Children comprise approximately 22% of the population in the United States.¹ In a widespread disaster such as a hurricane, pandemic, wildfire or major earthquake, children are at least proportionately affected to their share of the population, if not more so. They also have unique vulnerabilities including physical, mental, and developmental differences from adults, which make them more prone to adverse health effects of disasters.²⁻⁴ There are about 5000 pediatric critical care beds and 23 000 neonatal intensive care beds out of 900 000 total hospital beds in the United States.⁵ While no mechanism exists to consistently track pediatric acute care beds nationally (especially in real time), a previous study⁶ showed a 7% decline in pediatric medical-surgical beds between 2002 and 2011. This study also estimated there are about 30 000 acute care pediatric beds nationally. Finding appropriate hospital resources for the provision of care for pediatric disaster victims is an important concern for those charged with triaging patients in a major event.

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In addition to primary triage looms the threat of a large-scale evacuation of hospitalized children. Hospitalized pediatric patients are often clustered in large pediatric centers which often operate near or at capacity.⁷ Any event that threatens the vital infrastructure of a hospital, such as natural disasters or acts of terrorism, may force undesirable patient movement challenges. The evacuation of one pediatric center would cause a regional pediatric surge and potentially require interstate transfer of patients.⁸ Evacuating hundreds of pediatric patients safely and efficiently would prove quite challenging without a method to quickly classify the pediatric care levels at recipient hospitals. Finally, disasters that primarily affect adults can significantly impact large pediatric centers. Staffing shortages at nonpediatric centers, which may be due to pandemics or other incidents, often precipitate an influx of neonatal, pediatric, and obstetric patients to pediatric centers struggling with their own staffing shortages. A system to help direct the transport, admission, and care of these children would save time, resources, and lives.

The American Academy of Pediatrics (AAP) has a widely accepted system of classification for neonatal intensive care units.⁹ This 4-tiered system defines the lowest acuity as level 1 and the most acute and resource intensive beds to be level 4. A recent AAP policy statement¹⁰ defined pediatric levels of critical care into 3 tiers: community, tertiary, and quaternary or specialized. This classification system did not include the complex medical care delivered on pediatric acute care units in its definitions. These tiers also have not been widely operationalized by local, state, or federal emergency management agencies.

Existing pediatric surge plans, both publicly available and shared via personal communication, have variable definitions for pediatric levels of care. In New York City's pediatric surge model,¹¹ medical centers were stratified by the presence of a pediatric ICU. Los Angeles County's pediatric surge plan¹² has a robust, 8 tier

classification ranging from centers where no pediatric care is provided and emergency departments accepting pediatric patients (EDAPs) to large pediatric centers where the full range of medical and surgical services are available. Minnesota's pediatric surge plan¹³ uses pediatric trauma levels designated by the American College of Surgeons (ACS). While many of these plans share common themes, the lack of clear definitions for pediatric levels of care creates a babel effect, which can result in poor regional coordination.

To simplify the management of pediatric inpatient movement during an evacuation or pediatric surge event as well as their resource needs, it would be advantageous if all pediatric beds, both for neonates and older children, could be described with a simple universal system. This universal system would support both identification of appropriate care capability for transport and bed placement as well as advise resource management for logistical support.

Proposal

An interstate focus group from the Western Regional Alliance for Pediatric Emergency Management (WRAP-EM), a pediatric disaster center of excellence funded by the US Department of Health and Human Services, met iteratively in 2020 to discuss ways to standardize patient movement and surge definitions between its participating states (AZ, CA, NV, OR, WA, and UT). We initially discussed whether the domains of the TRAIN hospital disaster triage tool¹⁴ could preidentify pediatric levels of care required at a receiving facility. The TRAIN tool has been used to determine the level of medical transport required for hospitalized patients based on their resource needs to quickly facilitate resource requests with a simple, codified language for logistical support from emergency operations centers. Further discussion demonstrated that definitions surrounding pediatric levels of care required additional clarity to prevent inefficiencies during disaster response. Since the AAP has already

endorsed the concept of pediatric critical care levels and the widely accepted neonatal levels of care, we propose that a 4-tier system encompassing all pediatric inpatient beds would be the simplest and easiest to adopt at this time. In addition to aligning with the neonatal classification schema, using this 4-tier system for all pediatric beds would parallel with the TRAIN hospital disaster triage tool (see Table 1). We recognize that therapies performed on acute care units versus intensive care units will have institutional variation. Despite this, we suggest definitions for care within these pediatric levels of care (see Table 2). This would further guide pediatric patient triage and movement by personnel in emergency operations centers who may not have pediatric training.

DISCUSSION

Defining pediatric levels of care is complicated and controversial. Institutional guidelines dictate what constitutes critical care. For example, administration of high flow nasal cannula can be performed on acute care units in some institutions whereas, in others, this therapy would be limited to the intensive care setting. Even prehospital emergency medical service (EMS) protocols can vary from county to county and state to state. Further, state licensing boards define scopes of practice, which are not consistent.

Nonetheless, professional societies have historically defined levels of care. ACS has 4 designated trauma levels,¹⁵ which are widely accepted and used. Centers must meet specific criteria to qualify as a level 1 trauma center. As previously discussed, the AAP has already defined neonatal levels of care and levels of pediatric critical care. More recently, the American College of Obstetrics and Gynecology (ACOG) has pushed forth definitions for maternal levels of care.¹⁶

One source of potential confusion is misalignment between pediatric levels of care and the ACS's trauma designation levels as they run in opposite fashion to our WRAP-EM proposed levels. Hence, a

TABLE 1: NICU, PICU, and Proposed Pediatric Levels of Care Alignment with TRAIN Tool

Classification System	Increasing Acuity and/or Capability →				
Neonatal levels of care, AAP ^a	—	Level 1 well newborn	Level 2 special care	Level 3 NICU	Level 4 regional NICU
Pediatric ICU levels of care, AAP/ACCCM ^b	—	—	Community	Tertiary	Regional
Proposed pediatric levels of care	—	Level 1 acute	Level 2 intensive	Level 3 critical	Level 4 specialized
TRAIN transport	Blue/Car	Green/BLS	Yellow/ALS	Orange/CCT	Red/specialized

ALS, advanced life support; BLS, basic life support; CCT, critical care transport. —, not applicable.

^aAAP NICU levels numerically and by descriptors.

^b2019 AAP PICU levels of care by descriptors.

pediatric trauma level 1 can care for the highest acuity or complexity patients, whereas a pediatric level of care 1 is lowest acuity or complexity. The AAP system designating neonatal levels 1 to 4 is already widely used and understood by pediatric hospitals, and this conflict between trauma levels and neonatal levels already exists. Also, pediatric patient movement involves planning for both neonatal and pediatric patients; having 1 system for both populations will be much more feasible to implement in terms of communication and systems planning. We have addressed this conflict between trauma and pediatric levels by including plain language descriptors of the acuity levels so they may be described in both fashions.

ACOG's classification schema to help facilitate regionalized perinatal care

defines maternal level of care 1 as basic care and maternal level of care 4 as a regional perinatal health care center with the availability of medical and surgical care for the most complex maternal conditions. This ascending level of acuity and complexity is aligned with the AAP's neonatal levels of care. WRAP-EM's proposed pediatric levels of care mirror both schemas and would standardize language and facilitate logistical response in disaster by local, state, and federal emergency management agencies.

Having clearly defined pediatric levels of care align with neonatal, maternal, and TRAIN transport levels would be of great potential benefit in responding to a regional disaster. We hope hospitals would see the potential benefits of this system and voluntarily accept these pediatric levels of care. The neonatal and maternal

levels of care are already supported by their professional organizations. This is an opportunity for the AAP to support this proposal as a regional best practice for movement of hospitalized pediatric patients. There might be resistance from some hospitals to accepting lower level of care designations. This was true with neonatal levels of care when they were first promulgated, but they are now widely accepted. Designation levels also tend to promote more centers extending or upgrading their capabilities to meet or exceed standards they previously did not take into consideration.

Levels of care may be promoted in different ways by different jurisdictions. In California, for example, neonatal levels of care are enforced by the state through the California Children's Services (CCS). Other jurisdictions may choose to adopt our

TABLE 2: Proposed Pediatric Levels of Care Details

Level 1: Acute

- O2 by canula (simple or HFNC)
- Intermittent respiratory therapies (MDI or nebulized breathing treatment)
- IV fluids with intermittent IV medications
- Simple monitoring

Level 2: Intensive

- Provide pediatric resuscitation and routine mechanical ventilation (conventional or CPAP/BIPAP)
- Providers can be pediatricians, family practice docs, or adult or pediatric intensivists
- Community-based, shorter term stays without complex subspecialty access

Level 3: Critical

- Provide pediatric resuscitation and advanced mechanical ventilation (conventional at high PEEP, high frequency, or advanced CPAP/BIPAP)
- Provide full or almost full spectrum of pediatric subspecialty access
- Providers are pediatric intensivists

Level 4: Specialized

- Provide pediatric resuscitation and all levels of lung, heart, kidney support (including ECMO, CRRT) and typically manage complex multi system pediatric disease
- Provide full spectrum of pediatric subspecialty access
- Providers are pediatric intensivists
- Support transport and regional education

pediatric level of care designations solely for the purpose of pediatric disaster preparedness. Regardless of the level of promotion by regulatory organizations, it is critical that individual hospitals and health systems, regional disaster planning coalitions, and EMS agencies work together to implement a systematic approach to pediatric hospital care and transport that is consistent and straightforward.

Medical response to disasters largely depends upon either moving the victims to the needed resources or moving the resources to the appropriate victims. In a scenario requiring the evacuation of a major pediatric medical center or a pediatric surge event, accurate and efficient resource allocation could prevent progression into contingency or crisis care. Inefficiency and inaccuracy of such movements can result in increased morbidity and mortality. Given the relative paucity of pediatric and neonatal beds as well as their concentration in urban areas, a disaster affecting large numbers of children would require the cooperation of multiple institutions and agencies as well as regional coordination. A codified system for communicating resource needs for the transport and ongoing care of pediatric and neonatal patients is essential. Recently, a mechanism for statewide real-time bed tracking in Oregon that pulls data from EHRs around the state, had been proposed.¹⁷ Should such systems become available regionally or nationally, having a widely accepted system for categorizing pediatric beds would make this even more effective.

CONCLUSION

We propose a 4-tiered pediatric levels of care system for categorization of pediatric inpatient resources that aligns with the current AAP accepted 4-tiered system for neonatal inpatient resources. Our proposal is consistent with recent guidelines published by a pediatric critical care taskforce. Before implementation, we suggest validation through multi institutional, interstate disaster exercises; over time, these could also serve to ensure evolution to match new capabilities

and technologies. Should this model be successful in categorizing pediatric hospital resources and assist in the movement and distribution of hospitalized pediatric patients, regional or national adoption should be considered so we can best match children to our limited inpatient pediatric resources during disasters.

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