

Applying the ICU Liberation Bundle to Critically Ill Children

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Advancements in pediatric critical care have led to improved patient survival. Unfortunately, this has been accompanied by an emerging population of pediatric survivors who suffer persistent physical, cognitive, emotional, psychological, or social disabilities, collectively known as *post-intensive care syndrome-pediatrics*.¹ To combat these critical illness sequelae, the Society of Critical Care Medicine (SCCM) introduced the ICU Liberation Initiative to reduce harm and improve recovery in adults and children.² The ICU Liberation Bundle (formerly referred to the ABCDEF Bundle) consists of interconnected elements that aim to reduce the harmful effects of excessive sedation, prolonged immobilization, sleep disruption, and delirium by enabling wakefulness, comfort, spontaneous breathing, and early mobilization. Its efficacy, as well as a dose-response effect to ICU liberation, has been reported to impact several clinically meaningful, patient-centered outcomes in adults.^{3,4} While the ICU liberation guidelines target both adult and pediatric populations, guidance on how to best apply this practice in children is lacking.⁵ The aim of this article is to provide pediatric intensive care unit (PICU) practitioners with general guidance on implementation of the ICU Liberation Bundle. Learning from the adult collaborative efforts and single-center pediatric initiatives, the pediatric critical care community can use the following keys to success in their PICU liberation implementation journey (**Table 1**).

Application of ICU liberation is relatively new in pediatric care and represents a change in unit culture that takes time, resources, continual effort, auditing, and feedback for success. An essential first step is to

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apply an implementation framework that involves stakeholder engagement, an education and execution plan, and a process for evaluating the impact of implementing ICU liberation in the PICU.⁵ Establish a representative team of interprofessional champions that includes physicians, nurses, respiratory therapists, rehabilitation specialists, and other healthcare and family representatives. Assign agreed-upon roles and responsibilities for each team member, and set reasonable timelines to achieve the team’s goals. Tailor the bundle to the needs of your unit by assessing current unit practices, knowledge gaps, potential barriers, and facilitators to successful implementation. Determine which bundle elements to prioritize and implement initially, then develop a stepwise plan and timeline for rollout of each element.

Implementation of the PICU Liberation Bundle represents an investment of resources, so communicate regularly with the hospital and PICU leadership to ensure ongoing support and buy-in. Engage leadership on the benefits of PICU liberation and the strong evidence of its cost effectiveness.^{6,7}

Use of validated pediatric assessment tools for each of the elements of the bundle is crucial; integrate^{[[SEP]]} these tools in the electronic medical record, if possible. Using such objective measures facilitates communication between team members and allows for objective goal setting and assessment of daily targets. Introducing practice guidelines informed by the best available evidence supports knowledge for^{[[SEP]]} practicing each bundle component, in particular sedation, delirium prevention, and early mobilization.^{8,9}

A: Assess, Prevent, and Manage Pain^{[[SEP]]} Controlling pain is one of the most important elements of ICU liberation. The key to managing pain and discomfort is the application of routine, objective assessments. The revised Face, Legs, Activity,^{[[SEP]]} Cry, Consolability (FLACC) scale, Wong-Baker Faces Pain Rating Scale, and numeric rating pain scale are pediatric tools that can be applied to a broad age range.¹⁰ To ensure a “less is more” approach, consider nonpharmacological adjuncts and nonopioid agents as first-line treatment, followed by judicious use of opioids for analgesia. As with any medication, beware of the adverse effects of opioids, such as respiratory depression, constipation, and risk of tolerance and dependence.

B: Both Spontaneous Awakening Trials and Spontaneous Breathing Trials^{[L]_{SEP}} While spontaneous awakening trials are not commonly used in the PICU, care providers should strive to optimize the patient's level of sedation, depending on the stage of illness, to allow the patient to be awake and spontaneously breathing when possible. While a number of validated tools are used to assess the level of arousal in the PICU, the State Behavioral Scale (SBS) and the Richmond Agitation and Sedation Scale (RASS) are increasingly employed as they may be used in mechanically and nonmechanically ventilated children, and they are used as the initial step to pediatric delirium assessment.¹⁰⁻¹²

Daily screening to assess the patient's eligibility to undergo a spontaneous breathing trial is essential to reduce invasive mechanical ventilation duration and its associated morbidities.¹³ Given their expertise and greater availability at bedside, the respiratory therapists (with help from nursing team and physicians) are the ideal personnel to identify who is eligible to undergo breathing trials and to perform those trials.¹⁴ In PICUs lacking respiratory therapists, the nursing team can perform this task.

C: Choice of Analgesia and Sedation^{[L]_{SEP}} Sedation is typically given to facilitate invasive critical care interventions; however, most intubated children are excessively sedated, which is the key risk factor for the acquired morbidities of delirium, iatrogenic withdrawal, and immobility. ICU liberation promotes an analog-sedation approach, targeting lighter levels of sedation where possible and titration of sedatives based on objective goals.^{8,15} This approach has been shown to be feasible and safe in critically ill children.¹⁶⁻¹⁸ The increasing evidence of the relationship between benzodiazepines and delirium and sleep disruption has led to a preference for opioids and an increased interest in α_2 agonists, such as dexmedetomidine.¹⁹ Using nonpharmacological adjuncts, implementing sleep best practices, and tying together other aspects of the bundle, such as family-centered care, can facilitate comfort and may alleviate excessive sedative use.

D: Delirium: Assess, Prevent, and Manage^{[L]_{SEP}} Delirium is as common and important in critically ill children as it is in adults.^{20,21} Therefore, routine delirium monitoring should be the standard of care in all

PICUs, and strategies to prevent delirium should be prioritized. Two validated delirium screening tools are available for use with children: the Cornell Assessment of Pediatric Delirium (CAPD), which can be used for pediatric patients of any age, and the Pediatric Confusion Assessment Method for the Intensive Care Unit (pCAM-ICU), which can be used for patients older than 6 months.²²⁻²⁴ Delirium prevention can be achieved by promoting day/night cycles through daily routines (ie, physical activity during the day, sleep promotion at night) and minimizing exposure to medications that contribute to delirium, such as benzodiazepines and anticholinergic agents. Antipsychotic medications should be considered if nonpharmacological strategies alone are ineffective, symptoms are distressing to the patient, and delirium perpetuates sleep disruption.

E: Early Mobility and Exercise^[SEP] Pediatric early mobility programs consist of the following elements: screening the patient for readiness^[SEP] to mobilize each day, targeting the highest level of mobility that can be safely achieved based on the patient's stage of illness, and ensuring that mobility occurs through a coordinated, collaborative team effort.^{25,26} Mobility targets ideally should progress from in-bed, to edge-of-bed, and ultimately out-of-bed functional mobility. Special attention should be paid to safety during mobilization to prevent accidental device disconnection or dislodgement, and to the patient's tolerance and cardiorespiratory response.^{[SEP][SEP][SEP][SEP]}

F: Family Engagement and Empowerment^[SEP] Many PICUs have adopted patient- and family-centered interprofessional daily rounds, empowering families to be part of the decision-making process for the patient's daily care. Structured family care conferences can be used to establish long-term goals of care. Family engagement is key to the success of many elements of ICU liberation, such as providing comfort, promoting sleep, and facilitating mobilization and day-time activity, all of which serve to minimize pharmacological interventions. The SCCM's Patient-Centered Outcomes Research-ICU Collaborative is an example of how to engage families in care of the critically ill child.²⁷

Integration of Good Sleep Hygiene^[1]_{SEP} Another element of ICU liberation is under consideration: promoting integration of good sleep. Critically ill children are at risk for sleep disturbance, which may lead to escalation in sedative use, prolonged mechanical ventilation, delirium in the short term, and neurocognitive sequelae in the long term.²⁸ Management of sleep disturbances starts with the routine evaluation of baseline sleep preferences or routines, and monitoring of sleep quality using subjective assessment scales while the patient is in the PICU.²⁸ Good sleep can be achieved by ensuring wakefulness, promoting physical activity, and minimizing naps during the day; observing the child's usual bedtimes and supporting sleep hygiene by decreasing noise, light, and screen time at night. Minimize sleep disruption by clustering nursing care; observe the patient's usual routines and preferences where possible (ie, feeding times, optimal temperature, sleep position); treat pain; and when necessary, as a last resort, use sleep aid medications, such as melatonin.

The Future of ICU Liberation for Pediatric Patients^[1]_{SEP} The future of ICU liberation within the PICU relies on establishing a multicenter, quality improvement,^[1]_{SEP} learning collaborative. This collaborative would be used as platform for exchanging information on successes, challenges, and resources among the various PICU teams. ICU liberation provides interested teams with tools and a data set toolkit to assess, implement, and evaluate the success of implementation of each element of the ICU Liberation Bundle.

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Table 1. Keys to Successful PICU Liberation Implementation

- Establish a team of interprofessional champions.
- Obtain leadership buy-in.
- Use age-appropriate validated assessment tools.
- Integrate the assessment tools in the electronic medical record.
- Establish prevention and management best practice guidelines for each element of the ICU Liberation Bundle.
- Continue to audit adherence to each of the bundle elements, and plan feedback to ensure sustainability.